

12 Faculty of Science, including School of Computer Science

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12.1 The Faculty

12.1.1 Location

Dawson Hall
853 Sherbrooke Street West
Montreal, QC H3A 2T6
Canada

Telephone: (514) 398-4210
Faculty Website: www.mcgill.ca/science
Student Affairs Office Website: www.mcgill.ca/artscisao

The Student Affairs Office and the Office of the Associate Dean of the Faculty of Science are located in Dawson Hall, Rooms 110 and 115. The Student Affairs Office serves students in both the Faculty of Science and the Faculty of Arts.

12.1.2 Faculty Administrative Officers

Alan Shaver; B.Sc.(Car.), Ph.D.(M.I.T.)
Dean (to May 31, 2005)

Martin Grant; B.Sc.(P.E.I.), M.Sc., Ph.D.(Tor.)
Dean (from June 1, 2005)

Morton J. Mendelson; B.Sc.(McG.), A.M., Ph.D.(Harv.)
AssociateDean (Academic)

Henry Leighton; B.Sc., M.Sc.(McG.), Ph.D.(Alberta)
AssociateDean (Student Affairs)

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

Josie D'Amico

Assistant to the Dean

Sharon Bezeau; B.A.(Tor.), M.A.(C'dia)

Recorder and
Chief Investigator

Donald Sedgwick; B.Sc., M.Sc.(McG.)

Senior Adviser

12.1.3 Programs and Teaching in Science

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

In an effort to supplement classroom learning with real life experience, the Faculty of Science has increased opportunities for undergraduate students to participate in fieldwork. Certain B.Sc. programs can include an internship component. This is on top of the many undergraduate students the Faculty hires for Work-Study projects and other research programs. McGill Science students have an opportunity to get involved in the structuring of their own education. A Science Undergraduate Society initiative launched Operation Open Access, a project that gives Science students universal access to e-mail, the Internet, and the latest in science software through computer 'infopoints' located in areas of the campus frequented by Science students.

The Faculty of Science offers programs leading to the degree of Bachelor of Science (B.Sc.). Admission is selective; fulfilment of the minimum requirements does not guarantee acceptance. Admission criteria are described under "[General Admission and Documentation Requirements](#)", [section 3.5](#).

There are also two Diploma programs offered in Science. The "[Diploma in Environment](#)", [see section 14.8](#) under the McGill School of Environment, is a 30-credit program available to holders of a B.Sc. or B.A. or equivalent. The Diploma in Meteorology, [see section 12.12.2 "Atmospheric and Oceanic Sciences \(ATOC\)"](#), is a one-year program available to holders of a degree in Mathematics, Engineering, Physics and other appropriate disciplines who wish to qualify for a professional career in Meteorology. All credits for these diplomas must be completed at McGill.

The concurrent B.Sc./B.Ed. program is designed to provide students 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 12.12.29 "Science for Teachers" and "Concurrent Bachelor of Science \(Major or Major Concentration with a Minor for Teachers\) and Bachelor of Education Secondary Program"](#), in [section 7.5.1.3](#), Faculty of Education.

A Bachelor of Software Engineering program is offered jointly with the Faculty of Engineering, refer to the [Department of Electrical and Computer Engineering](#), in [section 8.4.4](#).

Finally, the Faculties of Arts and Science jointly offer the Bachelor of Arts and Science (B.A.&Sc.), which is described in the Arts and Science section of the Calendar.

12.1.4 Student Affairs Office

The Student Affairs Office provides assistance in interpreting records as well as general academic information and advice on the following: prerequisites and programs, degree requirements, registration, course change, procedures for withdrawal, deferred exams, supplemental exams, rereads, academic standing, inter-faculty transfer, year or term away, transfer credits, second programs, second degrees, and graduation.

Special requests can be made, in writing, to the Associate Dean (Student Affairs).

The Committee on Student Standing (CSS) will consider appeals of the Associate Dean's decisions. For information about CSS, see the Associate Dean's secretary.

12.2 Faculty Admission Requirements

For information about admission requirements for the B.Sc., please refer to "[Admission Requirements and Deadlines](#)", in [section 3.6.1](#).

For information about inter-faculty transfers, please refer to the General University Information and Regulations, "[Inter-Faculty Transfer](#)", in [section 4.3.11](#), as well as the relevant information posted on the Student Affairs Office Website at www.mcgill.ca/art-scisao, and in the Student Affairs Office.

12.3 Faculty Degree Requirements

Each student in the Faculty of Science must be aware of the Faculty Regulations as stated in this Calendar. 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 the student*. It is the student's responsibility to seek guidance from the Student Affairs Office 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, students must fulfill all Faculty and program requirements as indicated below:

"[Minimum Credit Requirement](#)", [see section 12.3.1](#)

"[Residency](#)", [see section 12.3.2](#)

"[Cumulative Grade Point Average \(CGPA\)](#)", [see section 12.3.3](#)

"[Time Limit for the Completion of the Degree](#)", [see section 12.3.4](#)

"[Program Requirements](#)", [see section 12.3.5](#)

"[Course Requirements](#)", [see section 12.3.6](#)

12.3.1 Minimum Credit Requirement

Each student's minimum credit requirement for the degree is determined at the time of acceptance and is specified in the letter of admission.

Students are normally admitted to a four-year program requiring the completion of 120 credits, but 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 statistics, 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.

Students who are readmitted after interrupting their studies for a period of five consecutive years or more 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 Associate Dean, in consultation with the appropriate department, may approve a lower minimum for students who had completed 60 credits or more before interrupting their studies.

Students who are readmitted after a period of absence are subject to the program and degree requirements in effect at the time of readmission. The Associate Dean, in consultation with the department, may approve exemption from any new requirements.

12.3.2 Residency

To obtain a B.Sc. degree, students 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 basic

science requirements defined below. At least two-thirds of all departmental program requirements (Honours, Major, Faculty Program, or Minor) must **normally** be completed at McGill. However, students in Honours, Major, and Faculty Programs who pursue an approved Study Away or Exchange Program may, with departmental approval, 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 diplomas is 30 credits completed at McGill.

12.3.3 Cumulative Grade Point Average (CGPA)

Each candidate for the degree must achieve a minimum cumulative grade point average (CGPA) of 2.00.

12.3.4 Time Limit for the Completion of the Degree

Students who need 96 or fewer credits to complete their degree requirements are expected to complete their program in no more than eight terms after their initial registration for the degree. Students who exceed these limits must receive permission from the Associate Dean (Student Affairs) to continue their studies. Students who expect to complete their degree requirements in fewer than 8 terms, but who wish to delay their graduation for valid academic reasons, must also seek permission from the Associate Dean (Student Affairs). Permission for exceeding the time limits will normally be granted only for valid academic reasons, such as a change of program (approval of the department is required) and part-time status.

Students in the Freshman Program become subject to these regulations one year after their initial registration.

12.3.5 Program Requirements

12.3.5.1 Freshman Program and Basic Science Requirements

Students who need 97-120 credits (four years) to complete their degree requirements must register in the Science Freshman Program, which is designed to provide the basic science foundation for a student's subsequent three-year Faculty, Major, or Honours program. The basic science requirements are as follows: two terms each of calculus, general chemistry, and general physics, and one term of biology.

Students who have completed the Diploma of Collegial Studies, Advanced Placement exams, Advanced Levels, the International Baccalaureate, the French Baccalaureate, or McGill placement examinations may receive exemption and/or credit for all or part of the basic science courses in biology, chemistry, mathematics and statistics, and physics. Similarly, students who have completed courses at other universities or colleges may receive exemptions and/or credits.

For a more detailed description of the Science Freshman Program, students should consult the Arts and Science Freshman Student information available on the Student Affairs Website, www.mcgill.ca/artscisao.

12.3.5.2 Faculty, Major, and Honours Programs

Science students who need 96 or fewer credits to complete their degree requirements are required to have an approved degree program and to select their courses in each term with a view to timely completion of their degree and program requirements. Students must register in one of the following types of departmental programs leading to the degree of Bachelor of Science:

A *Faculty program* is an approved coherent selection of courses giving students a useful concentration in a recognized area. Students in a Faculty program may choose a pattern of study that can range from one yielding a broad education to one specializing in particular areas.

Major programs are more specialized than Faculty programs and are usually centred on a specific discipline or department. For prospective teachers, the Faculty also offers Major programs that

can constitute the Science component of the Concurrent B.Sc./B.Ed. Program. For more information about this joint degree, refer to [section 12.3.5.5 "Concurrent B.Sc./B.Ed. Program"](#).

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

12.3.5.3 Minor and Minor Concentration Programs

In addition to the above degree programs, students in the Faculty of Science may select a Minor or approved Minor Concentration program. These are coherent sequences of courses in a given discipline or interdisciplinary area that may be taken in addition to the courses required for the degree program.

Science Minors consist of up to 24 credits.

Arts Minor Concentrations consist of 18 credits.

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

For a list of "[Minor Programs](#)", see [section 12.11.6](#); for Minor Concentrations that are approved for Science students, see [section 12.11.10 "Faculty of Arts Major and Minor Concentration Programs Available to Science Students"](#).

12.3.5.4 Other Second Programs

In addition to a Faculty, Major, or Honours program, students may pursue a second Faculty, Major, or Honours program, or an Arts Major Concentration program. A minimum of 36 new credits must be completed in the second program.

12.3.5.5 Concurrent B.Sc./B.Ed. Program

The Concurrent B.Sc./B.Ed. Program described in [section 12.12.29 "Science for Teachers"](#) is designed to provide students with the opportunity to obtain both a B.Sc. and a B.Ed after a minimum of 135 credits of study.

Science students who might want to enter the program should visit the B.Sc./B.Ed. Website at www.physics.mcgill.ca/~bscbed or contact Prof. Dik Harris, e-mail: dik.harris@mcgill.ca.

12.3.5.6 Internship Program for Engineering and Science (IYES)

Certain B.Sc. programs offered by the Department of Atmospheric and Oceanic Sciences, the Department of Mathematics and Statistics, the Department of Physics, and the School of Computer Science can include an internship component; see [section 12.11.9 "Internship Programs – Internship Year for Engineering and Science \(IYES\)"](#). Students from other departments are also eligible to apply for an internship year, but this will not be part of their degree designation. For more details, students should refer to the Faculty of Engineering, "[IYES: Internship Year for Engineering and Science](#)", in [section 8.2.8](#).

12.3.5.7 McGill School of Environment

The Faculty of Science is one of the three faculties in partnership with the McGill School of Environment; see [section 14 "McGill School of Environment"](#).

12.3.5.8 Bachelor of Software Engineering and B.Sc. in Software Engineering

The School of Computer Science, jointly with the Department of Electrical and Computer Engineering, offers a Bachelor of Software Engineering program. Graduates of the B.S.E. program should be eligible for accreditation (once accreditation standards for Software Engineers have been adopted). For program details, students should refer to the Faculty of Engineering, "[Department of Electrical and Computer Engineering](#)", in [section 8.4.4](#).

The School of Computer Science also offers a B.Sc. Major program in Software Engineering. For details of the B.Sc. Major, stu-

dents should refer to [section 12.12.8 "Computer Science \(COMP\)"](#). The B.Sc. program **does not** lead to accreditation.

12.3.6 Course Requirements

All required and complementary courses used to fulfill program requirements, including the basic science requirements, must be completed with a grade of C or better. Students who fail to obtain a satisfactory grade in a required course 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; students should consult their academic adviser.

Normally, students 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, a student may appeal to the Associate Dean for permission to take the course a third time. If permission is denied by the Associate Dean and/or by the Committee on Student Standing, on appeal, the student must withdraw from the program. If the failed course is a complementary course required by the program, a student may choose to replace it with another appropriate complementary course. If a student chooses 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 a student repeats 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.

12.3.6.1 Course Overlap

Students will not receive credit towards their degree for any course that overlaps in content with a course passed at McGill, at another university, at CEGEP, or advanced placement exams, Advanced Level results, International Baccalaureate Diploma, or French Baccalaureate. It is the student's responsibility to consult the Student Affairs Office 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 the Calendar.

Sometimes the same course is offered by two different departments. Such courses are called "double-prefix" courses. When such courses are offered simultaneously, students should take the course offered by the department in which they are obtaining their degree. For example, in the case of double-prefix courses CHEMXYZ and PHYSXYZ, Chemistry students would take CHEMXYZ and the Physics students would take PHYSXYZ. If a double-prefix course were offered by different departments in alternate years, students could take whatever course best fits their schedule.

Credit for computer and statistics courses offered by faculties other than Science requires the permission of the Associate Dean of Science (Student Affairs) and will be granted only under exceptional circumstances.

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

1. Credit will be given for ONLY ONE of the following introductory statistics courses: AEMA310, BIOL373, ECON227D1/ECON227D2, ECON257D1/ECON257D2, EPSC215, GEOG202, MATH203, MGCR271, PSYC204, SOCI350.
2. Credit will be given for ONLY ONE of the following intermediate statistics courses: AEMA411, ECON227D1/ECON227D2, ECON257D1/ECON257D2, GEOG351, MATH204, MGCR272, PSYC305, SOCI461.
3. Students who have already received credit for MATH 324 or MATH 357 will NOT receive credit for any of the following: AEMA310, AEMA411, BIOL373, ECON227D1/ECON227D2, ECON257D1/ECON257D2, EPSC215, MATH203, MATH204, MGCR271, MGCR272, PSYC204, PSYC305, SOCI350.

4. For 500-level statistics courses not listed above, students must consult a program adviser to ensure that no significant overlap exists. Where such overlap exists with a course for which the student has already received credit, credit for the 500-level course will not be allowed.
5. Credit for statistics courses offered by faculties other than Arts and Science requires the permission of the Associate Dean of Science (Student Affairs), except for students in the B.Sc. Major in Environment, who may take required statistics courses in the Faculty of Agricultural and Environmental Sciences necessary to satisfy their program requirements.
6. PSYC204 may not be taken if a grade of 75% or better was received in an equivalent course completed at CEGEP.

12.3.6.2 Project Courses

Students may normally receive no more than 12 credits for individual project or independent study courses toward a B.Sc. degree.

12.3.6.3 Courses outside the Faculties of Arts and Science

Students in the Faculty of Science should consult the statement of regulations for taking courses outside the Faculties of Arts and of Science. The regulations are posted in the Student Affairs Office and on the Student Affairs Website, www.mcgill.ca/artscisao. A list of approved/not approved courses in other faculties is posted with the regulations; students may take courses on the approved list and may not, under any circumstances, take courses on the not-approved list. Requests for permission to take courses that are not on either list should be addressed to the Associate Dean.

The regulations are as follows:

- Courses in other faculties that are considered as taught by Science (e.g., BIOT, EXMD, and PHAR) are so designated in the Science section of the Calendar.
- Courses in Music are considered as outside the Faculties of Arts and of Science, except MUAR courses, which are considered as Arts courses.
- Courses in other faculties can be taken as elective courses or as part of a program as specified in the Calendar.
- Students may take only 6 credits per year, up to 18 credits in all, of courses outside the Faculties of Arts and of Science.
- Students must have the necessary prerequisites and permission of the instructor for such courses.
- Credit for courses in Education and Continuing Education requires the permission of the Associate Dean of Science (Student Affairs).
- Credit for computer and statistics courses offered by faculties other than Arts and Science requires the permission of the Associate Dean of Science (Student Affairs) and will be granted only under exceptional circumstances.
- Students who use Minerva to register for a course that exceeds the specified limitations or that is not approved will have the course 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 students 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.
- For students registered in the McGill School of Environment **before September 2003**: Students in the MSE may take as many courses outside the Faculties of Arts and of Science as are necessary to complete their program of study. They may also take up to 18 credits of approved courses outside the Faculties of Arts and of Science beyond the requirements of their MSE programs.
- For students who registered in the McGill School of Environment **on or after September 2003**: Students in the MSE 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 their program of study.

- Students in the Major in Software Engineering may take as many courses outside the Faculties of Arts and of Science as are necessary to complete their program of study. They may also take up to 18 credits of approved courses outside the Faculties of Arts and Science beyond the requirements of their major.
- Students taking the Minor in Management 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.

12.3.6.4 Correspondence, Distance Education or Web-based Courses

Science students may obtain transfer credit for correspondence, distance education or Web-based courses if they receive prior approval from the appropriate McGill department for the course content **and** prior approval from the Associate Dean of Science (Student Affairs) for the method of delivery and evaluation.

12.3.6.5 Courses taken under the Satisfactory/Unsatisfactory Option

Students may take one elective course per term that is to be graded under the Satisfactory/Unsatisfactory Option, to a maximum of 10% of credits taken at McGill to fulfill their degree requirements. The decision to have an elective course graded as Satisfactory/Unsatisfactory must be made by students before the end of the Drop/Add period. This option is not available to Special, Visiting, Exchange or IUT students. For more information, students should consult "[Courses Taken under the Satisfactory/Unsatisfactory \(S/U\) Option](#)", in [section 4.3.5](#).

12.3.6.6 Courses in English as a Second Language (ESL)

ESL courses are open to Science students under the regulations specified by the English and French Language Centre.

12.3.6.7 Auditing of Courses

No auditing of courses is permitted at McGill.

12.3.6.8 Course Credit Weight

The credit assigned to a particular course should reflect the amount of effort it demands of the student. 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.

12.4 Advising

Fall-term academic advising for newly admitted students takes place during the week prior to the beginning of classes. Students who are newly admitted to the Winter term should consult the Calendar of Dates for exact advising dates.

Students who need 96 or fewer credits to complete their degree requirements must consult an academic adviser in their proposed department of study to obtain advice and approval of their course selection. Quebec students with a Diploma of Collegial Studies in Science have normally taken the equivalent of, and are therefore exempt from, the 100-level basic science courses in Biology, Chemistry, Mathematics and Statistics, and Physics. Such students may also be exempt from some 200-level courses. Students with satisfactory results in International Baccalaureate, French Baccalaureate, Advanced Levels, and Advanced Placement tests may also be exempt from some or all of the basic sciences courses. To facilitate program planning, they must present their transcripts and letters of admission. For a detailed description of

advising and registration procedures, students should refer to *Welcome to McGill*, which they receive upon acceptance from the Admissions, Recruitment and Registrar's Office, as well as to the information posted on the Student Affairs Website, www.mcgill.ca/artscisao.

Students who need 97-120 credits to complete their degree requirements will normally be registered in a Freshman Program until they complete their first year. They must consult an adviser in the Student Affairs Office to obtain advice and approval of their course selection. For a detailed description of advising and registration procedures, Freshman students should refer to *Welcome to McGill*, which they receive upon acceptance from the Admissions, Recruitment and Registrar's Office, as well as the information on the Student Affairs Website, www.mcgill.ca/artscisao.

Advising for all returning students takes place in March for the upcoming academic year. For more information, students should refer to the information on the Student Affairs Website, www.mcgill.ca/artscisao.

Academic advising is also available by e-mail. The address is adviser.artsci@mcgill.ca.

12.5 Registration

All students register by Minerva, McGill's Web-based registration system.

New students register in August prior to the first day of classes. For detailed information about registration, students should refer to "[Registration](#)", in [section 4.3](#), *Welcome to McGill*, the Student Affairs Website, www.mcgill.ca/artscisao, and the Minerva Website, www.mcgill.ca/minerva.

Returning students register at the end of March, April and May for the coming academic year. For detailed information about registration, students should refer to "[Registration](#)", in [section 4.3](#), the Student Affairs Website, www.mcgill.ca/artscisao, and the Minerva Website, www.mcgill.ca/minerva.

Students who fall into unsatisfactory standing at the end of the academic year will have their registration cancelled. They may not re-register in the Faculty. However, students who can provide proof of exceptional extenuating circumstances that affected their academic performance may appeal to the Associate Dean of Science (Student Affairs) for readmission. For more information, students should consult the Student Affairs Office, or read the information on the Student Affairs Website, www.mcgill.ca/artscisao.

Students who have an outstanding fee balance from a previous term or outstanding fines will not be permitted to register. In addition, students who have registered for the upcoming academic year, but subsequently take Summer courses without paying the fees, will have their registration cancelled. Registration on Minerva will be denied until these debts are paid in full. Students must pay all debts before the end of the registration period to be permitted to re-register. Students with financial problems should consult the Student Aid Office, Brown Student Services Building.

Students who decide not to return to McGill after initiating registration must withdraw from all of their courses on Minerva or inform the Student Affairs Office in writing. The deadline for withdrawal from the University is the same deadline as for a course withdrawal; see the Calendar of Dates. After the deadline, students may, under exceptional circumstances, be granted permission to withdraw from the University. Such students should contact the Student Affairs Office for further information.

12.5.1 Program Registration

Students should refer to *Welcome to McGill*, the Arts and Science Registration information on the Student Affairs Website, www.mcgill.ca/artscisao, or the Minerva Website, www.mcgill.ca/minerva.

See [section 12.11 "Lists of Programs Offered"](#) for a list of programs that can be taken by Science students.

12.5.2 Course Registration

All courses have limited enrolment.

Subject to the course restrictions listed in this section and unless otherwise indicated, students in the Faculty of Science may register for and take for credit any course in the sections of the Calendar applicable to the Faculties of Arts and of Science.

Since the registration system is unable to verify whether or not Faculty regulations are respected, it is technically possible to register for courses that are closed to Science students. When students' records are manually verified, however, any "closed" courses will be flagged after the end of course change period as "not for credit towards the B.Sc." As a result, the students' expected date of graduation may be delayed.

Some courses may require special permission. Students should consult this Calendar and/or the Class Schedule to determine if permission is required of the instructor, the department, or the Faculty for any course they wish to take.

Students who believe they have valid reasons to take a course that is normally closed to Science students must obtain permission from the Associate Dean of Science (Student Affairs) before registering for the course. Only the Associate Dean or, on appeal, the Committee on Student Standing, can make exceptions to the Faculty rules.

12.5.2.1 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.

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

CHEM199 FYS: Why Chemistry?

GEOG199 FYS: Geo-Environments

PHGY199 FYS: History of Genetic Engineering

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 Arts "[First-Year Seminars](#)", in [section 5.12.1](#).

12.5.2.2 Registration in Multi-Term Courses

Students who select a multi-term course are making a commitment to that course for its entirety. Student MUST register in the same section in all terms of a multi-term course. Credit will be jeopardized if students deliberately register in different sections of a multi-term course. In exceptional cases, when circumstances are beyond the student's control, the Student Affairs Office may grant permission to change sections mid-way through a multi-term course. Students must make their request in writing to the Associate Dean (Student Affairs) citing their reason for the request. The request must also have the written support of the instructors of the sections involved and of the coordinator of the course (if applicable).

12.5.3 Registration for Graduation

Students in their final year must indicate their expected date of graduation on Minerva and must verify this date on unofficial transcripts. When final-year students change their expected date of graduation, they must notify the Student Affairs Office immediately. Failure to do so may postpone graduation.

Students who complete their degree requirements at any time after their last registered term at McGill must apply to the Associate Dean (Student Affairs) to graduate. Application to graduate

must be made sufficiently in advance of the expected graduation date to allow the Faculty to verify the student's record. For further information, students should contact the Student Affairs Office.

12.6 Grading and Credit

Before the end of the course change (drop/add) period, each instructor will inform students of the following:

- whether there will be a final examination in the course;
- how term work will affect the final mark in the course;
- how term work will be distributed through the term;
- whether there will be a supplemental examination in the course, and if so, whether term work will be included in the supplemental grade (courses normally have supplemental examinations, and courses with formal final examinations *must* have supplementals);
- whether students with marks of D, F, J or U will have the option of submitting additional work, and, if so, how the supplemental mark will be calculated with the extra work.

12.6.1 Incomplete Grades

An instructor who believes that there is justification for a student to delay submitting term work may extend the deadline until after the end of the course. In this case, the instructor will submit a grade of K (incomplete), indicating the date by which the work is to be completed. The maximum extensions for the submission of grades to the Student Affairs Office are as follows:

- students graduating in June:

Fall, Winter and spanned courses	April 30
----------------------------------	----------
- non-graduating students:

Fall	April 30
Winter and spanned courses	July 30

Students' deadlines for submitting their work must be sufficiently in advance of these dates to ensure that the work can be graded and the mark submitted on time. It is important to note that instructors may impose earlier deadlines than those listed above.

If marks to clear Ks have not been submitted to the Student Affairs Office by April 30 for Fall courses, or July 30 for Winter/Winter courses and courses spanning Fall/Winter, the K is automatically changed to a KF and counts as an F in the GPA.

Students with a grade of K who have serious extenuating circumstances may request an extension of the K deadline (KE) from the Associate Dean (Student Affairs). Please refer to "[Grading and Grade Point Averages \(GPA\)](#)", in [section 4.6.3](#) for more information about grading and credit.

12.7 Examinations

Students should refer to "[Examinations](#)", in [section 4.7](#), for information about final examinations and deferred examinations. Note that for the Faculty of Science, "[University Regulations Concerning Final Examinations](#)", in [section 4.7.2.1](#) applies to courses up to and including the 500 level.

The exam schedules are posted on the McGill Website, www.mcgill.ca and in the Student Affairs Office, Dawson Hall, Room 110, normally one month after the start of classes for the Tentative Exam Schedule, and two months after the start of classes for the Final Examination Schedule. Students should also refer to the Student Affairs Website for more information: www.mcgill.ca/artscisao.

12.8 Supplemental Assessments

12.8.1 Supplemental Examinations

Students who wish to write supplemental examinations for certain courses must apply to the Student Affairs Office for permission. The following conditions apply:

- students must be in satisfactory or probationary standing;
- students must have received a final grade of D, F, J or U in the course;
- students must avail themselves of this privilege at the time of the next supplemental examination period;
- special permission is required if a student wishes to write supplementals totalling more than 8 credits;
- only one supplemental examination is allowed in a course;
- the supplemental result may or may not include the same proportion of class work as did the original grade; the instructor will announce the arrangements to be used for the course by the end of the course change period;
- the format of the supplemental examination (e.g., multiple-choice or essay questions) will not necessarily be the same as the format for the final examination, so students should consult the instructor about the format of the supplemental;
- the supplemental result will not erase the grade originally obtained, which is used in calculating the GPA; both the original mark and the supplemental result will be calculated in the CGPA;
- in courses in which both a supplemental examination and additional work are available, the student may choose the additional work or the examination or both; where both are written, only one supplemental mark will be submitted, reflecting marks for both the supplemental examination and the additional work;
- additional credit will not be given for a supplemental exam where the original grade for the course was a D and the student already received credit for the course;
- supplemental examinations in courses outside the Faculties of Arts or of Science are subject to the deadlines, rules and regulations of the relevant faculty;
- no supplemental examinations are available for students who fail to achieve satisfactory grades in a course with a deferred examination.

For courses in the Faculties of Arts and of Science, the supplemental examination period for Fall courses is during the months of April and May; for Winter courses, and courses spanning Fall/Winter, the supplemental examination period is during the last week of August.

Supplemental examination applications are available at the Student Affairs Office, and on their Website at www.mcgill.ca/artscisao. The deadline for submission of applications is March 1 for Fall courses and July 15 for Winter courses and courses spanning Fall/Winter. A non-refundable fee for each supplemental paper is payable at the time of application. Students who register for a supplemental examination and subsequently find themselves unprepared for it should not write it; except for the loss of the registration fee, there is no penalty for not writing a supplemental examination. Students should consult the Student Affairs Office for further information.

12.8.2 Additional Work

Instructors of courses that include graded written term work may choose to provide the option of additional work to eligible students. The following conditions apply:

- if there is an option for additional work, it must be announced in the course outline at the beginning of the course;

- additional work involves revising one or more previously submitted papers or submitting new written work to replace the original work;
- students must be in satisfactory or probationary standing;
- students must have received a final grade of D, J, F, or U in the course;
- the weight of the additional work will be equal to the weight given the work revised or replaced when the original mark was submitted;
- the mark resulting from the revised or additional work will be recorded as a supplemental mark;
- the supplemental result will not erase the grade originally obtained, which is used in calculating the GPA; both the original mark and the supplemental mark will count in calculating the CGPA;
- in courses in which both a supplemental examination and additional work are available, the student may choose the additional work or the examination or both; where both are written, only one supplemental mark will be submitted, reflecting marks for both the supplemental examination and the additional work;
- additional work in courses outside the Faculties of Arts and of Science is subject to the deadlines, rules, and regulations of the relevant faculty.

Additional work applications are available in the Student Affairs Office. The deadline for submission of applications is March 1 for Fall courses and July 15 for Winter courses and courses spanning Fall/Winter. A non-refundable fee is payable for each course at the time of application. Students should consult the Student Affairs Office for further information.

12.8.3 Reassessments and Rereads

In accordance with the Charter of Student Rights, and subject to the conditions stated therein, students have the right to consult any written submission for which they have received a mark, to discuss this submission with the examiner, and to obtain an impartial and competent review of any mark.

The Faculty of Science recognizes two types of impartial reviews: reassessments of coursework (i.e., of term papers, mid-terms, assignments, quizzes, etc.) and rereads of final examinations. **In both cases, rather than re-correct the work and grade it as they would have done themselves, reviewers assess the appropriateness of the original grade based, for example, on the application of the grading key to the student's work.** If a grade is deemed unfair, it is changed, whether the new grade is higher or lower than the original — i.e., the reviewer's grade takes precedence over the original grade.

A. Reassessment of Coursework

Reassessments of coursework are administered and conducted solely by the units involved according to procedures specified by the units and made available to staff and students. Requests for such reassessments must be made within 10 working days after the graded material has been made available for students to view it. Reassessments should normally be completed within 20 working days of the request.

B. Rereads of Final Examinations

Rereads of final examinations are administered by the Student Affairs Office, but conducted by the units involved. Students must apply in writing to the Student Affairs Office by March 31 for courses in the Fall term and by September 30 for courses in the Winter or Summer terms (these deadlines are strictly enforced and no requests for rereads will be accepted past them). Students are assessed a fee of \$35 for such rereads. It is strongly recommended, but not required, that students consult the instructor of the course before requesting a reread of a final examination.

Reassessments and rereads in courses not in the Faculty of Science are subject to the deadlines, rules, and regulations of the relevant faculty.

12.9 Academic Standing

Academic standing is based primarily on students' cumulative grade point average (CGPA), but may also be affected by their term grade point average (TGPA). Academic standing is assessed in January for the Fall term, in May for the Winter term, and in September for the Summer term. Academic standing in each term determines if students will be allowed to continue their studies in the next term and if any conditions will be attached to their registration.

Decisions about academic standing in the Fall term are based only on grades that are available in January. Grades for courses in which students have deferred examinations and Fall-term grades for courses that span the Fall and Winter terms do not affect academic standing for the Fall term, even though they will ultimately affect students' Fall TGPA. Therefore, academic standings for the Fall term that are designated as "interim" should be interpreted as advisory. Note that interim standing will not appear on external transcripts. **Interim standing decisions are mentioned below only if the rules for them differ from those for regular standing decisions.**

Satisfactory/Interim Satisfactory Standing

Students in satisfactory standing may continue in their program.

- New students are admitted to satisfactory standing.
- Students with a CGPA of 2.00 or greater are in satisfactory standing.

Probationary/Interim Probationary Standing

Students in probationary standing may continue in their program, but must carry a reduced load (maximum 14 credits per term) and raise their TGPA and CGPA to return to satisfactory standing (see above). They should see their departmental adviser to discuss their course selection.

Students in interim probationary standing may continue in their program, but should evaluate their course load and reduce it as appropriate. They are strongly advised to consult a departmental adviser, before the withdrawal deadlines, about their course selection for the Winter term.

- Students who were previously in satisfactory standing will be placed in probationary standing if their CGPA falls between 1.50 and 1.99.
- Students who were previously in probationary standing will remain in probationary standing if their CGPA falls between 1.50 and 1.99 and their TGPA is 2.50 or higher, although the TGPA requirement will not apply to the Summer term.
- Students who were previously in interim unsatisfactory standing will be placed in probationary standing if their CGPA falls between 1.50 and 1.99 and their TGPA is 2.50 or higher.
- Students who were previously in unsatisfactory readmitted standing will be placed in probationary standing (for the Fall or Winter term) if their CGPA is less than 2.00, and if they satisfy relevant conditions specified in their letter of readmission.

Unsatisfactory Readmitted Standing

Students who were previously in unsatisfactory standing and who were readmitted to the Faculty by the Associate Dean (Student Affairs) or the Committee on Student Standing will have their standing changed to unsatisfactory readmitted standing. Their course load is specified in their letter of readmission, as are the conditions they must meet to be allowed to continue in their program. They should see their departmental adviser to discuss their course selection.

Unsatisfactory/Interim Unsatisfactory Standing

Students in interim unsatisfactory standing may continue in their program, but should evaluate their course load and reduce it as appropriate. They are strongly advised to consult a departmental adviser, before the withdrawal deadlines, about their course selection for the Winter term.

Students in unsatisfactory standing have failed to meet the minimum standards set by the Faculty. They may not continue in their program, and their registration will be cancelled.

Appeals for readmission by students in unsatisfactory standing should be addressed to the Associate Dean (Student Affairs) no later than July 15 for readmission to the Fall term and November 15 for the Winter term. Readmission will be considered only when proof of extenuating circumstances that affected academic performance can be provided (e.g., medical or other documentation). Students in unsatisfactory standing for the second time must withdraw permanently.

Normally, supplemental examinations are not permitted; however, students in unsatisfactory standing may appeal to the Associate Dean (Student Affairs) for permission to write a supplemental examination, clearly stating the reasons for special consideration and providing proof as appropriate.

- Students will be placed in unsatisfactory standing (Winter or Summer term) or interim unsatisfactory standing (Fall term) if their CGPA falls or remains below 1.50.
- Students who were previously in probationary, unsatisfactory readmitted, or interim unsatisfactory standing will be placed in unsatisfactory standing (Fall or Winter term) if their TGPA falls below 2.50 and their CGPA is below 2.00.
- Students who were previously in unsatisfactory standing and who were readmitted to the Faculty by the Associate Dean or the Committee on Student Standing and who have not at least satisfied the conditions to attain probationary standing that were specified in the letter of readmission will be placed in unsatisfactory standing.

Students in the Concurrent B.Sc./B.Ed. Program who receive an F or J in any Education Field Experience course are placed in unsatisfactory standing. Although they may complete their term, they are required to withdraw from the Concurrent Program. However, they may apply to transfer to a conventional B.Sc. program as outlined in [section 12.12.29 "Science for Teachers"](#).

Incomplete Standings

Standing awaits deferred examination.

Must clear Ks, Ls or Supplemental.

Standing Incomplete.

Students with incomplete standings in the Winter or Summer term may register for the Fall term, but their standing must be resolved by the end of the course-change period for that term. Students whose incomplete standing changes to satisfactory, probationary, or interim unsatisfactory standing may continue in the program. Students whose standing changes to unsatisfactory standing may not continue in their program, and their registration will be cancelled.

Students whose standing changes to unsatisfactory and who wish to ask for permission to continue in their program must make a request to the Associate Dean (Student Affairs) as soon as they are placed in unsatisfactory standing. Readmission will be considered only when proof of extenuating circumstances that affected academic performance can be provided (e.g., medical or other documentation).

Students whose standing is still incomplete by the end of course change period should immediately consult with the Student Affairs Office.

At the end of the Winter term, students with a mark of K or L will be placed in the appropriate standing in June, if the outstanding mark in the course will not affect their result. Otherwise the standing decision will only be made once their incomplete marks have been cleared. For more information about incomplete grades, please refer to [section 12.6.1 "Incomplete Grades"](#).

12.10 Awards and Honorary Designations

12.10.1 Honours and First-Class Honours

Departments may recommend to the Faculty that graduating students registered in an Honours program be awarded *Honours* or *First-Class Honours* under the following conditions:

- students must complete all requirements imposed by the department;
- for *Honours*, the CGPA at graduation must be at least 3.00;
- for *First-Class Honours*, the CGPA at graduation must be at least 3.50;
- some departments may impose additional requirements, which must be met before students are recommended for *Honours* or *First-Class Honours*. These will be found in the departmental descriptions of Honours programs.

Students in an Honours program whose CGPA is below 3.00 or who did not satisfy certain program requirements must consult their adviser to determine if they are eligible to graduate in a program other than Honours.

12.10.2 Distinction or Great Distinction

Students in Faculty or Major programs whose academic performance is appropriate may be awarded their degrees with *Distinction* or *Great Distinction* under the following conditions:

- students must have completed a minimum of 60 McGill credits towards the B.Sc. degree to be eligible;
- for *Distinction*, the CGPA at graduation must be 3.30 to 3.49;
- for *Great Distinction*, the CGPA at graduation must be 3.50 or greater;
- these designations may be withdrawn in the case of transfer students, if their CGPA in another faculty or at another university is not comparable to the CGPA earned in the Faculty of Science.

12.10.3 Dean's Honour List

The designation *Dean's Honour List* may be awarded to graduating students under the following conditions:

- students must have completed a minimum of 60 McGill credits towards the B.Sc. degree to be considered;
- students must be in the top 10% of the Faculty's graduating class of students; this calculation is based on the CGPA;
- this honorary designation may be withdrawn in the case of transfer students, if their CGPA in another faculty or at another university is not comparable to the CGPA earned in the Faculty of Science.

The designation *Dean's Honour List* may be awarded at the end of each academic year to continuing students under the following conditions:

- students must have completed at least 27 graded credits during the academic year to be considered;
- students must be among the top 10% of the Faculty. This calculation is based on the TGPA.

12.10.4 Medals and Prizes

Various medals, scholarships and prizes are open to continuing and graduating students. Full details of these are set out in the *Undergraduate Scholarships and Awards Calendar*, available in the Admissions, Recruitment and Registrar's Office or on the Web: www.mcgill.ca. No application is required except in the case of the Moysse Travelling Scholarships.

12.11 Lists of Programs Offered

12.11.1 Faculty Programs

Anatomy and Cell Biology
 Biochemistry
 Biology
 Biology and Mathematics – see Biology
 Chemistry
 Chemistry and Biological Sciences – see Chemistry
 Chemistry and Mathematics – see Chemistry
 Mathematics and Computer Science – see Mathematics and Statistics. Also check with the School of Computer Science, since that unit limits enrolment.
 Mathematics, Statistics and Computer Science – see Mathematics and Statistics. Also check with the School of Computer Science, since that unit limits enrolment.
 Mathematics, Chemistry and Physics – see Mathematics and Statistics
 Microbiology and Immunology – application required, see departmental entry for information.
 Physics
 Physiology
 Psychology

12.11.2 Major Programs

Anatomy and Cell Biology
 Atmospheric Science
 Biochemistry
 Biology
 Chemistry
 Chemistry (Bio-organic option)
 Chemistry (Environmental Chemistry option)
 Chemistry (Materials)
 Computer Science
 Earth and Planetary Sciences
 Earth System Science (subject to Ministry of Education approval)
 Environment (Atmospheric Environment and Air Quality domain) – see McGill School of Environment
 Environment (Biodiversity and Conservation domain) – see McGill School of Environment
 Environment (Earth Sciences and Economics domain) – see McGill School of Environment
 Environment (Ecological Determinants of Health domain) – see McGill School of Environment
 Environment (Environmetrics domain) – see McGill School of Environment
 Environment (Food Production and Environment domain) – see McGill School of Environment
 Environment (Land Surface Processes and Environmental Change) – see McGill School of Environment
 Environment (Renewable Resource Management domain) – see McGill School of Environment
 Environment (Water Environments and Ecosystems domain) – see McGill School of Environment
 Geography
 Mathematics
 Microbiology and Immunology – application required, see departmental entry for information.
 Physics
 Physiology
 Psychology
 Software Engineering – application required, see unit entry for information.

12.11.3 Joint Major Programs

Atmospheric Science and Physics

Mathematics and Computer Science – see Mathematics and Statistics. Also check with the School of Computer Science, since that unit limits enrolment.

Physics and Computer Science – see Physics. Also check with the School of Computer Science, since that unit limits enrolment.

Physics and Geophysics

Physiology and Mathematics

Physiology and Physics

12.11.4 Honours Programs

Anatomy and Cell Biology

Applied Mathematics

Atmospheric Science

Biochemistry

Biology

Chemistry

Chemistry (Bio-organic option)

Chemistry (Environmental Chemistry option)

Chemistry (Materials)

Computer Science

Earth Sciences

Planetary Sciences

Geography

Immunology (Interdepartmental) – application required, see Faculty of Science entry for Immunology.

Mathematics

Microbiology and Immunology

Physics

Physiology

Probability and Statistics

Psychology

12.11.5 Joint Honours Programs

Mathematics and Computer Science – see Mathematics and Statistics. Also check with the School of Computer Science, since that unit limits enrolment.

Mathematics and Physics – see Physics

Physics and Chemistry – see Physics

12.11.6 Minor Programs

Atmospheric Science

Biology

Biotechnology

Chemical Engineering – see Chemistry

Chemistry

Cognitive Science

Computational Molecular Biology – see Computer Science

Computer Science

Earth and Planetary Sciences

Education for Science Students – see Science for Teachers

Electrical Engineering – see Physics

Environment – see McGill School of Environment

Geochemistry – see Earth and Planetary Sciences

Geography

Geographical Information Systems – see Geography

Human Nutrition – see Faculty of Agricultural and Environmental Sciences entry for School of Dietetics and Human Nutrition

Kinesiology – see Faculty of Science entry

Management – see Faculty of Science entry for Management

Mathematics

Music Technology – application required, see Faculty of Science entry for Music

Neuroscience

Pharmacology

Physics

Psychology

Statistics – see Mathematics and Statistics

Technological Entrepreneurship for Science Students – application required, see Faculty of Science entry

Notes:

1. The Minor in Computer Science is not available to students in the following programs: Honours in Computer Science; Honours in Mathematics and Computer Science; Faculty Program in Mathematics and Computer Science.
2. The Minor in Chemical Engineering is only available to students in Chemistry.
3. The Minor in Electrical Engineering is only available to students in the Major program in Physics.

12.11.7 Concurrent B.Sc/B.Ed. Program (Science for Teachers)

Major in Mathematics for Teachers – see Science for Teachers.

Major Concentration in Biology with a Minor in Chemistry for Teachers – see Science for Teachers.

Major Concentration in Biology with a Minor in Physics for Teachers – see Science for Teachers.

Major Concentration in Chemistry with a Minor in Biology for Teachers – see Science for Teachers.

Major Concentration in Chemistry with a Minor in Physics for Teachers – see Science for Teachers.

Major Concentration in Physics with a Minor in Biology for Teachers – see Science for Teachers.

Major Concentration in Physics with a Minor in Chemistry for Teachers – see Science for Teachers.

12.11.8 Bachelor of Arts and Science

Please see the Arts and Science section of the Calendar for details.

12.11.9 Internship Programs – Internship Year for Engineering and Science (IYES)

The following programs are also available with an internship component. For more information, please see "[IYES: Internship Year for Engineering and Science](#)", in [section 8.2.8](#).

Atmospheric and Oceanic Sciences

Major in Atmospheric Science

Honours in Atmospheric Science

Computer Science

Major in Computer Science

Honours in Computer Science

Mathematics and Statistics

Major in Mathematics

Honours in Mathematics

Honours in Applied Mathematics

Honours in Probability & Statistics

Joint Majors in Mathematics & Computer Science

Joint Honours in Mathematics & Computer Science

Physics

Faculty Program in Physics

Major in Physics

Honours in Physics

Joint Faculty Program in Mathematics, Chemistry and Physics

Joint Major Program in Atmospheric Science and Physics

Joint Major Program in Physics and Geophysics

Joint Honours Program in Physics and Chemistry

Joint Honours Program in Physics and Mathematics

12.11.10 Faculty of Arts Major and Minor Concentration Programs Available to Science Students

For more information, please see the relevant departmental entries in the Faculty of Arts section.

Major Concentrations

African Studies
 Anthropology
 Art History
 Canadian Studies
 Classics
 East Asian Studies
 Economics
 English – Cultural Studies
 English – Drama and Theatre
 English – Literature
 Geography (Urban Systems)
 German Language and Literature
 German Literature and Culture
 German Studies, Contemporary
 Hispanic Languages
 Hispanic Literature and Culture
 History
 Humanistic Studies
 International Development Studies
 Italian Civilization
 Italian Language and Literature
 Jewish Studies
 Langue et littérature françaises – Littres
 Langue et littérature françaises – Littres et traduction
 Langue et littérature françaises – Linguistique du français
 Latin-American Studies
 Linguistics
 Middle East Studies
 Music
 North American Studies
 Philosophy
 Philosophy and Western Religions
 Political Science
 Québec Studies
 Russian
 Scriptures and Interpretation – see Religious Studies
 Sociology
 Women's Studies
 World Religions – see Religious Studies

Minor Concentrations

African Studies
 Anthropology
 Art History
 Canada/Québec - see Political Science
 Canadian Ethnic Studies
 Canadian Studies
 Catholic Studies
 Classics
 Comparative Politics – see Political Science
 East Asian Language and Literature
 East Asian Cultural Studies
 East Asian Studies, Advanced
 Economics
 English – Cultural Studies
 English – Literature
 English – Drama and Theatre
 Geographical Information Systems – see Geography
 Geography
 German Language
 German Literature
 German Literature and Culture in Translation
 Hispanic Languages

Hispanic Literature and Culture
 History
 History and Philosophy of Science
 Humanistic Studies
 International Development Studies
 International Relations – see Political Science
 Italian Language and Literature
 Italian Civilization
 Jewish Law
 Jewish Studies
 Langue et littérature françaises – Littres
 Langue et littérature françaises – Littres et traduction
 Langue et littérature françaises – Langue et traduction
 Langue et littérature françaises – Langue française
 Langue et littérature françaises – Théorie et critique littéraires
 Linguistics
 Middle East Studies
 Middle East Languages
 Music
 North American Studies
 Philosophy
 Philosophy and Western Religions
 Political Science
 Political Economy – see Political Science
 Politics, Law and Society – see Political Science
 Québec Studies
 Russian – see Russian and Slavic Studies
 Russian Civilization – see Russian and Slavic Studies
 Scriptural Languages - see Religious Studies
 Social Studies of Medicine
 Sociology
 South Asia – see Political Science
 World Religions – see Religious Studies
 Women's Studies

12.12 Academic Programs

12.12.1 Anatomy and Cell Biology (ANAT)

Strathcona Anatomy and Dentistry Building
 3640 University Street, Room 1/48
 Montreal, QC H3A 2B2

Telephone: (514) 398-6335
 Website: www.medicine.mcgill.ca/anatomy

Chair — John J.M. Bergeron

Emeritus Professors

Yves Clermont; B.Sc.(Montr.), Ph.D.(McG.), F.R.C.S.
 Dennis G. Osmond; B.Sc., M.B., Ch.B., D.Sc.(Brit.), M.R.C.S.,
 L.R.C.P., F.R.S.C.
 H. Warshawsky; B.Sc.(Sir G.Wms), M.Sc., Ph.D.(McG.)

Professors

Alain Beaudet; M.Sc., Ph.D., M.D.(Montr.) (*joint appoint. with
 Neurology & Neurosurgery*)
 Gary C. Bennett; B.A., B.Sc.(Sir G.Wms.), M.Sc., Ph.D.(McG.)
 John J.M. Bergeron; B.Sc.(McG.), Ph.D., D.Phil.(Oxon.)
 James R. Braver; B.S.(Tufts), Ph.D.(Harv.)
 Miguel Burnier; M.D., M.Sc., Ph.D.(Brazil) (*joint appoint. with
 Ophthalmology*)
 Louis Hermo; B.A.(Loyola), M.Sc., Ph.D.(McG.)
 Charles P. Leblond; M.D.(Paris), Ph.D.(Montr.), D.Sc.(Acad.),
 F.R.S., F.R.S.C.
 Sandra C. Miller; B.Sc.(Sir G.Wm.), M.Sc., Ph.D.(McG.)
 Carlos R. Morales; DVM.(U.N., Argentina), Ph.D.(McG.)
 Barry I. Posner; M.D.(Man.), F.R.C.P.(C) (*joint appoint. with
 Medicine*)
 Alfredo Ribeiro-da-Silva; M.D., Ph.D.(Oporto) (*joint appoint. with
 Pharmacology and Therapeutics*)

Associate Professors

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

Philip Barker; B.Sc.(S.Fraser), Ph.D.(Alta.) (*joint appoint. with Neurology & Neurosurgery*)
 Orest W. Blaschuk; B.Sc.(Winn.), M.Sc.(Manit.), Ph.D.(Tor.) (*joint appoint. with Surgery*)
 Eugene Daniels; M.Sc., Ph.D.(Man.)
 Samuel David; Ph.D.(Man.) (*joint appoint. with Neurology & Neurosurgery*)
 Elaine Davis; B.Sc., M.Sc.(W.Ont.), Ph.D.(McG.)
 Timothy Kennedy; B.Sc.(McM.), M.Phil, Ph.D.(Columbia) (*joint appoint. with Neurology & Neurosurgery*)
 Antonis E. Koromilas; B.Sc., Ph.D.(Aristotelian U., Greece) (*joint appoint. with Oncology*)
 Michael F. Lalli; B.Sc., M.A.(Bowling Green), Ph.D.(McG.)
 Nathalie Lamarche; B.Sc., Ph.D.(Montr.)
 Martin Latterich; B.Sc., Ph.D.(Durham)
 Marc D. McKee; B.Sc., M.Sc., Ph.D.(McG.) (*joint appoint. with Dentistry*)
 Peter McPherson; B.Sc.(Manit.), Ph.D.(Iowa) (*William Dawson Scholar*) (*joint appoint. with Neurology & Neurosurgery*)
 Dieter Reinhardt; M.S.(Kaiserslautern), Ph.D.(Munich)
 Wayne Sossin; S.B.(M.I.T.), Ph.D.(Stan.) (*joint appoint. with Neurology & Neurosurgery*)
 Stephano Stifani; Ph.D.(Rome), Ph.D.(Alta.) (*joint appoint. with Neurology & Neurosurgery*)
 Hojatollah Vali; B.Sc., M.Sc., Ph.D.(Munich) (*joint appoint. with Earth and Planetary Sciences*)
 Dominique Walker; B.Sc., Ph.D.(Geneva) (*joint appoint. with Psychiatry*)

Assistant Professors
 Fiona Bedford; B.Sc.(Birm.), Ph.D.(Lond.)
 Eric Chevet; M.Sc., Ph.D.(Paris) (*joint appoint. with Surgery*)
 Michael T. Greenwood; B.Sc., M.Sc.(C' dia), Ph.D.(McG) (*joint appoint. with Medicine*)
 Craig Mandato; B.Sc., Ph.D.(Wat.)
 John F. Presley; B.A., Ph.D.(Texas)
 Gary E. Wild; B.Sc., Ph.D., M.D., C.M.(McG.) (*joint appoint. with Medicine*)

Associate Members
 Albert Berghuis (*Biochemistry*)
 Colin Chalk (*Neurology & Neurosurgery*)
 Claudio Cuello (*Pharmacology & Therapeutics*)
 Giovanni DiBattista (*Medicine*)
 Alyson Fournier (*Neurology & Neurosurgery*)
 Janet Henderson (*Medicine*)
 Paul F. Lasko (*Biology*)
 Andrea Leblanc (*Neurology & Neurosurgery*)
 Peter Metrakos Department of Surgery
 Philippe Seguela (*Neurology & Neurosurgery*)
 David Y. Thomas (*Biochemistry*)
 Jackie Vogel (*Neurology & Neurosurgery*)

Adjunct Professors
 Jean-François Cloutier; Ph.D.(McG.)
 Mirosław Cygler; M.Sc., Ph.D.(Lodz, Poland)
 Daniel Cyr; B.Sc., M.Sc.(C' dia), Ph.D.(Manit.)
 Michel Desjardins; M.Sc., Ph.D.(Montr.)
 Jacques Drouin; B.Sc., D.Sc.(Laval)
 Marko Horb; Ph.D.(State U. New York)
 Sadayuki Inoue; M.Sc., Ph.D.(Hok. U.)
 André Nantel; B.Sc., M.Sc.(Laval), Ph.D.(Chapel Hill)
 Maureen O'Conner-McCourt; Ph.D.(Alta.)
 Joachim Osterman; Ph.D.(U. Munchen, Germany)
 Joseph Schrag; M.Sc., Ph.D.(Ill.)
 Jackson G. Snipes; Ph.D., M.D.(Vanderbilt)
 Pierre Thibault; Ph.D.(Montr.)

The Department of Anatomy and Cell Biology offers courses which 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 Faculty 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 back-

ground for graduate studies in Anatomy and Cell Biology, or for further professional training in schools of medicine, dentistry and other health 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 and pharmaceutical and biotechnological industries.

The Department is equipped to perform cell fractionation, 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.

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

A Science Major Concentration in Biomedical Sciences is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "**Biomedical Sciences**", in section 6.12.4 for details.

FACULTY PROGRAM IN ANATOMY AND CELL BIOLOGY (57 credits)

Required Courses (39 credits)

ANAT212	(3)	Molecular Mechanisms of Cell Function
ANAT214	(3)	Systemic Human Anatomy
ANAT261	(4)	Introduction to Dynamic Histology (must be taken in U1)
ANAT262	(3)	Introductory Molecular and Cell Biology
ANAT321	(3)	Circuitry of the Human Brain
BIOL200	(3)	Molecular Biology
BIOL202	(3)	Basic Genetics
CHEM212*	(4)	Introductory Organic Chemistry 1
CHEM222*	(4)	Introductory Organic Chemistry 2
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2
MATH203*	(3)	Principles of Statistics 1
or PSYC204	(3)	Introduction to Psychological Statistics
or BIOL373	(3)	Biometry

* If the equivalents to these courses were passed in CEGEP, they are not required for the Anatomy and Cell Biology programs, and may not be re-taken at McGill. Students must take the equivalent number of credits in Elective Courses to satisfy the total credit requirement for their degree.

Complementary Courses (18 credits)

9 credits selected from:

ANAT322	(3)	Neuroendocrinology
ANAT365	(3)	Cell Biology: Secretory Process
ANAT381	(3)	Basis of Embryology
ANAT458	(3)	Membranes and Cellular Signaling
NEUR310	(3)	Cellular Neurobiology

9 credits selected from biologically oriented courses (BOC) in the following list:

BIOL300, BIOL301, BIOL303, BIOL306, BIOL313, BIOL314, BIOL357, BIOL370, BIOL389, BIOL468, BIOL475, BIOL516, BIOL518, BIOL520, BIOL522, BIOL524, BIOL530, BIOL531, BIOL532, BIOL544, BIOL551, BIOL572, BIOL588.
 ANAT322, ANAT365, ANAT381, ANAT432, ANAT458/BIOC458, ANAT541.
 BIOC311, BIOC312, BIOC450, BIOC454, BIOC455, BIOC503.
 BIOT505.
 EXMD401, EXMD502, EXMD503, EXMD504, EXMD506, EXMD507, EXMD508, EXMD509, EXMD510, EXMD512D1/EXMD512D2.
 MIMM314, MIMM323, MIMM324, MIMM386D1/MIMM386D2, MIMM387, MIMM413, MIMM414, MIMM465, MIMM466, MIMM509.
 NEUR310.
 NUTR307.

PATH300.
PHAR300, PHAR301, PHAR303, PHAR562, PHAR563.
PHGY311, PHGY312, PHGY313, PHGY314, PHGY451,
PHGY502, PHGY508, PHGY513, PHGY515, PHGY516,
PHGY517, PHGY518, PHGY552, PHGY556.
PSYT500.

MAJOR IN ANATOMY AND CELL BIOLOGY

(67 credits)

Required Courses (46 credits)

all Faculty Program required courses, plus:

BIOL301 (4) Cell and Molecular Laboratory
MIMM314 (3) Immunology

Complementary Courses (21 credits)

9 credits selected from:

ANAT322 (3) Neuroendocrinology
ANAT365 (3) Cell Biology: Secretory Process
ANAT381 (3) Basis of Embryology
ANAT458 (3) Membranes and Cellular Signaling
ANAT541 (3) Cell and Molecular Biology of Aging
NEUR310 (3) Cellular Neurobiology

12 credits of biologically oriented courses (BOC), as defined in the Faculty Program.

HONOURS IN ANATOMY AND CELL BIOLOGY (73 credits)

Students should register at the Major level in U1 and, if accepted, may enter the Honours Program at the beginning of U2. To enter the program, the student must obtain a CGPA of at least 3.00 at the end of U1. For promotion to the U3 year of the Honours program, or for entry into the program at this level, the 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 (55 credits)

all Major Program required courses, plus:

ANAT432 (9) Research Project: Anatomical Science

Complementary Courses (18 credits)

15 credits from:

ANAT322 (3) Neuroendocrinology
ANAT365 (3) Cell Biology: Secretory Process
ANAT381 (3) Basis of Embryology
ANAT458 (3) Membranes and Cellular Signaling
ANAT541 (3) Cell and Molecular Biology of Aging
NEUR310 (3) Cellular Neurobiology

3 credits of biologically oriented courses (BOC), as defined in the Faculty Program.

12.12.2 Atmospheric and Oceanic Sciences (ATOC)

Burnside Hall, Room 945
805 Sherbrooke Street West
Montreal, QC H3A2K6

Telephone: (514) 398-3764

Fax: (514) 398-6115

E-mail: undergraduateinfo.aos@mcgill.ca

Website: www.mcgill.ca/meteo

Chair — John R. Gyakum

Emeritus Professors

Roddy R. Rogers; B.S.(Texas), S.M.(M.I.T.), Ph.D.(N.Y.U.)
Edward J. Stansbury; M.A., Ph.D.(Tor.)

Professors

Jacques F. Derome; M.Sc.(McG.), Ph.D.(Mich.)
Henry G. Leighton; M.Sc.(McG.), Ph.D.(Alta.)
Charles A. Lin; B.Sc.(U.B.C.), Ph.D.(M.I.T.)

Lawrence A. Mysak; B.Sc.(Alta.), M.Sc.(Adel.), A.M.,
Ph.D.(Harv.), F.R.S.C. (*Canada Steamship Lines Professor of
Meteorology*)

Ronald E. Stewart; B.Sc.(Man.), M.Sc., Ph.D.(Tor.)
Man Kong (Peter) Yau; S.B., S.M., Sc.D.(M.I.T.)
Isztar I. Zawadzki; B.Sc.(Buenos Aires), M.Sc., Ph.D.(McG.)

Associate Professors

Peter Bartello; M.Sc., Ph.D.(McG.) (*joint appoint. with
Mathematics and Statistics*)

John R. Gyakum; B.Sc.(Penn.), M.Sc., Ph.D.(M.I.T.)
David Straub; B.S., M.S.(SW Louisiana), Ph.D.(Wash)

Assistant Professors

Parisa Ariya; B.Sc., Ph.D.(York) (*William Dawson Scholar*) (*joint
appoint. with Chemistry*)

Frédéric Fabry; B.Sc., M.Sc., Ph.D.(McG.) (*joint appoint. with
McGill School of Environment*)

Michel Bourqui; B.Sc., M.Sc.(EPFL, Switzerland), Ph.D.(ETHZ,
Switzerland) (*joint appoint. with Chemistry*)

Adjunct Professors

Gilbert Brunet, PierreGauthier, StéphaneLaroche,
RichardMénard, FrançoisSaucier, AyrtonZadra

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

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

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

The Department of Atmospheric and Oceanic Sciences offers four main programs in Atmospheric Science: Honours, Major, Minor, and a Joint Major in Atmospheric Science and Physics. The Honours program is meant for students with high standing. It is based on courses similar to those in the Major program, but provides the opportunity to take advanced optional courses. The Major program, although somewhat less intensive, satisfies the requirements for a professional career as a meteorologist, and like the Honours program equips the student to undertake postgraduate study in meteorology, atmospheric science, and related sciences (physical oceanography) at any of the leading universities. The Department also offers a special one-year Diploma program to B.Sc. or B.Eng. graduates.

A degree in Atmospheric Science can lead to a professional career in government service or private industry. The Meteorological Service of Canada has traditionally been the main employer of graduating students, but certain provincial governments and environmental consulting and engineering firms also employ graduates trained in atmospheric science. Positions in teaching and

research are available to graduates with M.Sc. and Ph.D. degrees. Students interested in any of the undergraduate programs should consult the Undergraduate Adviser, Room 946, Burnside Hall.

Internship Year for Engineering and Science (IYES)

IYES is a pre-graduate work experience program available to eligible students and normally taken between their U2 and U3 years. For more information, see "[IYES: Internship Year for Engineering and Science](#)", in [section 8.2.8](#).

The following programs are also available with an internship component:

- Major in Atmospheric Science
- Honours in Atmospheric Science

A Science Major Concentration in Earth, Atmosphere and Ocean Sciences is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "[Earth, Atmosphere and Ocean Sciences](#)", in [section 6.12.7](#) for details.

MINOR IN ATMOSPHERIC SCIENCE (18 credits)

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

Required Courses (15 credits)

- ATOC214 (3) Introduction: Physics of the Atmosphere
- ATOC215 (3) Oceans, Weather and Climate
- ATOC219 (3) Introduction to Atmospheric Chemistry or CHEM219 (3) Introduction to Atmospheric Chemistry
- ATOC309 (3) Weather Radars and Satellites
- ATOC315 (3) Water in the Atmosphere

Complementary Course (3 credits)

- ATOC412 (3) Atmospheric Dynamics
- or ATOC540 (3) Synoptic Meteorology 1

MAJOR IN ATMOSPHERIC SCIENCE (61 credits)

Required Courses (46 credits)

- ATOC214 (3) Introduction: Physics of the Atmosphere
- ATOC215 (3) Oceans, Weather and Climate
- ATOC309 (3) Weather Radars and Satellites
- ATOC315 (3) Water in the Atmosphere
- ATOC412 (3) Atmospheric Dynamics
- ATOC540 (3) Synoptic Meteorology 1
- ATOC541 (3) Synoptic Meteorology 2
- ATOC546 (1) Current Weather Discussion
- COMP208 (3) Computers in Engineering
- MATH222 (3) Calculus 3
- MATH223 (3) Linear Algebra
- MATH314 (3) Advanced Calculus
- MATH315 (3) Ordinary Differential Equations
- PHYS230 (3) Dynamics of Simple Systems
- PHYS232 (3) Heat and Waves
- PHYS257 (3) Experimental Methods 1

Complementary Courses (15 credits)

3-6 credits to satisfy a statistics requirement, usually:

- MATH203 (3) Principles of Statistics 1 or MATH323 (3) Probability and MATH324 (3) Statistics

3 credits selected from:

- PHYS333 (3) Thermal and Statistical Physics
- PHYS340 (3) Electricity and Magnetism

6-9 credits ordinarily selected from:

- ATOC419 (3) Advances in Chemistry of Atmosphere or CHEM419 (3) Advances in Chemistry of Atmosphere
- ATOC515 (3) Turbulence in Atmosphere and Oceans
- GEOG322 (3) Environmental Hydrology
- GEOG372 (3) Running Water Environments
- MATH317 (3) Numerical Analysis
- MATH319 (3) Partial Differential Equations
- MATH423 (3) Regression and Analysis of Variance

- PHYS241 (3) Signal Processing
- PHYS331 (3) Topics in Classical Mechanics
- PHYS332 (3) Physics of Fluids or MATH555 (4) Fluid Dynamics
- PHYS340 (3) Electricity and Magnetism
- PHYS342 (3) Electromagnetic Waves

JOINT MAJOR IN ATMOSPHERIC SCIENCE AND PHYSICS (67 credits)

This Major provides a solid basis for postgraduate study in meteorology, atmospheric physics, or related fields, and the necessary preparation for embarking on a professional career as a meteorologist directly after the B.Sc.

The program is jointly administered by the Department of Physics and the Department of Atmospheric and Oceanic Sciences. Students should consult undergraduate advisers in both departments.

Required Courses (64 credits)

- ATOC214 (3) Introduction: Physics of the Atmosphere
- ATOC215 (3) Oceans, Weather and Climate
- ATOC309 (3) Weather Radars and Satellites
- ATOC315 (3) Water in the Atmosphere
- ATOC412 (3) Atmospheric Dynamics
- ATOC540 (3) Synoptic Meteorology 1
- ATOC541 (3) Synoptic Meteorology 2
- ATOC546 (1) Current Weather Discussion
- MATH222 (3) Calculus 3
- MATH223 (3) Linear Algebra
- MATH314 (3) Advanced Calculus
- MATH315 (3) Ordinary Differential Equations
- PHYS230 (3) Dynamics of Simple Systems
- PHYS232 (3) Heat and Waves
- PHYS257 (3) Experimental Methods 1
- PHYS258 (3) Experimental Methods 2
- PHYS331 (3) Topics in Classical Mechanics
- PHYS333 (3) Thermal and Statistical Physics
- PHYS339 (3) Measurements Laboratory in General Physics
- PHYS340 (3) Electricity and Magnetism
- PHYS342 (3) Electromagnetic Waves
- PHYS446 (3) Quantum Physics

Complementary Course (3 credits)

- PHYS434 (3) Optics
- or PHYS439 (3) Laboratory in Modern Physics

HONOURS IN ATMOSPHERIC SCIENCE (70 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 the 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 (52 credits)

- ATOC214 (3) Introduction: Physics of the Atmosphere
- ATOC215 (3) Oceans, Weather and Climate
- ATOC309 (3) Weather Radars and Satellites
- ATOC315 (3) Water in the Atmosphere
- ATOC480 (3) Honours Research Project
- ATOC512 (3) Atmospheric and Oceanic Dynamics
- ATOC530 (3) Climate Dynamics 1
- ATOC540 (3) Synoptic Meteorology 1
- ATOC546 (1) Current Weather Discussion
- COMP208 (3) Computers in Engineering
- MATH222 (3) Calculus 3
- MATH223 (3) Linear Algebra
- MATH314 (3) Advanced Calculus

MATH315	(3)	Ordinary Differential Equations
MATH319	(3)	Partial Differential Equations
PHYS230	(3)	Dynamics of Simple Systems
PHYS232	(3)	Heat and Waves
PHYS257	(3)	Experimental Methods 1

Complementary Courses (18 credits)

3-6 credits to satisfy a statistics requirement, usually:

MATH203	(3)	Principles of Statistics 1
or MATH323	(3)	Probability
and MATH324	(3)	Statistics

3 credits selected from:

PHYS333	(3)	Thermal and Statistical Physics
PHYS340	(3)	Electricity and Magnetism

3-6 credits ordinarily selected from:

ATOC419	(3)	Advances in Chemistry of Atmosphere or CHEM419
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ATOC515	(3)	Turbulence in Atmosphere and Oceans
MATH317	(3)	Numerical Analysis
PHYS241	(3)	Signal Processing
PHYS331	(3)	Topics in Classical Mechanics
PHYS332	(3)	Physics of Fluids
or MATH555	(4)	Fluid Dynamics
PHYS340	(3)	Electricity and Magnetism
PHYS342	(3)	Electromagnetic Waves
GEOG322	(3)	Environmental Hydrology
GEOG372	(3)	Running Water Environments
MATH423	(3)	Regression and Analysis of Variance

6 credits selected from:

ATOC513	(3)	Waves and Stability
ATOC531	(3)	Climate Dynamics 2
ATOC541	(3)	Synoptic Meteorology 2

DIPLOMA IN METEOROLOGY (30 credits)

The Department offers an intensive, one-year program in theoretical and applied meteorology to B.Sc. or B.Eng. graduates of suitable standing in physics, applied mathematics or other appropriate disciplines, leading to a Diploma in Meteorology. The program is designed for students with little or no previous background in meteorology who wish to direct their experience to atmospheric or environmental applications, or who need to fulfill academic prerequisites in meteorology to qualify for employment. For further information, consult the Administrative Officer, Burnside Hall, Room 946.

An exemption of up to 6 credits may be allowed for courses already taken. Students granted such exemptions are required to add complementary courses from an approved list to maintain a total credit count of 30 completed at McGill.

Required Courses (18 credits)

ATOC512	(3)	Atmospheric & Oceanic Dynamics
ATOC513	(3)	Waves and Stability
ATOC530	(3)	Climate Dynamics 1
ATOC531	(3)	Climate Dynamics 2
ATOC540	(3)	Synoptic Meteorology 1
ATOC541	(3)	Synoptic Meteorology 2

Complementary Courses (12 credits)

6 credits selected from:

ATOC309	(3)	Weather Radars and Satellites
ATOC315	(3)	Water in the Atmosphere
ATOC419	(3)	Advances in Chemistry of Atmosphere or CHEM419

6 credits ordinarily selected from:

ATOC515	(3)	Turbulence in Atmosphere and Oceans
GEOG522	(3)	Advanced Environmental Hydrology
MATH317	(3)	Numerical Analysis
MATH319	(3)	Partial Differential Equations
PHYS331	(3)	Topics in Classical Mechanics
PHYS340	(3)	Electricity and Magnetism
PHYS342	(3)	Electromagnetic Waves
PHYS332	(3)	Physics of Fluids
or MATH555	(4)	Fluid Dynamics

EARTH SYSTEM SCIENCE INTERDEPARTMENTAL MAJOR

This program is offered by the Departments of Atmospheric & Oceanic Sciences, Earth & Planetary Sciences and Geography.

Students in the Department of Atmospheric & Oceanic Sciences interested in this program should contact Professor Peter Yau (peter.yau@mcgill.ca). For more information, see section 12.12.10 "Earth System Science Interdepartmental Major (ESYS)".

12.12.3 Biochemistry (BIOC)

McIntyre Medical Sciences Building, Room 802
3655 Promenade Sir William Osler
Montreal, QC H3G 1Y6

Telephone: (514) 398-1898

Fax: (514) 398-7384

E-mail: rachel.leger@mcgill.ca

Website: www.mcgill.ca/biochemistry/

Chair — David Y. Thomas

Emeritus Professors

Angus F. Graham; M.Sc.(Tor.), Ph.D., D.Sc.(Edin.), F.R.S.C.

Rose M. Johnstone; B.Sc., Ph.D.(McG.), F.R.S.C.

Samuel Solomon; M.Sc., Ph.D.(McG.), F.R.S.C.

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

Professors

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

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

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

Peter E. Braun; B.Sc., M.Sc.(U.B.C.), Ph.D.(Berk.)

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

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

Annette A. Herscovics; B.Sc., Ph.D.(McG.), F.R.S.C. (*joint appoint. with Oncology*)

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

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

William Muller; B.Sc., Ph.D.(McG.)

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

Morag Park; B.Sc., Ph.D.(Glasgow) (*William Dawson Scholar*) (*joint appoint. with Oncology*)

Jerry Pelletier; B.Sc., Ph.D.(McG.)

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

Joseph Shuster; B.Sc.(McG.), Ph.D.(Calif.), M.D.(Alta.) (*joint appoint. with Medicine*)

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

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

Clifford P. Stanners; B.Sc.(McM.), M.A., Ph.D.(Tor.) (*joint appoint. with Oncology*)

David Y. Thomas; B.Sc.(Bristol), M.Sc.,Ph.D.(Univ. College, Lond.), F.R.S.C.

Michel L. Tremblay; B.Sc., M.Sc.(Sher.), Ph.D.(McM.)

Maria Zannis-Hadjopoulos; B.Sc., M.Sc., Ph.D.(McG.) (*joint appoint. with Oncology*)

Associate Professors

Albert Berghuis; B.Sc., M.Sc.(Rijks Univ.Groningen, the Netherlands), Ph.D.(U.B.C.)

Kalle Gehring; M.Sc.(Mich.), Ph.D.(Berk.)

Alain Nepveu; B.Sc., M.Sc.(Montr.), Ph.D.(Sher.) (*joint appoint. with Oncology*)

Arnim Pause; B.Sc., M.Sc.(U. Konstanz, Germ.), Ph.D.(McG.)

Assistant Professors

Maxime Bouchard; B.Sc, Ph.D.(Laval)

Imed Gallouzi; Maitrise, DEA, Ph.D.(Montpellier,France)

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

Associate Members

Karine Auclair (*Chemistry*); John J. Bergeron (*Anatomy & Cell*

Biology); Katherine Cianflone (*Exp. Medicine, RVH*);

MarkS.Featherstone (*Oncology*); WilliamC.Galley (*Chemistry*);

Michael Hallett (*Computer Science*); Martin Latterich (*Anatomy &*

Cell Biology); PeterJ.Roughley (*Shriners Hospital*); ErwinSchurr

(*Exp. Medicine, RVH*); CharlesScriver (*Pediatrics, MCH*); Peter

Siegel (*Medicine*); Bernard Turcotte (*Exp. Medicine, RVH*);

SimonWing (*Medicine*); Xiang-Jiao Yang (*Molecular Oncology,*

RVH)

Adjunct Professors

Prabhat Arya (*NRC, Ottawa*); Michael Cordingley (*Boehringer-*

Ingelheim); MirekCygler (*B.R.I.*); Jacques Drouin (*Clin. Res.*

Inst.); Karen Meerovitch (*Phytobiotech*); Donald Nicholson (*Merck*

Frosst); MaureenD.O'Connor-McCourt (*B.R.I.*); Enrico Purisima

(*B.R.I.*); Martine Raymond (*Clin. Res. Inst.*); Sophie Roy (*Merck*

Frosst); MarcTherrien (*Clin. Res. Inst.*)

Biochemistry is the application of chemical, genetic, and biophysical approaches to the study of biological processes at the cellular and molecular level. Biochemists are interested in the dynamic events that occur in cells, for example, in mechanisms of brain function; cellular differentiation; energy utilization by animals and microorganisms and in the molecular basis of inheritance and disease. The biochemist seeks to determine how specific molecules such as proteins, nucleic acids, lipids, vitamins and hormones function in various cellular processes. Biochemists place particular emphasis on the regulation of reactions in living cells. The knowledge and methods developed by biochemists 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, the two basic components in the rapidly expanding field of Biotechnology.

Three programs are offered by the Department of Biochemistry. The Honours and Major 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 Faculty 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 Adviser.

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 in this area as well. The biochemist is in an advantageous position to fulfill this role and assume a wide variety of positions in

industry and the health field. These range from research and development in the chemical and pharmaceutical industries to testing as well as research in government and hospital laboratories to management. Many graduates take higher degrees in research and attain academic positions in universities and colleges.

PRE-PROGRAM REQUIREMENTS

Entrance requirements for the Faculty, Major and Honours programs are: 6 credits in elementary biology, 6 credits in general chemistry, 3 credits in organic chemistry, 6 credits in calculus, 8-9credits in physics.

ADVISER

New students interested in Biochemistry should call (514)398-1898 for information regarding academic advising.

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

A Science Major Concentration in Biomedical Sciences is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "**Biomedical Sciences**", in section6.12.4 for details.

FACULTY PROGRAM IN BIOCHEMISTRY (55 credits)

U1 Required Courses (16 credits)

BIOC212	(3)	Molecular Mechanisms of Cell Function
BIOL200	(3)	Molecular Biology
BIOL202	(3)	Basic Genetics
CHEM204	(3)	Physical Chemistry/Biological Sciences 1
CHEM222	(4)	Introductory Organic Chemistry 2

U1 Complementary Courses (9 credits)

6 credits selected from:

BIOL205	(3)	Biology of Organisms
MIMM211	(3)	Introductory Microbiology
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2

3 credits selected from:

BIOL373	(3)	Biometry
COMP202	(3)	Introduction to Computing 1
MATH222	(3)	Calculus 3
PSYC204	(3)	Introduction to Psychological Statistics

U2 Required Courses (15 credits)

BIOC300D1	(3)	Laboratory in Biochemistry
BIOC300D2	(3)	Laboratory in Biochemistry
BIOC311	(3)	Metabolic Biochemistry
BIOC312	(3)	Biochemistry of Macromolecules
CHEM302	(3)	Introductory Organic Chemistry 3

U2 Complementary Courses (3 credits)

3 credits selected from:

ANAT262	(3)	Introductory Molecular and Cell Biology
BIOL303	(3)	Developmental Biology
BIOL313	(3)	Eukaryotic Cell Biology
CHEM352	(3)	Structural Organic Chemistry
CHEM382	(3)	Organic Chemistry: Natural Products
MIMM314	(3)	Immunology

U3 Complementary Courses (12 credits)

at least 3 credits selected from:

BIOC450	(3)	Protein Structure and Function
BIOC454	(3)	Nucleic Acids

the remaining credits selected from the following list or the above:

ANAT261	(4)	Introduction to Dynamic Histology
BIOC404	(3)	Biophysical Chemistry
BIOC455	(3)	Neurochemistry
BIOC458	(3)	Membranes and Cellular Signaling
BIOL205	(3)	Biology of Organisms
BIOL300	(3)	Molecular Biology of the Gene

BIOL303	(3)	Developmental Biology
BIOL304	(3)	Evolution
BIOL314	(3)	Molecular Biology of Oncogenes
CHEM214	(3)	Physical Chemistry/Biological Sciences 2
CHEM257D1	(2)	Introductory Analytical Chemistry
CHEM257D2	(2)	Introductory Analytical Chemistry
CHEM352	(3)	Structural Organic Chemistry
CHEM362	(2)	Advanced Organic Chemistry Laboratory
CHEM382	(3)	Organic Chemistry: Natural Products
CHEM402	(3)	Advanced Bio-organic Chemistry
CHEM572	(3)	Synthetic Organic Chemistry
MIMM211	(3)	Introductory Microbiology
MIMM314	(3)	Immunology
PHAR300	(3)	Drug Action
PHAR301	(3)	Drugs and Disease
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2

MAJOR IN BIOCHEMISTRY (67 or 70 credits)

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

U1 Required Courses (20 credits)

BIOC212	(3)	Molecular Mechanisms of Cell Function
BIOL200	(3)	Molecular Biology
BIOL202	(3)	Basic Genetics
CHEM204	(3)	Physical Chemistry/Biological Sciences 1
CHEM222	(4)	Introductory Organic Chemistry 2
CHEM257D1	(2)	Introductory Analytical Chemistry
CHEM257D2	(2)	Introductory Analytical Chemistry

U1 Complementary Courses (9 credits)

6 credits, selected from:

BIOL205	(3)	Biology of Organisms
MIMM211	(3)	Introductory Microbiology
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2

3 credits selected from:

BIOL309	(3)	Mathematical Models in Biology
BIOL373	(3)	Biometry
COMP202	(3)	Introduction to Computing 1
MATH203	(3)	Principles of Statistics 1
MATH222	(3)	Calculus 3
PSYC204	(3)	Introduction to Psychological Statistics

U2 Required Courses (23 credits)

all Faculty Program U2 Required Courses, plus:

ANAT262	(3)	Introductory Molecular and Cell Biology
CHEM214	(3)	Physical Chemistry/Biological Sciences 2
CHEM362	(2)	Advanced Organic Chemistry Laboratory

U2 Complementary Courses (3 credits)

3 credits selected from:

BIOL303	(3)	Developmental Biology
BIOL313	(3)	Eukaryotic Cell Biology
CHEM352	(3)	Structural Organic Chemistry
CHEM382	(3)	Organic Chemistry: Natural Products
MIMM314	(3)	Immunology

U3 Required Courses (6 credits)

BIOC450	(3)	Protein Structure and Function
BIOC454	(3)	Nucleic Acids

U3 Complementary Courses (6 or 9* credits)

at least 3 credits selected from:

BIOC404	(3)	Biophysical Chemistry
BIOC455	(3)	Neurochemistry
BIOC458	(3)	Membranes and Cellular Signalling
BIOC460*	(6)	Advanced Lab in Biochemistry
BIOC503	(3)	Immunochemistry

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

BIOL300	(3)	Molecular Biology of the Gene
BIOL303	(3)	Developmental Biology

BIOL304	(3)	Evolution
BIOL313	(3)	Eukaryotic Cell Biology
BIOL314	(3)	Molecular Biology of Oncogenes
CHEM352	(3)	Structural Organic Chemistry
CHEM382	(3)	Organic Chemistry: Natural Products
CHEM402	(3)	Advanced Bio-organic Chemistry
CHEM552	(3)	Physical Organic Chemistry
CHEM572	(3)	Synthetic Organic Chemistry
EXMD502	(3)	Advanced Endocrinology
EXMD503	(3)	Advanced Endocrinology
MIMM314	(3)	Immunology
MIMM324	(3)	Fundamental Virology
PHAR300	(3)	Drug Action
PHAR301	(3)	Drugs and Disease
PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2

* Students who are given special permission to take BIOC460 are required to complete 9 credits of complementary courses in U3.

HONOURS IN 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 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 Student Affairs Officer 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 B in every required course. In borderline cases, the marks received in BIOC311 and BIOC312 will be of particular importance for continuation in the U3 Honours year.

For graduation in the Honours program, the student 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 (20 credits)

as for the Major Program U1

U1 Complementary Courses (9 credits)

as for the Major Program U1

U2 Required Courses (23 credits)

as for the Major Program U2

U2 Complementary Courses (3 credits)

as for the Major Program U2

U3 Required Courses (15 credits)

BIOC404	(3)	Biophysical Chemistry
BIOC450	(3)	Protein Structure and Function
BIOC454	(3)	Nucleic Acids
BIOC460	(6)	Advanced Lab in Biochemistry

U3 Complementary Courses (6 credits)

at least 3 credits selected from:

BIOC455	(3)	Neurochemistry
BIOC458	(3)	Membranes and Cellular Signaling
BIOC491	(6)	Independent Research
BIOC503	(3)	Immunochemistry

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

BIOL300	(3)	Molecular Biology of the Gene
BIOL303	(3)	Developmental Biology
BIOL304	(3)	Evolution
BIOL313	(3)	Eukaryotic Cell Biology
BIOL314	(3)	Molecular Biology of Oncogenes
CHEM352	(3)	Structural Organic Chemistry
CHEM382	(3)	Organic Chemistry: Natural Products
CHEM402	(3)	Advanced Bio-organic Chemistry
CHEM552	(3)	Physical Organic Chemistry
CHEM572	(3)	Synthetic Organic Chemistry

EXMD502	(3)	Advanced Endocrinology
EXMD503	(3)	Advanced Endocrinology
MIMM314	(3)	Immunology
MIMM324	(3)	Fundamental Virology
PHAR300	(3)	Drug Action
PHAR301	(3)	Drugs and Disease
PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2

INTERDEPARTMENTAL HONOURS IN IMMUNOLOGY (see section 12.12.14 "Immunology Interdepartmental Honours"); This program is offered by the Departments of Biochemistry, Microbiology and Immunology, and Physiology.

12.12.4 Biology (BIOL)

Stewart Biological Sciences Building, Room W4-7
1205 Avenue Docteur Penfield
Montreal, QC H3A 1B1

Telephone: (514) 398-6400

Fax: (514) 398-5069

Website: www.biology.mcgill.ca

Chair — Paul F. Lasko

Emeritus Professors

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

Clark Fraser; O.C., B.Sc.(Acadia), M.Sc., Ph.D., M.D.(McG.),
D.Sc.(Acadia), F.R.C.P.(C), F.R.S.C. (*Molson Emeritus
Professor of Genetics*) (*joint appoint. with Human Genetics*)

Sarah P. Gibbs; A.B., M.S.(C'nell), Ph.D.(Harv.), F.R.S.C.
(*Macdonald Emeritus Professor of Botany*)

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

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

Gordon A. Maclachlan; B.Sc.(Sask.), Ph.D.(Manit.) (*Macdonald
Emeritus Professor of Botany*)

Barid B. Mukherjee; B.Sc.(Calc.), M.S.(Brig.Young), Ph.D.(Utah)
(*joint appoint. with Human Genetics*)

Rolf Sattler; B.Sc.(Tubingen), Ph.D.(Munich), F.R.S.C.

Professors

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

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

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

Lauren Chapman; B.Sc.(Alta), Ph.D.(McG.)

Ronald Chase; A.B.(Stan.), Ph.D.(M.I.T.)

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

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

(on sabbatical)

Paul F. Lasko; A.B.(Harv.), Ph.D.(M.I.T.) (*Molson Professor of
Genetics*) (*joint appoint. with Anatomy & Cell Biology*)

Martin Lechowicz; B.A.(Mich. State), M.S., Ph.D.(Wis.)

Louis Lefebvre; B.Sc., M.A., Ph.D.(Montr.)

Michel Loreau; M.Sc., Ph.D.(Free Univ., Brussels)

Catherine Potvin; B.Sc., M.Sc.(Montr.), Ph.D.(Duke)

Rima Rozen; B.Sc., Ph.D.(McG.) (*James McGill Professor*)

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

Associate Professors

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

François Fagotto; Ph.D.(Neuchâtel)

Gregor Fussman; Diploma(Berlin), Ph.D.(Max-Planck-Institute)

Andrew Gonzalez; B.Sc.(Univ. Nottingham), Ph.D.(Imperial
College, Univ. London)

Siegfried Hekimi; M.Sc., Ph.D.(Geneva)

Robert L. Levine; B.Sc.(Brooklyn), M.Sc., Ph.D.(Yale)

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

Neil M. Price; B.Sc.(New Br.), Ph.D.(Br.Col.)

Assistant Professors

Ehab Abouheif; M.Sc.(C' dia), Ph.D.(Duke)

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

Irene Gregory-Eaves; B.Sc.(Vic., B.C.), M.Sc., Ph.D.(Queen's)

Frédéric Guichard; B.Sc.(Montr.), Ph.D.(Laval)

Christian Hardtke; M.Sc., Ph.D.(Munich) (on leave)

Paul Harrison; B.Sc.(National Univ. of Ireland), Ph.D.(University of
London)

Andrew Hendry; B.Sc.(Vic.,B.C.), M.Sc., Ph.D.(Wash.)

Rudiger Krahe; Diploma(Alexander University), Ph.D.(Humboldt
University)

Brian Leung; B.Sc.(Br.Col.), Ph.D.(Carleton)

Laura Nilson; B.A.(Colgate), Ph.D.(Yale) (*Canada Research Chair
in Genetics*)

Richard Roy; B.Sc.(Bishop's), Ph.D.(Laval)

Frieder Schoeck; Diploma(Erhangen), Ph.D.(Max-Planck-
Institute)

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

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

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

Associate Members

Allan Memorial Institute: Roberta Palmour

Biochemistry: David Y. Thomas

Centre for Research in Neuroscience: Donald Van Meyel

MGH: Sal Carbonetto, Pierre Drapeau

MNI: Kenneth Hastings, Paul Holland

Neurology and Neurosurgery: Michael Ferns

Neuroscience: Robert Dunn

Chair, Dept. of Human Genetics: David Rosenblatt

RVH: Hugh J. Clarke, Teruko Taketo

Redpath Museum: David Green, Hans Larsson, Anthony Ricciardi

Adjunct Professors

NRC Lab: Malcolm S. Whiteway

STRI: Eldredge Bermingham, Allen Herre, William F. Laurance,
David Roubik

U. of Montreal: Guy Rouleau

U. West Indies: Wayne Hunte

Biology is the study of living things at the molecular, cellular and organismal levels. It deals with fundamental questions such as the origin and evolution of plants and animals, interactions between living organisms and their environment, mechanisms of embryonic development, structure and function of the living cell and its organelles, molecular basis of inheritance, biochemical and genetic basis of human diseases, and the operation of the brain and the nervous system. The study of biology also has vast practical applications. The knowledge, methods and concepts developed through research in the various fields of biology are applied extensively in agriculture, medicine, biotechnology, genetic engineering, environmental protection and wildlife management.

The Department of Biology offers two Faculty Programs, a Major Program, an Honours Program, a Minor Program and a Minor Concentration in Science for Arts students. The details of these programs are given below.

The prerequisites for Biology programs include, in addition to the minimum requirements for admission to the Faculty of Science, an additional Biology and one course in Organic Chemistry. Students who have a DEC in Science but lack either of these courses must take them as extra requirements. It is advisable to take the additional CEGEP Biology in advance, if possible. The two Biology courses together prepare students for the Biology Program at McGill. Note that an introductory course in Cell and Molecular Biology (BIOL112) is offered in the Summer at McGill.

The programs in Biology offer students an opportunity to specialize in more than one area of biology and provide them with a broad training in biology as compared to the more specialized programs in Biochemistry, Microbiology, Physiology and Anatomy. A B.Sc. degree in Biology, therefore, prepares students for a wide range of employment opportunities, including entry to professional schools in medicine, veterinary science, dentistry, agriculture, nursing, education and library science. It also provides solid background for those interested in careers related to environmental protection, wildlife management, biotechnology and genetic engineering. A B.Sc. degree in Biology can also lead to postgraduate

studies and research careers in universities, research institutes, hospitals, and industrial or governmental laboratories.

The Department of Biology has well-equipped teaching and research laboratories and its academic staff members, research associates, postdoctoral fellows and graduate students carry out research in areas of molecular biology, human genetics, ecology, animal behaviour, developmental biology, neurobiology, marine biology, plant biology, and evolution. Its teaching and research resources are extended by the Redpath Museum; the Montreal Children's, Jewish General, Montreal General, Royal Victoria and Shriners Hospitals; Macdonald Campus; Montreal Neurological Institute; and the Sheldon Biotechnology Centre. For courses taught in the field, the stations at the Gault Nature Reserve, the Morgan Arboretum, the Bellairs Research Institute in Barbados, the Huntsman Marine Science Centre in New Brunswick, and the Smithsonian Tropical Research Institute in Panama are used. In addition, field stations near Lake Memphremagog and at Schefferville in northern Quebec are available for research projects.

The Department of Biology Undergraduate Programs 2005-2006 booklet ("Blue Book") describes in detail the content of each course and the level at which it is given, the aims and methods used, lectures, references, grading procedures, etc. The "Blue Book" also contains more information on registration, counselling, committee structure and the research interests and facilities which are represented in the Department. It is available on the Web at www.mcgill.ca/biology/undergrad/bluebook.html.

Inquiries about undergraduate programs should be directed to the Undergraduate Affairs Office, in Room W4/8, Stewart Biological Sciences Building, telephone (514) 398-7045.

Two Science Major Concentrations in Biology (Organismal Option and Cell/Molecular Option) are available to students pursuing the B.A. & Sc. degree. These Major Concentrations are described in the Bachelor of Arts and Science section of the Calendar; see "Biology (BIOL)", in section 6.12.3 for details. Also, two new Biology Minor Concentrations are under development. See www.mcgill.ca/artsciao/basc for details.

MINOR IN BIOLOGY (24 credits)

The Minor in Biology may be taken in conjunction with any primary program in the Faculty of Science (other than programs offered by the Department of Biology). Students are advised to consult the Undergraduate Adviser in Biology as early as possible (preferably during their first year), in order to plan their course selection.

Six credits of overlap are allowed between the Minor and the primary program.

Required Courses (15 credits)

BIOL200	(3)	Molecular Biology
BIOL201	(3)	Cell Biology and Metabolism
BIOL202	(3)	Basic Genetics
BIOL205	(3)	Biology of Organisms
BIOL215	(3)	Introduction to Ecology and Evolution

Complementary Courses (9 credits)

9 credits to be chosen from the Biology Department's course offerings, at the 300 level or above.

FACULTY PROGRAMS

In view of the constantly changing job market for B.Sc. graduates in biology, the Department has designed Faculty Programs to allow students to prepare for a wide range of employment opportunities. These programs offer students an opportunity to specialize in more than one area of biology, to broaden the scope of their scientific background. These programs can be tailored to provide a relatively broad spectrum of biology courses, or provide a degree of specialization in biology which approaches that of a Major Program. The flexibility and scope of these programs will not only enhance the graduate's prospects for employment, but also entrance into graduate studies.

FACULTY PROGRAM IN BIOLOGY (54 or 55 credits)

Required Courses (15 credits)

BIOL200	(3)	Molecular Biology
BIOL201	(3)	Cell Biology and Metabolism
BIOL202	(3)	Basic Genetics
BIOL205	(3)	Biology of Organisms
BIOL215	(3)	Introduction to Ecology and Evolution

Complementary Courses (39 or 40 credits)

21 or 22 credits of Biology courses, including

3 or 4 credits selected from:

BIOL206	(3)	Methods in Biology of Organisms
BIOL301	(4)	Cell and Molecular Laboratory

18 credits of Science courses including, at most, 3 credits of general interest Science courses (not listed in Science Major Programs).

Of the Complementary courses at least 6 of the 18 remaining Biology credits and 6 of the 18 Science credits must be above the 200 level, none may be at the 100 level; all are to be approved by the adviser.

FACULTY PROGRAM IN BIOLOGY AND MATHEMATICS

(57 credits)

[Additions to the Complementary course lists are under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

Required Courses (21 credits)

COMP202	(3)	Introduction to Computing 1
MATH133	(3)	Vectors, Matrices and Geometry
MATH222	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH315	(3)	Ordinary Differential Equations
MATH323	(3)	Probability
MATH324	(3)	Statistics

Complementary Courses (36 credits)

21 credits in Biology including

12 credits selected from:

BIOL200	(3)	Molecular Biology
BIOL201	(3)	Cell Biology and Metabolism
BIOL202	(3)	Basic Genetics
BIOL205	(3)	Biology of Organisms
BIOL206	(3)	Methods in Biology of Organisms
BIOL215	(3)	Introduction to Ecology and Evolution
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2

and 9 credits selected from:

BIOL303	(3)	Developmental Biology
BIOL306	(3)	Neurobiology and Behaviour
BIOL307	(3)	Behavioural Ecology/Sociobiology
BIOL324	(3)	Ecological Genetics
BIOL370	(3)	Human Genetics Applied
BIOL473	(3)	Ecology of Aquatic Invertebrates
BIOL520	(3)	Gene Activity in Development
BIOL530	(3)	Neural Basis of Behaviour
BIOL531	(3)	Neurobiology Learning Memory

6 credits of any other Biological Sciences courses

9 credits of Mathematics

including at least 3 credits selected from:

BIOL309	(3)	Mathematical Models in Biology
MATH437	(3)	Mathematical Methods in Biology
PHYS413	(3)	Physical Basis of Physiology

and at least 3 credits selected from:

MATH314	(3)	Advanced Calculus
MATH317	(3)	Numerical Analysis
MATH319	(3)	Partial Differential Equations
MATH327	(3)	Matrix Numerical Analysis
MATH407	(3)	Dynamic Programming
MATH423	(3)	Regression and Analysis of Variance

MATH447 (3) Stochastic Processes
or other suitable mathematics courses chosen in consultation with the adviser.

Advisers: Drs. M. Mackey and L. Glass (Department of Physiology)

MAJOR IN BIOLOGY (55 credits)

The Major requires 55 credits comprising 34 as specified below and 21 additional credits which are to be chosen by students in consultation with their adviser.

U1 Required Courses (18 credits)

BIOL200 (3) Molecular Biology
BIOL201 (3) Cell Biology and Metabolism
BIOL202 (3) Basic Genetics
BIOL205 (3) Biology of Organisms
BIOL206 (3) Methods in Biology of Organisms
BIOL215 (3) Introduction to Ecology and Evolution

U2 or U3 Required Courses (4 credits)

BIOL301 (4) Cell and Molecular Laboratory

U2 or U3 Complementary Courses (12 credits)

12 credits selected from:

BIOL300 (3) Molecular Biology of the Gene
BIOL303 (3) Developmental Biology
BIOL304 (3) Evolution
BIOL306 (3) Neurobiology and Behaviour
BIOL308 (3) Ecological Dynamics

Other Complementary Courses (21 credits)

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

BIOLOGY CONCENTRATIONS

The concentrations set out below are only guidelines for specialized training. They do not constitute sets of requirements. Students interested in advanced studies in any biological discipline are strongly advised to develop their skills in computing as appropriate. As an aid to students wishing to specialize, the concentrations list key and other suggested courses by discipline.

Animal Behaviour Concentration

Understanding the diverse ways in which animals feed, mate, care for their offspring, avoid predators, select their habitats, communicate, and process information constitute the subject matter of behaviour. Several approaches are used to study these questions. Some focus on ecological consequences and determinants, some on physiological, genetic and developmental mechanisms, others on evolutionary origins.

Key courses:

BIOL304, BIOL305, BIOL306, BIOL307, BIOL331 or BIOL334 or another field course with a significant behavioural component, BIOL373.

Other suggested courses:

BIOL377, BIOL471D1/BIOL471D2, BIOL477, BIOL478

Since animal behaviour builds upon the fields of behaviour, ecology, and evolutionary biology, most courses from these fields will be relevant. Some courses that focus on a particular taxonomic group such as birds (Natural Resource Sciences WILD420), amphibians and reptiles (BIOL327) and marine mammals (BIOL335) include a significant amount of behaviour.

Biological Diversity and Systematics

The study of biological diversity deals with the maintenance, emergence, and history of the inexhaustible variety of different kinds of organisms. It is deeply concerned with the particular characteristics of different organisms and therefore emphasizes the detailed study of particular groups and forms the basis of comparative biology. Our knowledge of diversity is organized through the study of

systematics, which seeks to understand the history of life and the phylogenetic and genetic relationships of living things. Appreciation and knowledge of diversity and systematics are essential in ecology and evolutionary biology and underlie all work in resource utilization and conservation biology.

Key course:

BIOL304, BIOL305, BIOL373

Other suggested courses:

BIOL240, BIOL324, BIOL327, BIOL328, BIOL329, BIOL331 or BIOL334, BIOL335, BIOL341, BIOL350, BIOL352, BIOL465, BIOL471D1/BIOL471D2, BIOL477 or BIOL478, BIOL505, BIOL555D1/BIOL 555D2, BIOL569, BIOL594

Macdonald Campus:

PLNT358, PLNT451; ENTO440; WILD 212, WILD 307, WILD 313, WILD350, WILD420; WILD 424

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:

BIOL304, BIOL305, BIOL307, BIOL324, BIOL331, BIOL352, BIOL373, BIOL435, BIOL471D1/BIOL471D2, BIOL477 or BIOL478, BIOL555D1/BIOL555D2, BIOL569, BIOL570, BIOL571, BIOL572, BIOL594

Other suggested courses in Organismal Biology:

BIOL240, BIOL327, BIOL328, BIOL335, BIOL350,

Macdonald Campus: WILD420

Genetics and Development: BIOL300, BIOL303

Ecology and Behaviour: BIOL309, BIOL329, BIOL331, BIOL341, BIOL534

Experimental Plant Biology Concentration

Research interests span modern molecular genetics, plant physiology and biochemistry, plant ecology and genetics, plant morphogenesis, and the adaptation and evolution of plant form and function. Research is carried out in the field and in the Department's large, excellent controlled-environment facilities. The importance of adaptation to climate and the use of plants for food, chemicals, pharmaceuticals and materials underlie research using biotechnology and quantitative methods to improve cultivated plants and understand natural plant populations.

Key courses:

BIOL300, BIOL303, BIOL305, BIOL373, BIOL485

Other suggested courses:

BIOL465, BIOL471D1/BIOL471D2, BIOL477, BIOL478, BIOL555D1/BIOL555d2

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:

BIOL301, BIOL370, BIOL373, BIOL516, BIOL520, BIOL568, BIOL575

Other suggested courses:

BIOC311; BIOL314, BIOL471D1/BIOL471D2, BIOL477, BIOL478, BIOL551; CHEM203 or CHEM204 and CHEM214, MIMM314

Molecular Genetics and Development Concentration

The discoveries that have fuelled the ongoing biomedical and biotechnological revolution have arisen at the intersection of a number of fields of biological investigation, including molecular biology, genetics, cellular and developmental biology and biochemistry. A substantial and significant quantity of this research

has been conducted upon model eukaryotic organisms, such as yeast, nematode, the fruit fly, and the mustard weed, *Arabidopsis*. In the molecular genetics and development concentration students will obtain a comprehensive understanding of how the “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:

BIOL300, BIOL301, BIOL303, BIOL373, BIOL551, BIOL569; CHEM203 or CHEM204, CHEM214

Other suggested courses:

BIOL313, BIOL314, BIOL471D1/BIOL471D2, BIOL477, BIOL478, BIOL516, BIOL518, BIOL520, BIOL524, BIOL544

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 which can range from the mundane (e.g., regulation of heart rate) to the magnificent (e.g., musical composition). The neurobiology discipline is 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 examination of 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:

BIOL306, BIOL373, BIOL389, BIOL530, BIOL531, BIOL532, BIOL588

Other suggested courses:

ANAT321, ANAT322; BIOC455; BIOL300, BIOL303, BIOL471D1/BIOL471D2, BIOL477, BIOL478; NEUR310; PHAR562; PHGY451, PHGY520, PHGY556; PSYC311, PSYC318, PSYC342, PSYC410, PSYC470, PSYC522; PSYT500

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 modelling. 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 BIOL331 and/or other field courses should be considered as vital to all concentrations in this area.

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, three of the courses (limnology, fish ecology, and aquatic invertebrate ecology) involve field components 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:

BIOL305, BIOL308, BIOL331 or another field course, BIOL373, BIOL432, BIOL441, BIOL442, BIOL465; COMP202 or COMP273

Other suggested courses:

BIOL307, BIOL329, BIOL534; GEOG305, GEOG306, GEOG308, GEOG322

Macdonald Campus:

ZOOL315

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:

BIOL305, BIOL308, BIOL331 or BIOL334, BIOL350, BIOL373; COMP202 or COMP273

Other suggested courses:

BIOL307, BIOL324, BIOL327, BIOL328, BIOL329, BIOL432, BIOL441, BIOL442, BIOL465, BIOL534, BIOL540, BIOL571, BIOL594; GEOG302

Macdonald Campus: PLNT451, PLNT460

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 to employment in aquatic biology and oceanography.

Key courses:

BIOL305, BIOL308, BIOL335, BIOL373, BIOL441, BIOL442

Other suggested courses:

ATOC220, ATOC512, ATOC550, ATOC551, ATOC561; BIOL329, BIOL331, BIOL334, BIOL432, BIOL465, BIOL534; EPSC542

For students intending to proceed to graduate work, one independent studies course (BIOL471D1/BIOL471D2, BIOL477 or BIOL478) is recommended. Because of the importance of numerical analyses in all fields of ecology, courses in Biometry (e.g. BIOL373) and Computer Science (COMP202 or COMP273) are recommended.

HONOURS IN BIOLOGY (68 or 71 credits)

The Honours Program in Biology is designed expressly as a preparation for graduate studies and research, and provides students with an enriched training in biology and some research experience in a chosen area. Acceptance into the Honours Program at the end of U2 requires a CGPA of 3.50 and approval of a 9- or 12-credit Independent Studies proposal (see listing of BIOL479 and BIOL480 for details). For an Honours degree, a minimum CGPA of 3.50 in the U3 year and adherence to the program as outlined below are the additional requirements. The new 3.50 requirement applies only beginning with students entering McGill in the Fall of 2005.

U1 Required Courses (18 credits)

as for the Major program

U2 and U3 Required Courses (7 credits)

BIOL301	(4)	Cell and Molecular Laboratory
BIOL373	(3)	Biometry

U2 and U3 Complementary Courses (30 credits)

12 credits selected from:

BIOL300	(3)	Molecular Biology of the Gene
BIOL303	(3)	Developmental Biology
BIOL304	(3)	Evolution
BIOL306	(3)	Neurobiology and Behaviour
BIOL308	(3)	Ecological Dynamics

18 credits in Biology at the 300 level or higher

U3 Required Courses (4 credits)

BIOL499D1 (2) Honours Seminar in Biology
 BIOL499D2 (2) Honours Seminar in Biology

U3 Complementary Courses (9 or 12 credits)

either:

BIOL479D1 (4.5) Independent Studies in Biology
 BIOL479D2 (4.5) Independent Studies in Biology

or:

BIOL480D1 (6) Independent Studies in Biology
 BIOL480D2 (6) Independent Studies in Biology

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 [section 15.1.3 "Panama Field Study Semester"](#). You can also visit the following Website for details:
www.mcgill.ca/mse/field_study/panama

AFRICAN FIELD STUDY SEMESTER The Department of Geography, Faculty of Science, coordinates the 15-credit interdisciplinary African Field Study Semester, see [section 15.1.1 "African Field Study Semester"](#).

Note: The AFSS will only be offered in 2005-2006 pending approval by the Dean of Science.

Also available is a [Minor in Computational Molecular Biology](#); for more information, see [section 12.12.8 "Computer Science \(COMP\)"](#).

12.12.5 Biotechnology (BIOT)

Sheldon Biotechnology Centre
 Lyman Duff Building

Telephone: (514) 398-3998

Program Supervisor

Professor Hugh P.J. Bennett; B.A.(York), Ph.D.(Brun.)

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 BIOT course listed in the course section of this Calendar is considered as a course taught by the Faculty of Science.

GENERAL REGULATIONS

To obtain the Minor in Biotechnology the 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.

MINOR IN BIOTECHNOLOGY (24 credits)**PROGRAM FOR STUDENTS IN THE FACULTY OF SCIENCE*****Required Courses** (15 credits)

BIOL200 (3) Molecular Biology
 BIOL201 (3) Cell Biology and Metabolism
 or BIOC212 (3) Molecular Mechanisms of Cell Function
 BIOL202 (3) Basic Genetics
 BIOT505 (3) Selected Topics in Biotechnology
 MIMM211 (3) Introductory Microbiology

Complementary Courses (9 credits)

selected from courses outside the department of the main program, these may be taken from those listed as required courses for Engineering students. Alternatively, or in addition, courses may be taken from the lists below, in which case at least three courses must be taken from one area of concentration as grouped.

* As 18 credits must be applied exclusively to the Minor, approved substitutions must be made for any of the specified courses which are part of the student's main program.

PROGRAM FOR STUDENTS IN THE FACULTY OF ENGINEERING***Required Courses** (12 credits)

BIOT505 (3) Selected Topics in Biotechnology
 CHEE200 (3) Introduction to Chemical Engineering
 CHEE204 (3) Chemical Manufacturing Processes
 CHEE474 (3) Biochemical Engineering

Complementary Courses (12 credits)

selected from courses outside the department of the main program, these may be taken from those listed as required courses for Science students. Alternatively, or in addition, courses may be taken from the lists below, in which case at least three courses must be taken from one area of concentration as grouped.

* As 18 credits must be applied exclusively to the Minor, approved substitutions must be made for any of the specified courses which are part of the student's main program.

Biomedicine

ANAT541 Cell and Molecular Biology of Aging
 EXMD504 Biology of Cancer
 PATH300 Human Disease

Chemistry

CHEM382 Organic Chemistry: Natural Products
 CHEM402 Advanced Bio-organic Chemistry
 CHEM552 Physical Organic Chemistry

Immunology

ANAT261 Introduction to Dynamic Histology
 BIOC503 Immunochemistry
 MIMM314 Immunology
 MIMM414 Advanced Immunology
 PHGY513 Cellular Immunology

Management*

ECON208 Microeconomics Analysis and Applications
 MGCR211 Introduction to Financial Accounting
 MGCR341 Finance 1
 MGCR352 Marketing Management 1
 MGCR472 Operations Management

* These courses may not also be used for a Management Minor, nor for complementary, by Engineering students.

Microbiology

MIMM323 Microbial Physiology
 MIMM324 Fundamental Virology
 MIMM413 Parasitology
 MIMM465 Bacterial Pathogenesis
 MIMM466 Viral Pathogenesis

Molecular Biology (Biology)

BIOL300 Molecular Biology of the Gene
 BIOL314 Molecular Biology of Oncogenes
 BIOL520 Gene Activity in Development

BIOL551 Molecular Biology: Cell Cycle
BIOL524 Topics in Molecular Biology

Molecular Biology (Biochemistry)

BIOC311 Metabolic Biochemistry
BIOC312 Biochemistry of Macromolecules
BIOC450 Protein Structure and Function
BIOC454 Nucleic Acids
BIOC455 Neurochemistry

Physiology

EXMD401 Physiology and Biochemistry Endocrine Systems
EXMD502 Advanced Endocrinology
EXMD503 Advanced Endocrinology
PHAR562 General Pharmacology 1
PHAR563 General Pharmacology 2
PHGY517 Artificial Internal Organs
PHGY518 Artificial Cells

Plant Biology

BIOL357 Plant Physiology
BIOL526 Plants and Extreme Environments

Pollution*

CHEE471 Industrial Water Pollution Control
CIVE225 Environmental Engineering
CIVE430 Water Treatment and Pollution Control
CIVE526 Solid Waste Management
CIVE553 Stream Pollution and Control

* These courses may not also be used for an Environmental Engineering Minor by Engineering students.

General

MIME310 Engineering Economy

12.12.6 Chemistry (CHEM)

Otto Maass Chemistry Building
801 Sherbrooke Street West
Montreal, QC H3A 2K6

Website: www.mcgill.ca/chemistry

Departmental Office: Room 322. Telephone: (514) 398-6999
Student Advisory Office: Room 304. Telephone: (514) 398-3653
Website: www.mcgill.ca/chemistry/advising

Chair — R. Bruce Lennox

Emeritus Professors

Byung Chan Eu; B.Sc.(Seoul), Ph.D.(Brown)
Tak-Hang Chan; B.Sc.(Tor.), M.A., Ph.D.(Prin.), F.C.I.C., F.R.S.C.
(*Tomlinson Professor of Chemistry*)
John F. Harrod; B.Sc., Ph.D.(Birm.)
(*Tomlinson Emeritus Professor of Chemistry*)
Alan S. Hay; B.Sc., M.Sc.(Alta.), Ph.D.(Ill.), D.Sc.(Alta.), F.R.S.,
F.N.Y., Acad.Sci. (*Tomlinson Emeritus Professor of Chemistry*)
Robert H. Marchessault; B.Sc.(Loyola), Ph.D.(McG.), D.Sc.
(C'dia), F.R.S.C. (*E.B. Eddy Professor of Industrial Chemistry*)
Mario Onyszchuk; B.Sc.(McG.), M.Sc.(W.Ont.), Ph.D.(McG.),
Ph.D.(Cantab.)
Donald Patterson; M.Sc.(McG.), Doc.(St-Etienne) (*Otto Maass
Emeritus Professor of Chemistry*)
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.(Amherst), Ph.D.(M.I.T.), F.C.I.C.
(*William C. Macdonald Emeritus Professor of Chemistry*)
Leon E. St-Pierre; B.Sc.(Alta.), Ph.D.(Notre Dame, Ind.), F.C.I.C.
Michael A. Whitehead; B.Sc., Ph.D., D.Sc.(Lond.), F.C.I.C.

Professors

D. Scott Bohle; B.A.(Reed College), M.Phil., Ph.D.(Auck.),
(*CRC Tier I Chair*)
Ian S. Butler; B.Sc., Ph.D.(Brist.), F.C.I.C., C.Chem.,
F.R.S.C.(U.K.)
Masad J. Damha; B.Sc., Ph.D.(McG.) (*James McGill Professor*)
Adi Eisenberg; B.S.(Worcester Polytech.), M.A., Ph.D.(Prin.),
F.C.I.C. (*Otto Maass Professor of Chemistry*)

Derek G. Gray; B.Sc. (Belf.), M.Sc., Ph.D.(Man.), F.C.I.C.
(*NSERC Paprican Chair*)

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

George Just; Ing.Chem.(E.T.H. Zürich), Ph.D.(W.Ont.), F.C.I.C.
(*William C. Macdonald Professor of Chemistry*)

R. Bruce Lennox; B.Sc., M.Sc., Ph.D.(Tor.)

C.J. Li; B.Sc.(Zhengzhou), M.Sc.(C.A.S.), Ph.D.(McG.),
(*CRC Tier I Chair*)

David Ronis; B.Sc.(McG.), Ph.D.(M.I.T.)

Eric D. Salin; B.Sc.(Calif.), Ph.D.(Oreg.St.)

Bryan C. Sanctuary; B.Sc., Ph.D.(U.B.C.)

Alan G. Shaver; B.Sc.(Car.), Ph.D.(M.I.T.)

Theo G.M. van de Ven; Kand. Doc.(Utrecht), Ph.D.(McG.),
(*NSERC Paprican Chair*)

Associate Professors

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

Bruce Arndtsen; B.A.(Car. College), Ph.D.(Stan.)

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

William C. Galley; B.Sc.(McG.), Ph.D.(Calif.)

James Gleason; B.Sc.(McG.), Ph.D.(Virginia)

Ashok K. Kakkar; B.Sc.(Punjab), M.Sc.(H.P.U.), Ph.D.(Wat.)

Joan F. Power; B.Sc., Ph.D.(C'dia)

Linda Reven; B.A.(Car. College), Ph.D.(Ill.)

Assistant Professors

Parisa Ariya; B.Sc., Ph.D.(York) (*William Dawson Scholar*) (*joint
appoint. with Atmospheric & Oceanic Sciences*)

Karine Auclair; B.Sc.(U.Q.A.C.), Ph.D.(Alta.)

Christopher J. Barrett; B.Sc., M.Sc., Ph.D.(Queen's)

Patanjali Kambhampati; B.A.(Car. College), Ph.D.(Texas)

Nicolas Moitessier; Ph.D.(Nancy)

Hanadi Sleiman; B.Sc.(A.U.B.), Ph.D.(Stan.) (*William Dawson
Scholar*)

Paul Wiseman; B.Sc.(St.F.X.), Ph.D.(W.Ont.) (*joint appoint. with
Physics*)

Faculty Lecturers

John Finkenbine; B.S.(Capital), Ph.D.(McG.)

Grazyna Wilczek; M.Sc., Doctorate Chem. Sci.(Warsaw)

Associate Members

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

K. Gehring (*Biochemistry*)

P. Grütter (*Physics*)

Orval A. Mamer (*University Clinic*)

Barry I. Posner (*Medicine*)

Adjunct Professors

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

Romas Kazlauskas; B.Sc.(Clev.St.), Ph.D.(M.I.T.)

R. St. John Manley; B.Sc., Ph.D.(McG.), D.Sc.(Uppsala)

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

Youla Tsantrizos; B.Sc., Ph.D.(McG.)

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

C.T. Yim; B.Sc.(Fu-Dan), Ph.D.(McG.)

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

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 towards 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. ès S., D.E.A.(Paris), Ph.D.(McG.)

David N. Harpp; A.B.(Middlebury), M.A.(Wesleyan),
Ph.D.(N.Carolina), F.C.I.C. (*William C. Macdonald Professor of 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, dealing with the compounds of carbon; 2) inorganic chemistry, concerned with the chemistry and compounds of elements other than carbon; 3) analytical chemistry, which deals with the identification of substances and the quantitative measurement of their compositions; and 4) physical chemistry, which treats the physical laws and energetics governing chemical reactions. Naturally, there is a great deal of overlap between these different areas, and the boundaries are becoming increasingly blurred. After a general course at the collegial level, courses in organic, inorganic, analytical and physical chemistry are offered through the university years. Since chemistry is an experimental science, laboratory classes accompany most undergraduate courses. In addition, courses are offered in polymer, theoretical, green, nano and biological chemistry to upper-year undergraduates.

There are two main programs in the Department of Chemistry, Honours and Major. The Honours program is intended primarily for students wishing to pursue graduate studies in chemistry. While the Major program is somewhat less specialized, it is still recognized as sufficient training for a career in chemistry. It can also lead to graduate studies although an additional qualifying year may be necessary. There are also a number of Faculty programs available. Interested students may inquire about these at the Student Advisory Office, Room 304, Otto Maass Chemistry Building, or see www.mcgill.ca/chemistry/advising.

PRE-PROGRAM REQUIREMENTS

Students entering from the Freshman program must have included CHEM120/CHEM110, BIOL111 or BIOL112, MATH150/MATH151 or MATH140/ MATH141, PHYS131/PHYS142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses.

REQUIRED COURSES IN CHEMISTRY PROGRAMS

The required courses in Chemistry programs consist of 56 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 from outside Quebec or transfer students should consult the academic adviser.

A computer science course, either COMP102 or COMP202, will be required during U1 for students who have no previous intro-

duction to computer *programming*. Students are required to contact their adviser on this matter. Completion of Mathematics MATH222 and MATH315 during U1 is strongly recommended. Physics PHYS242 should be completed during U2.

Chemistry Majors and Honours Programs

Required Courses (56 credits)

CHEM212*	(4)	Introductory Organic Chemistry 1
CHEM213	(3)	Introductory Physical Chemistry
CHEM222*	(4)	Introductory Organic Chemistry 2
CHEM273	(1)	Chemical Kinetics
CHEM277D1	(1.5)	Analytical Chemistry
CHEM277D2	(1.5)	Analytical Chemistry
CHEM281	(3)	Inorganic Chemistry 1
CHEM302	(3)	Introductory Organic Chemistry 3
CHEM345	(3)	Molecular Properties and Structure 1
CHEM355	(3)	Molecular Properties and Structure 2
CHEM363	(2)	Physical Chemistry Laboratory 1
CHEM365	(2)	Statistical Thermodynamics
CHEM367	(3)	Instrumental Analysis 1
CHEM377	(3)	Instrumental Analysis 2
CHEM381	(3)	Inorganic Chemistry 2
CHEM392	(3)	Integrated Inorganic/Organic Laboratory
CHEM393	(2)	Physical Chemistry Laboratory 2
MATH133*	(3)	Vectors, Matrices and Geometry
MATH222*	(3)	Calculus 3
MATH315	(3)	Ordinary Differential Equations
PHYS242	(2)	Electricity and Magnetism

* asterisks denote courses with CEGEP equivalents

HONOURS IN CHEMISTRY (74 credits)

Required Courses (56 credits)

56 credits as listed above

Complementary Courses (18 credits)

6 credits of research*:

CHEM470	(6)	Research Project
or CHEM480	(3)	Research Project
and CHEM490	(3)	Research Project

and 12 credits of additional Chemistry courses:

- 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

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

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

HONOURS WITH BIO-ORGANIC OPTION (78credits)

Required Courses (60 credits)

54 credits, all courses specified above for Chemistry Honours, except PHYS242

plus the following 6 credits:

BIOL200	(3)	Molecular Biology
BIOL201	(3)	Cell Biology and Metabolism

Complementary Courses (18 credits)

6 credits of research*:

CHEM470	(6)	Research Project
or CHEM480	(3)	Research Project
and CHEM490	(3)	Research Project

6 credits, two of:

BIOL202	(3)	Basic Genetics
BIOL301	(3)	Cell and Molecular Laboratory
CHEM502	(3)	Advanced Bio-Organic Chemistry
MIMM211	(3)	Introductory Microbiology
MIMM314	(3)	Immunology
MIMM323	(3)	Microbial Physiology
PHGY201	(3)	Human Physiology: Control Systems
PHGY202	(3)	Human Physiology: Body Functions
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2

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

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

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

HONOURS IN CHEMISTRY: ENVIRONMENTAL CHEMISTRY OPTION (77credits)

Required Courses (62 credits)

56 credits, all courses specified above for Honours Chemistry, plus the following 6 credits

CHEM219 (3) Introduction to Atmospheric Chemistry
CHEM307 (3) Analytical Chemistry of Pollutants

Complementary Courses (15 credits)

6 credits of research*:

CHEM470 (6) Research Project
or CHEM480 (3) Research Project
and CHEM490 (3) Research Project

3 credits, one of:

CHEM419 (3) Advances in Chemistry of Atmosphere
CHEM462 (3) Green Chemistry
CHEM567 (3) Chemometrics: Data Analysis
CHEM575 (3) Chemical Kinetics

6 credits, two of

ATOC220 (3) Introduction to Oceanic Sciences
CHEM352 (3) Structural Organic Chemistry
CHEM597 (3) Analytical Spectroscopy
EPSC542 (3) Chemical Oceanography

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

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

HONOURS WITH MATERIALS OPTION (77credits)

Required Courses (62 credits)

56 credits, all courses specified above for Honours Chemistry plus the following 6 credits:

CHEM344 (3) Advanced Materials
CHEM455 (3) Introductory Polymer Chemistry

Complementary Courses (15 credits)

6 credits of research*:

CHEM470 (6) Research Project
or CHEM480 (3) Research Project
and CHEM490 (3) Research Project

6 credits, two of:

CHEM531 (3) Chemistry of Inorganic Materials
CHEM534 (3) Nanoscience and Nanotechnology
CHEM543 (3) Chemistry of Pulp and Paper
CHEM571 (3) Polymer Synthesis
CHEM585 (3) Colloid Chemistry

3 credits, one of:

CHEE481 (3) Polymer Engineering
MIME260 (3) Materials Science and Engineering
MRKT360 (3) Marketing of Technology

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

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

JOINT HONOURS IN PHYSICS AND CHEMISTRY, see "Physics (PHYS)", section 12.12.25.

MAJOR IN CHEMISTRY (62 credits)

Required Courses (56 credits)

56 credits as listed above

Complementary Courses (6 credits)

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

Attainment of the Major degree requires a CGPA of 2.00.

MAJOR WITH BIO-ORGANIC OPTION (66 credits)

Required Courses (63 credits)

54 credits, all courses specified above for the Chemistry Major, except PHYS242

plus the following 9 credits:

BIOL200 (3) Molecular Biology
BIOL201 (3) Cell Biology and Metabolism
CHEM502 (3) Advanced Bio-Organic Chemistry

Complementary Course (3 credits)

one of:

BIOL202 (3) Basic Genetics
BIOL301 (3) Cell and Molecular Laboratory
MIMM211 (3) Introductory Microbiology
PHGY201 (3) Human Physiology: Control Systems
PHGY202 (3) Human Physiology: Body Functions
PHGY209 (3) Mammalian Physiology 1
PHGY210 (3) Mammalian Physiology 2

Attainment of the Major degree requires a CGPA of 2.00.

MAJOR IN CHEMISTRY: ENVIRONMENTAL CHEMISTRY OPTION (65 credits)

Required Courses (62 credits)

56 credits, all courses specified above for the Chemistry Major, plus the following 6 credits:

CHEM219 (3) Introduction to Atmospheric Chemistry
CHEM307 (3) Analytical Chemistry of Pollutants

Complementary Course (3 credits)

one of:

CHEM419 (3) Advances in Chemistry of Atmosphere
CHEM462 (3) Green Chemistry
CHEM567 (3) Chemometrics: Data Analysis
CHEM575 (3) Chemical Kinetics

Attainment of the Major degree requires a CGPA of 2.00.

MAJOR WITH MATERIALS OPTION (65 credits)

Required Courses (62 credits)

56 credits, all courses specified above for the Chemistry Major, plus the following 6 credits:

CHEM344 (3) Advanced Materials
CHEM455 (3) Introductory Polymer Chemistry

Complementary Course (3 credits)

one of:

CHEM531 (3) Chemistry of Inorganic Materials
CHEM534 (3) Nanoscience and Nanotechnology
CHEM543 (3) Chemistry of Pulp and Paper
CHEM571 (3) Polymer Synthesis
CHEM585 (3) Colloid Chemistry

Attainment of the Major degree requires a CGPA of 2.00.

FACULTY PROGRAMS IN CHEMISTRY

Faculty programs in Chemistry are constructed from the U1 courses and the general courses of U2 and U3 intended for these students. Consult the Department of Chemistry Student Advisory Office for an adviser. A computer science course, either COMP102 or COMP202, will be required during U1 for students who have no previous introduction to computer programming.

FACULTY PROGRAM IN CHEMISTRY (52 credits)

Required Courses (31 credits)

CHEM212* (4) Introductory Organic Chemistry 1
CHEM222* (4) Introductory Organic Chemistry 2

CHEM277D1	(1.5)	Analytical Chemistry
CHEM277D2	(1.5)	Analytical Chemistry
CHEM302	(3)	Introductory Organic Chemistry 3
CHEM345	(3)	Molecular Properties and Structure 1
CHEM367	(3)	Instrumental Analysis 1
CHEM377	(3)	Instrumental Analysis 2
MATH222*	(3)	Calculus 3
MATH315	(3)	Ordinary Differential Equations
PHYS242	(2)	Electricity and Magnetism

* asterisks denote courses with CEGEP equivalents

Complementary Courses (21 credits)

6 credits, one of the following course sets:

CHEM204	(3)	Physical Chemistry/Biological Sciences 1 and CHEM214 (3) Physical Chemistry/Biological Sciences 2 or CHEM213 (3) Introductory Physical Chemistry and CHEM355 (3) Molecular Properties and Structure 2
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6 credits, two of the following courses:

CHEM201	(3)	Modern Inorganic Chemistry 1 or CHEM281 (3) Inorganic Chemistry 1
CHEM301	(3)	Modern Inorganic Chemistry 2 or CHEM381 (3) Inorganic Chemistry 2

9 credits from:

CHEM352	(3)	Structural Organic Chemistry
CHEM355	(3)	Molecular Properties and Structure 2
CHEM363	(2)	Physical Chemistry Laboratory 1
CHEM382	(3)	Organic Chemistry: Natural Products
CHEM392	(3)	Integrated Inorganic/Organic Laboratory
CHEM393	(2)	Physical Chemistry Laboratory 2

or any 400-level courses in Chemistry for which the prerequisites are satisfied.

FACULTY PROGRAM IN CHEMISTRY AND BIOLOGICAL SCIENCES (55 credits)

Required Courses (49 credits)

BIOL200	(3)	Molecular Biology
BIOL201	(3)	Cell Biology and Metabolism
BIOL205	(3)	Biology of Organisms
BIOL301	(4)	Cell and Molecular Laboratory
BIOL304	(3)	Evolution
CHEM204	(3)	Physical Chemistry/Biological Sciences 1
CHEM214	(3)	Physical Chemistry/Biological Sciences 2
CHEM222*	(4)	Introductory Organic Chemistry 2
CHEM257D1	(2)	Introductory Analytical Chemistry
CHEM257D2	(2)	Introductory Analytical Chemistry
CHEM302	(3)	Introductory Organic Chemistry 3
CHEM352	(3)	Structural Organic Chemistry
CHEM362	(2)	Advanced Organic Chemistry Laboratory
CHEM382	(3)	Organic Chemistry: Natural Products
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2
PHYS242	(2)	Electricity and Magnetism

* asterisks denote courses with CEGEP equivalents

Complementary Courses (6 credits)

6 credits approved by the adviser.

FACULTY PROGRAM IN CHEMISTRY AND MATHEMATICS (51 or 52credits)

Required Courses (46 credits)

CHEM212*	(4)	Introductory Organic Chemistry 1
CHEM222*	(4)	Introductory Organic Chemistry 2
CHEM277D1	(1.5)	Analytical Chemistry
CHEM277D2	(1.5)	Analytical Chemistry
CHEM281	(3)	Inorganic Chemistry 1
CHEM345	(3)	Molecular Properties and Structure 1
CHEM355	(3)	Molecular Properties and Structure 2
MATH222*	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH314	(3)	Advanced Calculus

MATH315	(3)	Ordinary Differential Equations
MATH317	(3)	Numerical Analysis
MATH319	(3)	Partial Differential Equations
MATH323	(3)	Probability
MATH324	(3)	Statistics
PHYS242	(2)	Electricity and Magnetism

* asterisks denote courses with CEGEP equivalents

Complementary Courses (5 or 6 credits)

5 or 6 credits, one of the following course sets:

CHEM204	(3)	Physical Chemistry/Biological Sciences 1 and CHEM214 (3) Physical Chemistry/Biological Sciences 2 or CHEM213 (3) Introductory Physical Chemistry and CHEM365 (2) Statistical Thermodynamics
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FACULTY PROGRAM IN MATHEMATICS, CHEMISTRY AND PHYSICS, see "Mathematics and Statistics (MATH)", in section 12.12.17.

The Major Concentration in Chemistry (part of B.A. & Sc. degree), the Faculty Programs in Chemistry, and Minor in Chemistry are not accredited by l'Ordre des chimistes du Québec or the Chemical Institute of Canada.

MINOR IN CHEMISTRY (18 credits)

Required Courses (18 credits)

CHEM203	(3)	Survey of Physical Chemistry
CHEM212	(4)	Introductory Organic Chemistry 1
CHEM222*	(4)	Introductory Organic Chemistry 2
CHEM257D1	(2)	Introductory Analytical Chemistry
CHEM257D2	(2)	Introductory Analytical Chemistry
CHEM281	(3)	Inorganic Chemistry 1

* asterisks denote courses with CEGEP equivalents

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

MINOR IN CHEMICAL ENGINEERING (24 credits)

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

Required Courses (7 credits)

CHEE200	(4)	Introduction to Chemical Engineering
CHEE204	(3)	Chemical Manufacturing Processes

Complementary Courses (17 credits)

at least one of:

CHEE220	(3)	Chemical Engineering Thermodynamics
CHEE314	(4)	Fluid Mechanics

with the remainder chosen from the following:

CHEE230	(3)	Environmental Aspects of Technology
CHEE315	(4)	Heat and Mass Transfer
CHEE351	(3)	Separation Processes
CHEE370	(3)	Elements of Biotechnology
CHEE380	(3)	Materials Science
CHEE392	(4)	Project Laboratory 1
and CHEE393	(5)	Project Laboratory 2
CHEE438	(3)	Engineering Principles in Pulp and Paper Processes
CHEE452	(3)	Particulate Systems
CHEE471	(3)	Industrial Water Pollution Control
CHEE472	(3)	Industrial Air Pollution Control
CHEE481	(3)	Polymer Engineering
CHEE487	(3)	Chemical Processing: Electronics Industry
CHEE494	(3)	Research Project and Seminar
or CHEE495	(4)	Research Project and Seminar
MATH314	(3)	Advanced Calculus

12.12.7 Cognitive Science

Program Director — Professor James McGilvray

Website: www.cogsci.mcgill.ca

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

The Minor in Cognitive Science is intended to supplement and support Major or Honours programs in Computer Science, Linguistics, Philosophy, or Psychology. Students wishing to enrol in this Minor must register with the Program Director.

MINOR IN COGNITIVE SCIENCE (27credits)**Required Course (3 credits)**

PSYC532 (3) Cognitive Science

Complementary Courses (24 credits)

from outside of the student's home department, selected from the courses listed below.

Computer Science

COMP424 (3) Topics: Artificial Intelligence 1
COMP426 (3) Automated Reasoning
COMP558 (3) Fundamentals of Computer Vision

Educational Psychology

EDPE555 (3) Applied Cognitive Science

Linguistics

LING331 (3) Phonology 1
LING355 (3) Language Acquisition 1
LING370 (3) Introduction to Semantics
LING371 (3) Syntax 1
LING419 (3) Linguistic Theory 1
LING440 (3) Morphology
LING531 (3) Phonology 2
LING555 (3) Language Acquisition 2
LING571 (3) Syntax 2
LING590 (3) Language Acquisition and Breakdown

Mathematics

MATH318 (3) Mathematical Logic
MATH328 (3) Computability and Mathematical Linguistics

Philosophy

PHIL210 (3) Introduction to Deductive Logic 1
PHIL304 (3) Chomsky
PHIL306 (3) Philosophy of Mind
PHIL310 (3) Intermediate Logic
PHIL410 (3) Topics in Advanced Logic 1
PHIL415 (3) Philosophy of Language
PHIL419 (3) Epistemology
PHIL506 (3) Seminar: Philosophy of Mind
PHIL507 (3) Seminar: Cognitive Science

Psychology

PSYC211 (3) Intro Behavioural Neuroscience
PSYC212 (3) Perception
PSYC213 (3) Cognition
PSYC301 (3) Learning
PSYC308 (3) Behavioural Neuroscience 1
PSYC311 (3) Human Cognition and the Brain
PSYC353 (3) Laboratory in Human Perception
PSYC410 (3) Special Topics in Neuropsychology
PSYC413 (3) Cognitive Development
PSYC470 (3) Memory and Brain

12.12.8 Computer Science (COMP)

McConnell Engineering Building, Room 318
3480 University Street
Montreal, QC H3A 2A7
Telephone: (514) 398-7071
Fax: (514) 398-3883

Undergraduate Student Affairs Office
Lorne Trottier Building, Room 2060
3630 University Street
Montreal, QC H3A 2B2
Telephone: (514) 398-7071
Fax: (514) 398-4653

E-mail: ugrad-sec@cs.mcgill.ca

Website: www.cs.mcgill.ca/acadpages/undergrad

Director — TBA

Emeritus Professor

Christopher Paige

Professors

David M. Avis; B.Sc.(Wat.), Ph.D.(Stan.) (*on leave Jan. - June 2006*)
Luc P. Devroye; M.S.(Louvain), Ph.D.(Texas) (*James McGill Professor*)
Laurie Hendren; B.Sc., M.Sc.(Queen's), Ph.D.(Cornell)
Tim H. Merrett; B.Sc.(Queen's), D.Phil.(Oxon.) (*on leave 2005-2006*)
Monroe M. Newborn; B.E.E.(R.P.I.), Ph.D.(Ohio St.), F.A.C.M.
Prakash Panangaden; M.Sc.(I.I.T. Kanpur), M.S.(Chicago), Ph.D.(Wis.)
Bruce Reed; B.Sc., Ph.D.(McG.) (*Canada Research Chair*)
Denis Thérien; B.Sc.(Montr.), M.Sc., Ph.D.(Wat.) (*James McGill Professor*)
Godfried T. Toussaint; B.Sc.(Tulsa), Ph.D.(Br.Col.)
Sue Whitesides; M.S.E.E.(Stan.), Ph.D.(Wis.)
Associate Professors
Xiao-Wen Chang; B.Sc., M.Sc.(Nanjing), Ph.D.(McG.) (*on leave 2005-2006*)
Claude Crépeau; B.Sc., M.Sc.(Montr.), Ph.D.(M.I.T.)
Gregory Dudek; B.Sc.(Queen's), M.Sc., Ph.D.(Tor.) (*William Dawson Scholar*)
Nathan Friedman; B.A.(W.Ont.), Ph.D.(Tor.)
Kaleem Siddiqi; B.Sc.(Lafayette), M.Sc., Ph.D.(Brown) (*William Dawson Scholar*)
Carl Tropper; B.Sc.(McG.), Ph.D.(Brooklyn Poly.)

Assistant Professors

Mathieu Blanchette; B.Sc., M.Sc.(Montr.), Ph.D.(Wash.)
David Bryant; B.Sc., Ph.D.(U. of Canterbury)
Michael Trevor Hallett; B.Sc.(Queen's), Ph.D.(Victoria)
Patrick Hayden; B.Sc.(McG.), Ph.D.(Oxford)
Bettina Kemme; B.Sc., M.Sc.(U. of Erlangen-Nuremberg, Germany), Ph.D.(ETH, Zurich)
Jörg Kienzle; Eng.Dip, Ph.D.(Swiss Fed. IT)
Allison Klein; B.A.(Stanford), M.A., Ph.D.(Prin.)
Michael Langer; B.Sc.(McG.), M.Sc.(U. Toronto), Ph.D.(McG.)
Muthucumar Maheswaran; B.Sc.(U. Peradeniya), M.Sc., Ph.D.(Purdue)
Brigitte Pientka; B.Sc., M.Sc.(Technical University of Darmstadt, Germany), Ph.D.(Carnegie Mellon University)
Joelle Pineau; B.Sc. (Waterloo), M.Sc., Ph.D.(Carnegie Mellon)
Doina Precup; B.Sc.(Tech. U. of Cluj-Napoca), M.Sc., Ph.D.(U.Mass.)
Martin Robillard; B.Eng.(École Polytech. de Montréal), M.Sc., Ph.D.(UBC)
Hans Vangheluwe; B.Sc., M.Sc., D.Sc.(Ghent, Belgium)
Clark Verbrugge; B.A.(Queen's), Ph.D.(McG.)
Adrian Vetta; B.Sc., M.Sc.(London School of Economics, U.K.), Ph.D (M.I.T.)

Faculty Lecturer

Joseph Vybihal; M.Sc.(McG.)

Associate Member

Thomas Richard Shultz (*Psychology*)

Adjunct Professors

Stefan Brands, Renato De Mori, Ioannis Rekleitis

The study of computer science encompasses everything from pure theory to hands-on applications including the analysis of algorithms, programming languages, compilers, databases, operating systems, robotics, computer vision, artificial intelligence and computational biology.

The School currently operates a general purpose computing facility to support teaching, a large undergraduate workstation laboratory and numerous laboratories spanning many areas of research in computer science.

The School of Computer Science (SOCS) currently offers eight undergraduate computing labs and two large open work areas consisting of workstations on the 3rd floor of the Lorne Trottier Building. In the McConnell Engineering Building, SOCS offers one general graduate laboratory and 15 laboratories dedicated to the following research areas: Advanced Networking, Artificial Intelligence, Computational Geometry, Computational Perception, Computer Graphics, Crypto and Quantum Information, Databases and Secondary Storage, Distributed Information Systems, Mobile Robotics and Vision, Modelling, Simulation and Design, Parallel and Distributed Simulation, Polyhedral Computation, Reasoning and Learning, Compilers, and Software Engineering.

The undergraduate teaching facilities consist of a network of over 250 Pentium IV, Pentium III and AMD class workstations equipped with 18" LCDs and run FreeBSD and GNU/Linux operating systems. The facility also includes several computer servers comprised of seven Sun Enterprise servers, three Windows remote application servers, a central file server, backup server, mail server, and web server. Dialup Internet access is provided through the McGill Computing Centre.

All students planning to enter Computer Science programs should make an appointment with an academic adviser through the School's Undergraduate Student Affairs Office.

The School of Computer Science offers:

- A major program and an honours program in Computer Science through the Faculty of Science
- A major program in Software Engineering through the Faculty of Science
- A minor through the Faculty of Science and Engineering
- A joint major and a joint honours program with the Department of Mathematics and Statistics through the Faculty of Science (see [section 12.12.17 "Mathematics and Statistics \(MATH\)"](#))
- A joint major with the Department of Physics through the Faculty of Science (see [section 12.12.25 "Physics \(PHYS\)"](#))
- A major concentration and minor concentration through the Faculty of Arts
- A minor in Computational Molecular Biology
- Special programs involving Computer Science are also available in the Faculties of Management, Engineering and Music.

Some graduate courses in Computer Science are available to suitably qualified senior undergraduates. The School also offers graduate research studies leading to M.Sc. and Ph.D. degrees. For further details, consult the *Graduate and Postdoctoral Studies Calendar*.

The School's courses are available as electives to Engineering students. Engineering students interested in a Minor in Computer Science should consult [Computer Science Courses and Minor Program](#), in [section 8.5.4](#) in the Faculty of Engineering section.

Internship Year for Engineering and Science (IYES)

IYES is a pre-graduate work experience opportunity available to eligible students and normally taken between their U2 and U3 years. For more information, see ["IYES: Internship Year for Engineering and Science"](#), in [section 8.2.8](#).

The following programs are also available with an internship component:

Major in Computer Science
Honours in Computer Science

Students intending to pursue a Major in Computer Science or Software Engineering should have a reasonable mathematical background and should have completed MATH140 (or MATH150), MATH141 (or MATH151) and MATH133, or their CEGEP equivalents. These three mathematics courses should 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 COMP202. However, taking COMP202 in the Freshman Year, or completing an equivalent course in CEGEP, would be an asset and allows students to take more advanced courses earlier in their program.

More information about the admission process and the programs is available at www.cs.mcgill.ca.

MINOR IN COMPUTER SCIENCE (24 credits)

The Computer Science Minor may 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. Approval must be given by the School of Computer Science for the particular selection of courses to be credited towards the Computer Science Minor. This should be done before registering for the final term of studies. All courses must be passed with a grade of C or better.

Students may receive credit towards their Computer Science Minor by taking certain approved courses outside the School of Computer Science. These courses must have a high computer science content. A student will not be permitted to receive more than six credits from such courses. These courses must be approved by the School of Computer Science in advance.

If a student's Major program requires Computer Science courses, up to six credits of Computer Science courses may be used to fulfill both Major and Minor requirements.

Required Courses (12 credits)

COMP202	(3)	Introduction to Computing 1
COMP203	(3)	Introduction to Computing 2
COMP206	(3)	Introduction to Software Systems
COMP302	(3)	Programming Languages and Paradigms

Complementary Courses (12 credits)

selected from:

COMP251*	(3)	Data Structures and Algorithms
COMP273	(3)	Introduction to Computer Systems
COMP303	(4)	Programming Techniques
COMP304	(3)	Object-oriented Design
COMP310	(3)	Computer Systems and Organization
COMP330	(3)	Theoretical Aspects: Computer Science
COMP335	(3)	Software Engineering Methods
COMP350	(3)	Numerical Computing
or MATH317	(3)	Numerical Analysis
COMP360	(3)	Algorithm Design Techniques
COMP409	(3)	Concurrent Programming
COMP410	(3)	Mobile Computing
COMP412	(3)	Software for E-commerce
COMP417	(3)	Intro Robotics and Intelligent Systems
COMP420	(3)	Files and Databases
COMP421	(3)	Database Systems
COMP423	(3)	Data Compression
COMP424	(3)	Topics: Artificial Intelligence 1
COMP426	(3)	Automated Reasoning
COMP433	(3)	Personal Software Engineering
COMP435	(3)	Basics of Computer Networks
COMP462	(3)	Computational Biology Methods
COMP490	(3)	Intro to Probabilistic Analysis Algorithms
COMP505	(3)	Advanced Computer Architecture
COMP506	(3)	Advanced Analysis of Algorithms
COMP507	(3)	Computational Geometry
COMP512	(4)	Distributed Systems
COMP520	(4)	Compiler Design
COMP522	(4)	Modelling and Simulation

COMP523	(3)	Language-based Security
COMP524	(3)	Theoretical Foundations of Programming Languages
COMP526	(3)	Probabilistic Reasoning and AI
COMP533	(3)	Object-Oriented Software Development
COMP534	(3)	Team Software Engineering
COMP535	(3)	Computer Networks 1
COMP537	(3)	Internet Programming
COMP538	(3)	Person-Machine Communication
COMP540	(3)	Matrix Computations
COMP557	(3)	Fundamentals of Computer Graphics
COMP558	(3)	Fundamentals of Computer Vision
COMP560	(3)	Graph Algorithms and Applications
COMP563	(3)	Molecular Evolution Theory
COMP564	(3)	Computational Gene Regulation
COMP566	(3)	Discrete Optimization 1
COMP567	(3)	Discrete Optimization 2
COMP573	(3)	Microcomputers
COMP575	(3)	Fundamentals of Distributed Algorithms
COMP577	(3)	Distributed Database Systems
MATH240	(3)	Discrete Structures 1

or from courses outside the School approved by the adviser, to a maximum of 6 credits.

* Note: COMP 251 is a prerequisite for many of the other complementary courses, and MATH240 is a prerequisite for COMP251.

MINOR IN COMPUTATIONAL MOLECULAR BIOLOGY (24credits)

Computational molecular biology is the sub-discipline of bioinformatics that is located at the intersection of computer science and molecular biology. The focus of this area is on techniques for managing and analyzing molecular sequence data. This program will provide undergraduate students in the biological sciences with the skills from computer science to solve computational problems arising in molecular biology and genomics and will provide students with the necessary skills to build software tools from these algorithms.

The Minor in Computational Molecular Biology is not open to students in Computer Science or Joint Computer Science programs.

Required Courses (24 credits)

COMP202	(3)	Introduction to Computing 1
COMP203	(3)	Introduction to Computing 2
COMP251	(3)	Data Structures and Algorithms
COMP360	(3)	Algorithm Design Techniques
COMP462	(3)	Computational Biology Methods
COMP563	(3)	Molecular Evolution Theory
COMP564	(3)	Computational Gene Regulation
MATH240	(3)	Discrete Structures 1

FACULTY PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE under "Mathematics and Statistics (MATH)", in section 12.12.17.

FACULTY PROGRAM IN MATHEMATICS, STATISTICS AND COMPUTER SCIENCE under "Mathematics and Statistics (MATH)", in section 12.12.17.

MAJOR IN COMPUTER SCIENCE (60 credits)

Freshman Program students interested in Computer Science should try to take COMP202 if possible, but it is not required for entry to the Major. A student entering the Major with insufficient programming background may take COMP202, which will not count for credit toward the Major but will count for elective credit.

Required Courses (42 credits)

COMP250	(3)	Introduction to Computer Science
COMP251	(3)	Data Structures and Algorithms
COMP206	(3)	Introduction to Software Systems
COMP273	(3)	Introduction to Computer Systems
COMP302	(3)	Programming Languages and Paradigms

COMP310	(3)	Computer Systems and Organization
COMP330	(3)	Theoretical Aspects: Computer Science
COMP350	(3)	Numerical Computing
COMP360	(3)	Algorithm Design Techniques
MATH222	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH240	(3)	Discrete Structures 1
MATH323	(3)	Probability
MATH340	(3)	Discrete Structures 2

Complementary Courses (18 credits)

15 credits from:

COMP303	(4)	Programming Techniques
COMP304	(3)	Object-oriented Design
COMP335	(3)	Software Engineering Methods
COMP361	(3)	Systems Development Project
COMP409	(3)	Concurrent Programming
COMP410	(3)	Mobile Computing
COMP412	(3)	Software for E-commerce
COMP417	(3)	Intro Robotics and Intelligent Systems
COMP420	(3)	Files and Databases
COMP421	(3)	Database Systems
COMP423	(3)	Data Compression
COMP424	(3)	Topics: Artificial Intelligence 1
COMP426	(3)	Automated Reasoning
COMP433	(3)	Personal Software Engineering
COMP435	(3)	Basics of Computer Networks
COMP462	(3)	Computational Biology Methods
COMP490	(3)	Intro to Probabilistic Analysis Algorithms
COMP505	(3)	Advanced Computer Architecture
COMP506	(3)	Advanced Analysis of Algorithms
COMP507	(3)	Computational Geometry
COMP512	(4)	Distributed Systems
COMP520	(4)	Compiler Design
COMP522	(4)	Modelling and Simulation
COMP523	(3)	Language-based Security
COMP524	(3)	Theoretical Foundations of Programming Languages
COMP525	(3)	Formal Verification
COMP526	(3)	Probabilistic Reasoning and AI
COMP531	(3)	Theory of Computation
COMP533	(3)	Object-Oriented Software Development
COMP534	(3)	Team Software Engineering
COMP535	(3)	Computer Networks 1
COMP537	(3)	Internet Programming
COMP538	(3)	Person-Machine Communication
COMP540	(3)	Matrix Computations
COMP547	(3)	Cryptography and Data Security
COMP557	(3)	Fundamentals of Computer Graphics
COMP558	(3)	Fundamentals of Computer Vision
COMP560	(3)	Graph Algorithms and Applications
COMP563	(3)	Molecular Evolution Theory
COMP564	(3)	Computational Gene Regulation
COMP566	(3)	Discrete Optimization 1
COMP567	(3)	Discrete Optimization 2
COMP573	(3)	Microcomputers
COMP575	(3)	Fundamentals of Distributed Algorithms
COMP577	(3)	Distributed Database Systems
ECSE323	(3)	Digital System Design
ECSE426	(3)	Microprocessor Systems
ECSE531	(3)	Real Time Systems
ECSE548	(3)	Introduction to VLSI Systems

3 credits from Mathematics selected from:

MATH242	(3)	Analysis 1
MATH243	(3)	Analysis 2
MATH255	(3)	Honours Analysis 2

or any 300-level or above Mathematics course (excluding MATH338, MATH323, MATH 340)

JOINT MAJOR IN MATHEMATICS AND COMPUTER SCIENCE under "Mathematics and Statistics (MATH)", in section 12.12.17.

JOINT MAJOR IN PHYSICS AND COMPUTER SCIENCE under "Physics (PHYS)", in section 12.12.25.

MAJOR IN SOFTWARE ENGINEERING (69 credits)

Required Courses (60 credits)

- COMP202 (3) Introduction to Computing 1
- COMP206 (3) Introduction to Software Systems
- COMP250 (3) Introduction to Computer Science
- COMP251 (3) Data Structures and Algorithms
- COMP273 (3) Introduction to Computer Systems
- COMP302 (3) Programming Languages and Paradigms
- COMP304 (3) Object-oriented Design
- COMP310 (3) Computer Systems and Organization or ECSE427 (3) Operating Systems
- COMP330 (3) Theoretical Aspects: Computer Science
- COMP360 (3) Algorithm Design Techniques
- COMP361 (3) Systems Development Project
- ECSE321 (3) Introduction to Software Engineering
- ECSE428 (3) Software Engineering Practice
- ECSE429 (3) Software Validation
- ECSE495 (3) Software Engineering Design Project
- MATH222 (3) Calculus 3
- MATH223 (3) Linear Algebra
- MATH240 (3) Discrete Structures 1
- MATH323 (3) Probability
- MATH324 (3) Statistics

Complementary Courses (9 credits)

selected from the following:

- COMP303 (4) Programming Techniques
- COMP335 (3) Software Engineering Methods
- COMP350 (3) Numerical Computing
- COMP409 (3) Concurrent Programming
- COMP410 (3) Mobile Computing
- COMP412 (3) Software for E-commerce
- COMP420 (3) Files and Databases
- COMP421 (3) Database Systems
- COMP424 (3) Topics: Artificial Intelligence 1
- COMP433 (3) Personal Software Engineering
- COMP435 (3) Basics of Computer Networks
- COMP505 (3) Advanced Computer Architecture
- COMP512 (4) Distributed Systems
- COMP520 (4) Compiler Design
- COMP522 (4) Modelling and Simulation
- COMP523 (3) Language-based Security
- COMP525 (3) Formal Verification
- COMP526 (3) Probabilistic Reasoning and AI
- COMP533 (3) Object-Oriented Software Development
- COMP535 (3) Computer Networks 1
- COMP537 (3) Internet Programming
- COMP547 (3) Cryptography and Data Security
- COMP558 (3) Fundamentals of Computer Vision
- COMP560 (3) Graph Algorithms and Applications
- COMP566 (3) Discrete Optimization 1
- COMP575 (3) Fundamentals of Distributed Algorithms
- COMP577 (3) Distributed Database Systems
- ECSE200 (3) Fundamentals of Electrical Engineering
- ECSE210 (3) Circuit Analysis
- ECSE291 (2) Electrical Measurement Laboratory
- ECSE303 (3) Signals and Systems 1
- ECSE304 (3) Signals and Systems 2
- ECSE322 (3) Computer Engineering
- ECSE323 (5) Digital Systems Design
- ECSE404 (3) Control Systems
- ECSE411 (3) Communications Systems
- ECSE420 (3) Parallel Computing
- ECSE421 (3) Embedded Systems

- ECSE422 (3) Fault Tolerant Computing
- ECSE424 (3) Human-Computer Interaction
- ECSE425 (3) Computer Organization and Architecture
- ECSE426 (3) Microprocessor Systems or COMP573 (3) Microcomputers
- ECSE504 (3) Computer Control
- ECSE522 (3) Asynchronous Circuits and Systems
- ECSE526 (3) Artificial Intelligence
- ECSE529 (3) Image Processing and Communication
- ECSE530 (3) Logic Synthesis
- ECSE531 (3) Real Time Systems
- ECSE532 (3) Computer Graphics or COMP557 (3) Fundamentals of Computer Graphics
- MATH315 (3) Ordinary Differential Equations
- MATH381 (3) Complex Variables and Transforms

HONOURS IN COMPUTER SCIENCE (72 credits)

Honours students must maintain a CGPA of 3.00 and must have at least this average upon graduation as well.

Required Courses (45 credits)

- COMP206 (3) Introduction to Software Systems
- COMP250 (3) Introduction to Computer Science
- COMP252 (3) Algorithms and Data Structures
- COMP273 (3) Introduction to Computer Systems
- COMP302 (3) Programming Languages and Paradigms
- COMP310 (3) Computer Systems and Organization
- COMP330 (3) Theoretical Aspects: Computer Science
- COMP350 (3) Numerical Computing
- COMP362 (3) Honours Algorithm Design
- COMP400 (3) Technical Project and Report
- MATH222 (3) Calculus 3
- MATH223 (3) Linear Algebra
- MATH240 (3) Discrete Structures 1
- MATH323 (3) Probability
- MATH340 (3) Discrete Structures 2 or MATH350 (3) Graph Theory and Combinatorics

Complementary Courses (27 credits)

24 credits of COMP and/or ECSE courses, 12 credits of which must be at the 500 level, from the list of complementary courses for the Major in Computer Science, with the addition of COMP552 Combinatorial Optimization.

3 credits, any 300-level or above Mathematics course (excluding MATH323, MATH 338, MATH340, MATH350)

JOINT HONOURS IN MATHEMATICS AND COMPUTER SCIENCE under "Mathematics and Statistics (MATH)", in section 12.12.17. Students must consult an Honours adviser in both Departments.

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

COMPUTER SCIENCE COURSE RESTRICTION NOTES

The following programs are defined as belonging to the Core Group or the Mathematics Group to simplify the explanation of course restrictions:

Core Group:

- Major in Computer Science
- Honours in Computer Science
- Joint Major in Mathematics and Computer Science
- Joint Major in Physics and Computer Science
- Joint Honours in Mathematics and Computer Science
- Major in Software Engineering
- Bachelor of Software Engineering
- Major Concentration in the Foundations of Computing
- Minor Concentration in Foundations of Computing
- Minor Concentration in Computer Science
- Faculty Program in Mathematics and Computer Science
- Faculty Program in Mathematics, Statistics and Computer Science

Mathematics Group:

Honours in Mathematics
 Honours in Applied Mathematics
 Honours in Probability and Statistics

12.12.9 Earth and Planetary Sciences (EPSC)

Frank Dawson Adams Building, Room 238
 3450 University Street
 Montreal, QC H3A2A7

Telephone: (514) 398-6767
 Fax: (514) 398-4680
 E-mail: carol.matthews@mcgill.ca
 Website: www.eps.mcgill.ca

Chair — Alfonso Mucci

Emeritus Professors

Wallace H. MacLean; B.Geol.Eng.(Colorado Sch. of Mines),
 M.Sc.(Appl.), Ph.D.(McG.)
 Eric W. Mountjoy; B.A.Sc.(U.B.C.), Ph.D.(Tor.) (*William E. Logan
 Emeritus Professor of Geology*)
 Colin W. Stearn; B.Sc.(McM.), M.S., Ph.D.(Yale), F.R.S.C.

Professors

Jafar Arkani-Hamed; B.Eng.(Tehran), Ph.D.(M.I.T.)
 Don M. Francis; B.Sc.(McG.), M.Sc.(U.B.C.), Ph.D.(M.I.T.)
 (*Dawson Professor of Geology*)
 Andrew J. Hynes; B.Sc.(Tor.), Ph.D.(Cantab.) (*William E. Logan
 Professor of Geology*)
 Olivia G. Jensen; B.Sc., M.Sc., Ph.D.(U.B.C.)
 Robert F. Martin; B.Sc.(Ott.), M.S.(Penn. State), Ph.D.(Stan.)
 Alfonso Mucci; B.Sc., M.Sc.(Montr.), Ph.D.(Miami)
 A.E. (Willy) Williams-Jones; B.Sc., M.Sc.(Natal), Ph.D.(Queen's)

Associate Professors

Don Baker; B.A.(Chic.), Ph.D.(Penn.)
 Bruce Hart; B.A.(McM.), M.Sc.(U.Q. à Rimouski), Ph.D.(W.Ont.)
 Jeanne Paquette; B.Sc., M.Sc.(McG.), Ph.D.(Stonybrook)
 John Stix; AB (Dart.), M.Sc., Ph.D.(Tor.)
 Hojatollah Vali; B.Sc., M.Sc., Ph.D.(Munich) (*Director, Electron
 Microscopy Centre*)

Assistant Professor

Mairi Best; B.Sc.(Laurentian), Ph.D.(Chic.)

The domain of Earth and Planetary Sciences includes the solid Earth and its hydrosphere and extends to the neighbouring terrestrial planets. It is a multidisciplinary field in which the principles of chemistry, physics, and mathematics are applied to the rich problems of the real world in order to understand how planets like the Earth work; in the past, the present, and the future.

Career opportunities are many and varied for graduates in the Earth and Planetary Sciences. There is presently a demand for graduates with expertise in many disciplines of the Earth Sciences. Our students are recruited for employment in the petroleum and mining industries, and in the environmental sector. During the Summer months undergraduate students are generally able to obtain employment from industry or government agencies, providing them with both financial benefits and first-hand geoscientific experience. Career opportunities in planetary science are presently limited to universities and research organizations.

The Department has a full-time staff of 13 professors and one faculty lecturer. There are approximately 50 graduate and 60 undergraduate students. Classes are therefore small at all levels, resulting in an informal and friendly atmosphere throughout the Department in which most of the faculty and students interact on a first-name basis. Emphasis is placed equally on quality teaching and research providing undergraduate students with a rich and exciting environment in which to explore and learn.

The undergraduate curriculum is designed to provide both a rigorous foundation in the physical sciences and the flexibility to create an individualized program in preparation for careers in industry, teaching, or research. In addition to the Major and Honours undergraduate programs, the Department also offers a Joint Major in Physics and Geophysics which provides a rigorous math-

ematics and physics preparation and a geological background in the geosciences.

The Minor in Earth and Planetary Sciences offers Science students from other departments the opportunity to obtain exposure to the Earth Sciences, while the Minor in Geochemistry is oriented towards Chemistry Major students who want to see the application of chemistry to problems in the Earth and Planetary Sciences.

Students interested in any of the programs should inquire at Room 238, Frank Dawson Adams Building, (514) 398-6767, or should consult the Undergraduate Director, Don Baker, Room 310, Frank Dawson Adams Building, (514) 398-7485, if they do not have an adviser.

A Science Major Concentration in Earth, Atmosphere and Ocean Sciences is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "[Earth, Atmosphere and Ocean Sciences](#)", in [section 6.12.7](#) for details.

MINOR IN EARTH AND PLANETARY SCIENCES (18 credits)**Required Courses (7 credits)**

EPSC210 (3) Introductory Mineralogy
 EPSC212 (4) Introductory Petrology

Complementary Courses (11 credits)

EPSC201 (3) Understanding Planet Earth
 or EPSC233 (3) Earth and Life History

8 credits selected from:

EPSC203 (3) Structural Geology 1
 EPSC231 (2) Field School 1
 EPSC243 (3) Environmental Geology
 EPSC334 (3) Invertebrate Paleontology
 EPSC350 (3) Tectonics
 EPSC451 (3) Hydrothermal Mineral Deposits
 EPSC452 (3) Mineral Deposits 2
 EPSC542 (3) Chemical Oceanography
 EPSC561 (3) Ore-forming Processes 1
 EPSC562 (3) Ore-forming Processes 2
 BIOL352 (3) Vertebrate Evolution
 Other Earth and Planetary Sciences courses may be substituted with permission.

MINOR IN GEOCHEMISTRY (25 credits)**Required Courses (10 credits)**

EPSC201 (3) Understanding Planet Earth
 EPSC210 (3) Introductory Mineralogy
 EPSC212 (4) Introductory Petrology

Complementary Courses (15 credits)

15 credits selected from:
 EPSC220 (3) Principles of Geochemistry
 EPSC243 (3) Environmental Geology
 EPSC501 (3) Crystal Chemistry
 EPSC519 (3) Isotope Geology
 EPSC542 (3) Chemical Oceanography
 EPSC545 (3) Low-Temperature Geochemistry
 EPSC561 (3) Ore-forming Processes 1
 EPSC562 (3) Ore-forming Processes 2

MAJOR IN EARTH AND PLANETARY SCIENCES (66 credits)

Undergraduate Director: Don Baker, FD Adams, Room 310, (514) 398-7485

U1 Required Courses (27 credits)

EPSC203 (3) Structural Geology 1
 EPSC210 (3) Introductory Mineralogy
 EPSC212 (4) Introductory Petrology
 EPSC220 (3) Principles of Geochemistry
 EPSC231 (2) Field School 1
 EPSC233 (3) Earth and Life History
 EPSC312 (3) Spectroscopy of Minerals

MATH222 (3) Calculus 3
approved (3) statistics course

Note: Students who have not had the following course or its equivalent in CEGEP or the Freshman Program may be required to take MATH133 Vectors, Matrices and Geometry.

U2 and/or U3 Required Courses (24 credits)

EPSC320 (3) Elementary Earth Physics
EPSC334 (3) Invertebrate Paleontology
EPSC350 (3) Tectonics
EPSC423 (3) Igneous Petrology
EPSC445 (3) Metamorphic Petrology
EPSC452 (3) Mineral Deposits 2
EPSC455 (3) Sedimentary Geology
EPSC519 (3) Isotope Geology

Complementary Courses (15 credits)

3 credits, one of:

EPSC331 (3) Field School 2
EPSC341 (3) Field School 3

plus 12 credits (4 courses) chosen from the following:

EPSC330 (3) Earthquakes and Earth Structure
EPSC425 (3) Sediments to Sequences
EPSC435 (3) Geophysical Applications
EPSC451 (3) Hydrothermal Mineral Deposits
EPSC501 (3) Crystal Chemistry
EPSC530 (3) Volcanology
EPSC542 (3) Chemical Oceanography
EPSC547 (3) High Temperature Geochemistry
EPSC548 (3) Processes of Igneous Petrology
EPSC549 (3) Hydrogeology
EPSC550 (3) Selected Topics 1
EPSC551 (3) Selected Topics 2
EPSC552 (3) Selected Topics 3
EPSC561 (3) Ore-forming Processes 1
EPSC562 (3) Ore-forming Processes 2
EPSC570 (3) Cosmochemistry
EPSC580 (3) Aqueous Geochemistry
EPSC590 (3) Applied Geochemistry Seminar

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.

HONOURS IN EARTH SCIENCES (75 credits)

(CGPA \geq 3.20)

U1 Required Courses (27 credits)

EPSC203 (3) Structural Geology 1
EPSC210 (3) Introductory Mineralogy
EPSC212 (4) Introductory Petrology
EPSC220 (3) Principles of Geochemistry
EPSC231 (2) Field School 1
EPSC233 (3) Earth and Life History
EPSC312 (3) Spectroscopy of Minerals
MATH222 (3) Calculus 3
approved (3) statistics course

Note: Students who have not had the following course or its equivalent in CEGEP or the Freshman Program may be required to take MATH133 Vectors, Matrices and Geometry.

U2 and/or U3 Required Courses (33 credits)

EPSC320 (3) Elementary Earth Physics
EPSC350 (3) Tectonics
EPSC423 (3) Igneous Petrology
EPSC445 (3) Metamorphic Petrology
EPSC452 (3) Mineral Deposits 2
EPSC455 (3) Sedimentary Geology
EPSC480D1 (3) Honours Research Project
EPSC480D2 (3) Honours Research Project
EPSC519 (3) Isotope Geology

MATH314 (3) Advanced Calculus
MATH315 (3) Ordinary Differential Equations

Complementary Courses (15 credits)

3 credits, one of:

EPSC331 (3) Field School 2
EPSC341 (3) Field School 3

plus 12 credits (4 courses) chosen from the following:

EPSC330 (3) Earthquakes and Earth Structure
EPSC334 (3) Invertebrate Paleontology
EPSC425 (3) Sediments to Sequences
EPSC435 (3) Geophysical Applications
EPSC451 (3) Hydrothermal Mineral Deposits
EPSC501 (3) Crystal Chemistry
EPSC530 (3) Volcanology
EPSC542 (3) Chemical Oceanography
EPSC547 (3) High Temperature Geochemistry
EPSC548 (3) Processes of Igneous Petrology
EPSC549 (3) Hydrogeology
EPSC550 (3) Selected Topics 1
EPSC551 (3) Selected Topics 2
EPSC552 (3) Selected Topics 3
EPSC561 (3) Ore-forming Processes 1
EPSC562 (3) Ore-forming Processes 2
EPSC570 (3) Cosmochemistry
EPSC580 (3) Aqueous Geochemistry
EPSC590 (3) Applied Geochemistry Seminar

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.

HONOURS IN PLANETARY SCIENCES (81 credits)

CGPA \geq 3.20

U1 Required Courses (27 credits)

EPSC203 (3) Structural Geology
EPSC210 (3) Introductory Mineralogy
EPSC212 (4) Introductory Petrology
EPSC220 (3) Principles of Geochemistry
EPSC231 (2) Field School 1
EPSC233 (3) Earth and Life History
EPSC312 (3) Spectroscopy of Minerals
MATH222 (3) Calculus 3
MATH223 (3) Linear Algebra

Note: Students who have not had the following course or its equivalent in CEGEP or the Freshman Program may be required to take MATH133 Vectors, Matrices and Geometry.

U2 and/or U3 Required Courses (42 credits)

EPSC320 (3) Elementary Earth Physics
EPSC330 (3) Earthquakes and Earth Structure
EPSC350 (3) Tectonics
EPSC423 (3) Igneous Petrology
EPSC480D1 (3) Honours Research Project
EPSC480D2 (3) Honours Research Project
EPSC510 (3) Geodynamics and Geomagnetism
EPSC519 (3) Isotope Geology
EPSC570 (3) Cosmochemistry
MATH314 (3) Advanced Calculus
MATH315 (3) Ordinary Differential Equations
MATH317 (3) Numerical Analysis
MATH319 (3) Partial Differential Equations
PHYS340 (3) Electricity and Magnetism

Complementary Courses (12 credits)

3 credits, one of:

PHYS251 (3) Classical Mechanics 1
PHYS230 (3) Dynamics of Simple Systems

plus 9 credits (3 courses) chosen from the following:

EPSC334 (3) Invertebrate Paleontology

EPSC425	(3)	Sediments to Sequences
EPSC435	(3)	Geophysical Applications
EPSC451	(3)	Hydrothermal Mineral Deposits
EPSC501	(3)	Crystal Chemistry
EPSC530	(3)	Volcanology
EPSC542	(3)	Chemical Oceanography
EPSC547	(3)	High Temperature Geochemistry
EPSC548	(3)	Processes of Igneous Petrology
EPSC549	(3)	Hydrogeology
EPSC550	(3)	Selected Topics 1
EPSC551	(3)	Selected Topics 2
EPSC552	(3)	Selected Topics 3
EPSC561	(3)	Ore-forming Processes 1
EPSC562	(3)	Ore-forming Processes 2
EPSC570	(3)	Cosmochemistry
EPSC580	(3)	Aqueous Geochemistry
EPSC590	(3)	Applied Geochemistry Seminar

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.

JOINT MAJOR IN PHYSICS AND GEOPHYSICS under "Physics (PHYS)", in section 12.12.25.

12.12.10 Earth System Science Interdepartmental Major (ESYS)

Earth System Science (ESYS) views Earth as a single integrated system that provides a unifying context to examine the interrelationships between all components of the Earth system. The approach concentrates on the nature of linkages among the biological, chemical, human and physical subsystems of the Earth. ESS primarily involves studying the cycling of matter and energy through the atmosphere, biosphere, cryosphere, eosphere, and hydrosphere. ESS examines the dynamics and interrelationships among these processes at time scales that range from billions of years to days, and seeks to understand how these interrelationships have changed over time.

The ESS Major is offered jointly by the following departments:

Atmospheric and Oceanic Sciences (ATOC)
Earth and Planetary Sciences (EPSC)
Geography (GEOG)

The individual departments, their disciplines, and specific courses offered by them are described in their respective entries in this Calendar.

Program Advisers:

Department of Atmospheric and Oceanic Sciences:

Professor Peter Yau
Burnside Hall, Room 818
E-mail: peter.yau@mcgill.ca
Telephone: (514) 398-3719

Department of Earth and Planetary Sciences:

Professor Don Baker
Frank Dawson Adams, Room 310
E-mail: donb@eps.mcgill.ca
Telephone: (514) 398-7485

Department of Geography:

to December 2005 -
Professor Tim Moore
Burnside Hall, Room 626
E-mail: tim.moore@mcgill.ca
Telephone: (514) 398-4961

from January 2006 -

Professor Raja Sengupta
Burnside Hall, Room 412
E-mail: sengupta@geog.mcgill.ca
Telephone: (514) 398-5316

Major in Earth System Science (57 or 58 credits)
(Awaiting Ministry of Education Approval)

Required Courses (33 credits)

ATOC214	(3)	Introduction: Physics of the Atmosphere
BIOL215	(3)	Introduction to Ecology and Evolution
ENVR200	(3)	The Global Environment
ESYS200	(3)	Earth System Processes
GEOG203	(3)	Environmental Systems
MATH203	(3)	Principles of Statistics 1 (or equivalent course)
MATH222	(3)	Calculus 3
ATOC308	(3)	Principles of Remote Sensing or GEOG308
ESYS300	(3)	Investigating the Earth System
ESYS301	(3)	Earth System Modelling
ESYS500	(3)	Earth Systems Applications

Complementary Courses (24 or 25 credits)

3 credits, one of the following courses:

EPSC210	(3)	Introductory Mineralogy
EPSC220	(3)	Principles of Geochemistry

3 or 4 credits, one of the following courses:

ATOC215	(3)	Oceans, Weather and Climate
EPSC212	(4)	Introductory Petrology
GEOG272	(3)	Earth's Changing Surface

18 credits from the following course list, with at least 3 credits from each of subject codes ATOC, EPSC, and GEOG. At least 9 of the 18 credits must be at the 400 level or higher.

ATOC309	(3)	Weather Radars and Satellites
ATOC315	(3)	Water in the Atmosphere
ATOC412	(3)	Atmospheric Dynamics
ATOC419	(3)	Advances in Chemistry of Atmosphere
ATOC512	(3)	Atmospheric and Oceanic Dynamics
ATOC513	(3)	Waves and Stability
ATOC530	(3)	Climate Dynamics 1
ATOC531	(3)	Climate Dynamics 2
ATOC540	(3)	Synoptic Meteorology 1
ATOC541	(3)	Synoptic Meteorology 2
BIOL308	(3)	Ecological Dynamics
BIOL309	(3)	Mathematical Models in Biology
BIOL432	(3)	Limnology
BIOL441	(3)	Biological Oceanography
BIOL465	(3)	Conservation Biology
BIOL534	(3)	Theoretical Ecology
BIOL540	(3)	Ecology of Species Invasions
BREE319	(3)	Engineering Mathematics (<i>offered on Macdonald Campus</i>)
EPSC312	(3)	Spectroscopy of Minerals
EPSC320	(3)	Elementary Earth Physics
EPSC331	(3)	Field School 2
EPSC334	(3)	Invertebrate Paleontology
EPSC341	(3)	Field School 3
EPSC350	(3)	Tectonics
EPSC423	(3)	Igneous Petrology
EPSC425	(3)	Sediments to Sequences
EPSC445	(3)	Metamorphic Petrology
EPSC452	(3)	Mineral Deposits 2
EPSC455	(3)	Sedimentary Geology
EPSC519	(3)	Isotope Geology
EPSC530	(3)	Volcanology
EPSC542	(3)	Chemical Oceanography
EPSC549	(3)	Hydrogeology
EPSC580	(3)	Aqueous Geochemistry
EPSC590	(3)	Applied Geochemistry Seminar
GEOG305	(3)	Soils and Environment
GEOG306	(3)	Raster Geo-Information Science
GEOG307	(3)	Socioeconomic Applications of GIS
GEOG321	(3)	Climatic Environments
GEOG322	(3)	Environmental Hydrology
GEOG350	(3)	Ecological Biogeography

GEOG351	(3)	Quantitative Methods
GEOG372	(3)	Running Water Environments
GEOG380	(3)	Adaptive Environmental Management
GEOG495	(3)	Field Studies - Physical Geography
GEOG499	(3)	Subarctic Field Studies
GEOG505	(3)	Global Biogeochemistry
GEOG506	(3)	Perspectives on Geographic Information Analysis
GEOG522	(3)	Advanced Environmental Hydrology
GEOG535	(3)	Remote Sensing and Interpretation
GEOG536	(3)	Geocryology
GEOG537	(3)	Advanced Fluvial Geomorphology
GEOG550	(3)	Quaternary Paleocology
MATH314	(3)	Advanced Calculus
MATH315	(3)	Ordinary Differential Equations
MATH317	(3)	Numerical Analysis
MATH319	(3)	Partial Differential Equations
MATH323	(3)	Probability
MATH326	(3)	Nonlinear Dynamics and Chaos
MATH423	(3)	Regression and Analysis of Variance
MATH437	(3)	Mathematical Methods in Biology
MATH447	(3)	Stochastic Processes
MATH525	(3)	Sampling Theory and Applications
NRSC540	(3)	Socio-Cultural Issues in Water
PHYS331	(3)	Topics in Classical Mechanics
PHYS332	(3)	Physics of Fluids
PHYS340	(3)	Electricity and Magnetism
PHYS342	(3)	Electromagnetic Waves

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

12.12.11 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 the "[McGill School of Environment](#)", in [section 14](#), where they will find information concerning the Minor Program in Environment and the B.Sc. Major Program in Environment.

12.12.12 Experimental Medicine (EXMD)

Lady Meredith House, Room 101
E-mail: experimental.medicine@mcgill.ca
Website: www.medicine.mcgill.ca/EXPMED/expmed1.html

Experimental Medicine is a division of the Department of Medicine. There are no B.Sc. programs in Experimental Medicine, but the EXMD courses listed in the Courses section of this Calendar are considered as courses taught by the Faculty of Science.

12.12.13 Geography (GEOG)

Burnside Hall, Room 705
805 Sherbrooke Street West
Montreal, QC H3A2K6
Telephone: (514) 398-4951 or 398-4111
Fax: (514) 398-7437
Website: www.geog.mcgill.ca

Chair — G.O. Ewing

Emeritus Professor
B.J. Garnier; M.A.(Cantab.)

Professors
P.G. Brown; B.A.(Haverford), M.A., Ph.D.(Col.) (*joint appoint. with McGill School of Environment and Natural Resource Sciences*)

T.R. Moore; B.Sc.(Swansea), Ph.D.(Aberd.) (*on leave 2006*)
N.T. Roulet; B.Sc., M.Sc.(Trent), Ph.D.(McM.) (*on leave 2005*)
(*James McGill Professor*)

G.W. Wenzel; M.A.(Manit.), Ph.D.(McG.)

Associate Professors

G.L. Chmura; B.Sc.(Mass.), M.Sc.(R.I.), Ph.D.(L.S.U.)

O.T. Coomes; B.Sc.(U.Vic.), M.A.(Tor.), Ph.D.(Wsc.)

G.O. Ewing; M.A.(Glas.), M.A., Ph.D.(McM.)

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

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

L. Müller-Wille; Dr.phil.(Münster) (*on leave Sept. 2005 - August 2006*)

W.H. Pollard; B.A., M.Sc.(Guelph), Ph.D.(Ott.)

J. Unruh; B.A.(Kansas), M.S.(Wisc.), Ph.D.(Ariz.)

Assistant Professors

K.D. Mok; B.E.S., B. Math.(Wat.), M. Pl.(Queen's), Ph.D.(Tor.)

G. Peterson; B.A.Sc., M.Sc.(Wat.), Ph.D.(Florida)

N.A. Ross; B.A., M.A.(Queen's), Ph.D.(McM.)

J.W. Seaquist; B.Sc.(Tor.), Ph.D.(Lund)

R. Sengupta; B.Sc.(Bombay), M.Sc.(Indian IT Mumbai), M.S.,

Ph.D.(Illinois-Carbondale) (*joint appoint. with McGill School of Environment*)

R.E. Sieber; B.Sc.(Mich. St.), M.P.A.(W. Mich.), Ph.D.(Rutgers)
(*joint appoint. with McGill School of Environment*)

I.B. Strachan; B.Sc.(Tor.), M.Sc., Ph.D.(Queen's) (*cross appoint. with Natural Resource Sciences*)

S. Turner; B.Soc.Sci., M.Soc.Sc.(Waikata), Ph.D.(Hull)

J. Wiles; B.A., M.A.(Otago), Ph.D.(Queen's)

The Department of Geography offers programs in both Arts and Science. All B.A. programs in Geography (including Urban Systems) can be found in the Faculty of Arts entry [Geography \(GEOG\)](#), in [section 5.12.23](#).

Geography is the study of physical environments and human habitats. It deals with people and places. It covers issues such as global warming and climate change, regional economic disparities, urban transportation, native land claims and permafrost problems. Both a physical and a social science, it provides a unique opportunity to obtain a broad exposure to modes of analyzing the many environmental and locational problems of contemporary society.

The World Commission on Environment and Development has identified the evidence and possible consequences of currently widespread land use practices which cannot be sustained. Geography is an integrative discipline concerned with the relations between culture systems and resource bases. Students interested in understanding, or working towards the resolution of, the environmental "crisis" should select courses which deal with (1) the dynamics of natural systems (courses in the physical geography of terrestrial, atmospheric and hydrological systems); (2) the dynamics of human systems (courses in cultural, social, economic, political and urban geography); (3) the context of development and land use changes; and (4) practical skills such as Geographical Information Systems, cartography, remote sensing, image analysis and resource management.

Students may pursue programs focusing on urban systems, the geography of economic development, people and their natural environment, the geography of living systems. Students planning to enter a program in Geography should telephone (514) 398-4951, or leave a message at 398-4111, for an appointment with an adviser. Students should consult Undergraduate Info. on the departmental Website.

Graduates find employment in a wide range of commercial activities, as well as in government and education. Others pursue graduate work in geography or urban planning.

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 Option is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "[Geography \(GEOG\)](#)", [section 5.12.23](#) for details.

MINOR IN GEOGRAPHY (expandable into the B.Sc. Major in Geography) (18 credits)

The Minor in 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)

- GEOG203 (3) Environmental Systems
- GEOG216 (3) Geography of the World Economy
- GEOG217 (3) The Canadian City
- GEOG302 (3) Environmental Management 1

Complementary Courses (6 credits)

6 credits of Geography courses at the 300 and 400 level.

B.Sc. MINOR IN GEOGRAPHICAL INFORMATION SYSTEMS (18 credits)

The Minor in GIS is designed to provide students in the Faculty of Science who have an interest in GIS with a basic, but comprehensive, knowledge of concepts and methods relating to the analysis of geospatial data.

Required Courses (15 credits)

- GEOG201 (3) Introductory Geo-Information Science
- GEOG306 (3) Raster Geo-Information Science
- GEOG307 (3) Socioeconomic Applications of GIS
- GEOG308 (3) Principles of Remote Sensing
- GEOG506 (3) Perspectives on Geographic Information Analysis

Complementary Course (3 credits)

one course to be chosen from:

- ATOC414 (3) Applications of Remote Sensing
- COMP420 (3) Files and Databases
- COMP557* (3) Fundamentals of Computer Graphics
- GEOG535 (3) Remote Sensing and Interpretation
- GEOG551 (3) Environmental Decisions
- URBP505 (3) Geographic Information Systems

*Note prerequisites

B.Sc. MAJOR IN GEOGRAPHY (58 credits)

The Major is designed to provide a coverage of the main elements of physical geography.

Required Courses (22 credits)

- GEOG201 (3) Introductory Geo-Information Science
- GEOG203 (3) Environmental Systems
- GEOG216 (3) Geography of the World Economy
- GEOG217 (3) The Canadian City
- GEOG272 (3) Earth's Changing Surface
- GEOG302 (3) Environmental Management 1
- GEOG351 (3) Quantitative Methods
- GEOG290 (1) Local Geographical Excursion (In 2005 reserve Sept. 23-25)

Complementary Courses (36 credits)

3 credits of statistics*

- BIOL373 (3) Biometry
- GEOG202 (3) Statistics and Spatial Analysis
- MATH203 (3) Principles of Statistics 1
- PSYC204 (3) Introduction to Psychological Statistics
- SOCI350 (3) Statistics in Social Research

* Credit given for statistics courses is subject to certain restrictions, see Faculty Degree Requirements, [section 12.3.6.1 "Course Overlap"](#)

3 credits of GIS techniques:

- GEOG306 (3) Raster Geo-Information Science

- GEOG308 (3) Principles of Remote Sensing

12 credits of systematic physical geography:

- GEOG305 (3) Soils and Environment
- GEOG321 (3) Climatic Environments
- GEOG322 (3) Environmental Hydrology
- GEOG350 (3) Ecological Biogeography
- GEOG372 (3) Running Water Environments

3 credits of field courses:

- GEOG495 (3) Field Studies - Physical Geography
- GEOG496 (3) Geographical Excursion
- GEOG497 (3) Ecology of Coastal Waters
- GEOG499 (3) Subarctic Field Studies

(Field course availability is determined each year in February.)

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.

Geography Approved Course List – Majors and Honours

- GEOG404 (3) Environmental Management 2
- GEOG501 (3) Modelling Environmental Systems
- GEOG505 (3) Global Biogeochemistry
- GEOG506 (3) Perspectives on Geographic Information Analysis
- GEOG522 (3) Advanced Environmental Hydrology
- GEOG523 (3) Advanced Climatology
- GEOG535 (3) Remote Sensing and Interpretation
- GEOG536 (3) Geocryology
- GEOG537 (3) Advanced Fluvial Geomorphology
- GEOG550 (3) Quaternary Paleocology

B.Sc. HONOURS IN GEOGRAPHY (66 credits)

The Honours program is designed to provide specialized systematic training in physical geography. Honours students are required to achieve better than a B- in all courses counted towards their program. In addition, Honours students must complete a 6-credit research paper. Honours students are encouraged to participate in 500-level seminars with graduate students, but it is not advisable to take more than one in a term.

In addition to the Faculty requirement that Honours students maintain a minimum CGPA and program GPA of at least 3.20, students who enter a Geography Honours Program on or after September 2004 must achieve at least a B in all required program courses.

Required Courses (24 credits)

- GEOG201 (3) Introductory Geo-Information Science
- GEOG203 (3) Environmental Systems
- GEOG272 (3) Earth's Changing Surface
- GEOG302 (3) Environmental Management 1
- GEOG351 (3) Quantitative Methods
- GEOG381 (3) Geographic Thought and Practice
- GEOG491D1 (3) Honours Research
- GEOG491D2 (3) Honours Research

Complementary Courses (42 credits)

6 credits of introductory courses, two of:

- GEOG210 (3) Global Places and Peoples
- GEOG216 (3) Geography of the World Economy
- GEOG217 (3) The Canadian City

3 credits of statistics*, one of:

- BIOL373 (3) Biometry
- GEOG202 (3) Statistics and Spatial Analysis
- MATH203 (3) Principles of Statistics 1
- PSYC204 (3) Introduction to Psychological Statistics
- SOCI350 (3) Statistics in Social Research

* Credit given for statistics courses is subject to certain restrictions, see Faculty Degree Requirements, [section 12.3.6.1 "Course Overlap"](#)

3 credits of GIS techniques:

- GEOG306 (3) Raster Geo-Information Science
- GEOG308 (3) Principles of Remote Sensing

12 credits of systematic physical geography:

- GEOG305 (3) Soils and Environment
- GEOG321 (3) Climatic Environments
- GEOG322 (3) Environmental Hydrology
- GEOG350 (3) Ecological Biogeography
- GEOG372 (3) Running Water Environments

3 credits of field courses:

- GEOG495 (3) Field Studies - Physical Geography
- GEOG496 (3) Geographical Excursion
- GEOG497 (3) Ecology of Coastal Waters
- GEOG499 (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 in a term.

AFRICAN FIELD STUDY SEMESTER

The Department of Geography, Faculty of Science, coordinates the 15-credit interdisciplinary African Field Study Semester, [see section 15.1.1 "African Field Study Semester"](#). **Note: The AFSS will only be offered in 2005-06 pending approval by the Dean of Science.**

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 [see section 15.1.3 "Panama Field Study Semester"](#).

GEOGRAPHY COURSES OF MOST INTEREST TO SCIENCE STUDENTS:

- GEOG199 FYS: Geo-Environments
- GEOG201 Introductory Geo-Information Science
- GEOG203 Environmental Systems
- GEOG205 Global Change: Past, Present and Future
- GEOG272 Earth's Changing Surface
- GEOG290 Local Geographical Excursion
- GEOG302 Environmental Management 1
- GEOG305 Soils and Environment
- GEOG306 Raster Geo-Information Science
- GEOG308 Principles of Remote Sensing
- GEOG321 Climatic Environments
- GEOG322 Environmental Hydrology
- GEOG350 Ecological Biogeography
- GEOG351 Quantitative Methods
- GEOG370 Protected Areas
- GEOG372 Running Water Environments
- GEOG404 Environmental Management 2
- GEOG490 Geography: Independent Studies
- GEOG495 Field Studies - Physical Geography
- GEOG496 Geographical Excursion
- GEOG497 Ecology of Coastal Waters
- GEOG499 Subarctic Field Studies
- GEOG501 Modelling Environmental Systems
- GEOG505 Global Biogeochemistry
- GEOG506 Perspectives on Geographic Information Analysis
- GEOG522 Advanced Environmental Hydrology
- GEOG523 Advanced Climatology
- GEOG535 Remote Sensing and Interpretation
- GEOG536 Geocryology
- GEOG537 Advanced Fluvial Geomorphology
- GEOG550 Quaternary Paleocology

EARTH SYSTEM SCIENCE INTERDEPARTMENTAL MAJOR, [see section 12.12.10 "Earth System Science Interdepartmental Major \(ESYS\)"](#).

This program is offered by the Departments of Atmospheric & Oceanic Sciences, Earth & Planetary Sciences and Geography.

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

- Professor Timothy Moore, until December 2005 (tim.moore@mcgill.ca)
- Professor Raja Sengupta, from January 2006 (sengupta@geog.mcgill.ca)

12.12.14 Immunology Interdepartmental Honours

Students must obtain a U1 GPA or a U2 CGPA of 3.30 for admission to this enrolment-limited program. U1 students should inform the program adviser of their intent to enter the Honours Immunology Program during their U1 Winter term and confirm their intention in writing by April 1. U2 or U3 students can apply for admission at any time.

For graduation in the Honours program, the student must complete a minimum of 90 credits, and achieve a CGPA of not less than 3.30. The five immunology courses (MIMM314, BIOC503, MIMM414, PHGY419D1/D2, PHGY513) must all be passed with a grade not less than B.

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

Apply to Dr. M. G. Baines, Microbiology and Immunology, malcolm.baines@mcgill.ca, (514) 398-4443 or (514) 398-3928 or Dr. Julie Desbarats, Physiology, julie.desbarats@mcgill.ca, (514) 398-4327 or (514) 398-5126.

INTERDEPARTMENTAL HONOURS IN IMMUNOLOGY

(77credits)

U1 Required Courses (20 credits)

BIOL200	(3)	Molecular Biology
BIOL201	(3)	Cell Biology and Metabolism
or BIOC212	(3)	Molecular Mechanisms of Cell Function
CHEM203	(3)	Survey of Physical Chemistry
or CHEM204	(3)	Physical Chemistry/Biological Sciences 1
CHEM212	(4)	Introductory Organic Chemistry 1
CHEM222	(4)	Introductory Organic Chemistry 2
PHGY209	(3)	Mammalian Physiology 1
or MIMM211	(3)	Introductory Microbiology

U1, U2 or U3 Required Course (3 credits)

BIOL373	(3)	Biometry
or MATH203	(3)	Principles of Statistics 1
or PSYC204	(3)	Introduction to Psychological Statistics

U1 Complementary Courses (6 credits)

3 credits, one of:

ANAT261	(4)	Introduction to Dynamic Histology
MIMM211	(3)	Introductory Microbiology
PHGY210	(3)	Mammalian Physiology 2

3 credits selected from:

ANAT214	(3)	Systematic Human Anatomy
ANAT262	(3)	Introductory Molecular and Cell Biology
BIOL202	(3)	Basic Genetics
BIOL205	(3)	Biology of Organisms
BIOL304	(3)	Evolution
CHEM257D1	(2)	Introductory Analytical Chemistry
and CHEM257D2	(2)	Introductory Analytical Chemistry
COMP202	(3)	Introduction to Computing 1
COMP203	(3)	Introduction to Computing 2
MATH204	(3)	Principles of Statistics 2
MIMM212	(2)	Laboratory in Microbiology
PHGY209	(3)	Mammalian Physiology 1

U2 Required Courses (15 credits)

BIOC311	(3)	Metabolic Biochemistry
BIOC312	(3)	Biochemistry of Macromolecules
MIMM314	(3)	Immunology
BIOC300D1	(3)	Laboratory in Biochemistry
and BIOC300D2	(3)	Laboratory in Biochemistry
or MIMM386D1	(3)	Laboratory in Microbiology and Immunology
and MIMM386D2	(3)	Laboratory in Microbiology and Immunology

U2 Complementary Courses (9 credits)

one of:

ANAT261	(4)	Introduction to Dynamic Histology
MIMM211	(3)	Introductory Microbiology
PHGY210	(3)	Mammalian Physiology 2

plus two courses, 6 credits, selected from:

ANAT265	(3)	Cell Biology: Secretory Process
BIOL300	(3)	Molecular Biology of the Gene
BIOL314	(3)	Molecular Biology of Oncogenes
CHEM302	(3)	Introductory Organic Chemistry 3
MATH222	(3)	Calculus 3
MATH315	(3)	Ordinary Differential Equations
or BIOL309	(3)	Mathematical Models in Biology
MIMM323	(3)	Microbial Physiology
MIMM324	(3)	Fundamental Virology
PATH300	(3)	Human Disease
PHAR300	(3)	Drug Action
PHAR301	(3)	Drugs and Disease
PHAR303	(3)	Principles of Toxicology
PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2
PHGY313	(3)	Intermediate Physiology 3
PHGY314	(3)	Integrative Neuroscience

U3 Required Courses (18 credits)

BIOC503	(3)	Immunochemistry
MIMM414	(3)	Advanced Immunology
PHGY419D1	(4.5)	Project and Seminar in Immunology
PHGY419D2	(4.5)	Project and Seminar in Immunology
PHGY513	(3)	Cellular Immunology

U3 Complementary Courses (6 credits)

6 credits selected from:

BIOL520	(3)	Gene Activity in Development
BIOC404	(3)	Biophysical Chemistry
BIOC450	(3)	Protein Structure and Function
BIOC454	(3)	Nucleic Acids
BIOC458	(3)	Membranes and Cellular Signaling
or ANAT458	(3)	Membranes and Cellular Signaling
MIMM413	(3)	Parasitology
MIMM465	(3)	Bacterial Pathogenesis
MIMM466	(3)	Viral Pathogenesis
MIMM509	(3)	Inflammatory Processes
PHAR503	(3)	Drug Design and Development 1
PHAR504	(3)	Drug Design and Development 2
PHGY531	(3)	Topics in Applied Immunology
PHGY552	(3)	Cellular and Molecular Physiology

12.12.15 Kinesiology for Science Students

The Minor in Kinesiology is designed to provide students in B.Sc. programs with basic but comprehensive knowledge of scientific bases of human physical activity and its relationship with health and well-being.

Students registered in the Minor in Kinesiology 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.

MINOR IN KINESIOLOGY FOR SCIENCE STUDENTS

(24 credits)

Required Courses (9 credits)

EDKP206	(3)	Biomechanics of Human Movement
EDKP393	(3)	Skill Learning and Expertise
EDKP395	(3)	Exercise Physiology

Complementary Courses (15 credits)

6 credits, two of the following courses:

PHGY201	(3)	Human Physiology: Control Systems
or PHGY209	(3)	Mammalian Physiology 1
PHGY202	(3)	Human Physiology: Body Functions
or PHGY210	(3)	Mammalian Physiology 2

9 credits, three of the following courses:

EDKP261	(3)	Motor Development
EDKP303	(3)	Advanced Biomechanics
EDKP330	(3)	Physical Activity and Health
EDKP394	(3)	Historical Perspectives
EDKP396	(3)	Adapted Physical Activity
EDKP444	(3)	Ergonomics
EDKP445	(3)	Exercise Metabolism
EDKP446	(3)	Physical Activity and Ageing
EDKP447	(3)	Motor Development 2
EDKP448	(3)	Exercise and Health Psychology
EDKP449	(3)	Exercise Pathophysiology 2
EDKP485	(3)	Exercise Pathophysiology 1
EDKP495	(3)	Scientific Principles of Training
EDKP498	(3)	Sport Psychology
EDKP505	(3)	Sport in Society
EDKP542	(3)	Environmental Exercise Physiology
EDKP550	(3)	Analyzing Instructional Behaviors
EDKP553	(3)	Physical Activity Assessments
EDKP566	(3)	Biomechanical Assessment
EDKP568	(3)	Biomechanics Instrumentation

12.12.16 Management Minor Program

The Minor in Management allows Science students to include courses in their undergraduate program that will help prepare them for a career in management. Also available to Science students is the [Minor in Technological Entrepreneurship for Science students, in section 12.12.30 "Technological Entrepreneurship for Science Students"](#).

Acceptance to the program is both competitive and restricted. At the time of application, a CGPA greater than 2.50 is required and at least one course (MGCR211) toward the Minor program must have been completed with a grade of C or better.

Application procedures will be announced in September. Please consult Ron Critchley, Student Adviser, Faculty of Management Student Affairs Office, Bronfman 110, for details.

Students who are not formally registered for the Minor but who nevertheless complete all its requirements may apply to have the Minor approved during their last term.

Students registered in the Minor in Management may not take additional courses outside the Faculties of Arts and of Science.

To obtain the Minor in Management, all courses must be completed with a grade of C or better.

MINOR IN MANAGEMENT (24 credits)

Required Courses (9 credits)

MGCR211 (3) Introduction to Financial Accounting
 MGCR293 (3) Managerial Economics
 MATH203 (3) Principles of Statistics 1
 or its equivalent as authorized by the Faculty of Science. Students majoring in certain programs, for example in Mathematics, cannot take MATH203 but must take MATH324 instead. (Note: Credit given for statistics courses is subject to certain restrictions, see Faculty Degree Requirements, [section 12.3.6.1 "Course Overlap"](#).)

Complementary Courses (15 credits)

3 credits from:

MGCR213 (3) Introduction to Management Accounting
 MGCR341 (3) Finance 1
 MGCR382 (3) International Business

3 credits from:

MGCR222 (3) Introduction to Organizational Behaviour
 MGCR320 (3) Managing Human Resources
 MGCR352 (3) Marketing Management 1

3 credits from:

MGCR360 (3) Social Context of Business
 MGCR373 (3) Operations Research 1
 MGCR423 (3) Organizational Policy

6 credits from:

any approved 300- or 400-level Management courses for which the prerequisites, if any, have been met.

Note: B.Sc. students must not take MGCR331, ORGB420, ORGB429 or any INSY course.

12.12.17 Mathematics and Statistics (MATH)

Burnside Hall, Room 1005
 805 Sherbrooke Street West
 Montreal, QC H3A 2K6

Telephone: (514) 398-3800

Fax: (514) 398-3899

Website: www.math.mcgill.ca

Chair — Kohur GowriSankaran

Emeritus Professors

Michael Barr; A.B., Ph.D.(Penn.) (*Peter Redpath Emeritus Professor of Pure Mathematics*)

Marta Bunge; M.A., Ph.D.(Penn.)

Jal R. Choksi; B.A.(Cantab.), Ph.D.(Manc.)

Joachim Lambek; M.Sc., Ph.D.(McG.), F.R.S.C. (*Peter Redpath Emeritus Professor of Pure Mathematics*)

Arak M. Mathai; M.Sc.(Kerala), M.A., Ph.D.(Tor.)
 Sherwin A. Maslowe; B.Sc.(Wayne State), M.Sc., Ph.D.(Calif.)
 William O.J. Moser; B.Sc.(Manit.), M.A.(Minn.), Ph.D.(Tor.)
 V. Seshadri; B.Sc., M.Sc.(Madras), Ph.D.(Oklahoma)
 John C. Taylor; B.Sc.(Acad.), M.A.(Queen's), Ph.D.(McM.)

Professors

William J. Anderson; B.Eng., Ph.D.(McG.)

William G. Brown; M.A.(Col.), B.A., Ph.D.(Tor.)

Henri Darmon; B.Sc.(McG.), Ph.D.(Harv.), F.R.S.C.

(*James McGill Professor*)

Stephen W. Drury; M.A., Ph.D.(Cantab.)

Kohur GowriSankaran; B.A., M.A.(Madras), Ph.D.(Bombay)

Pengfei Guan; B.Sc.(Zhejiang), M.Sc., Ph.D.(Princeton)

Jacques C. Hurtubise; B.Sc.(Montr.), Ph.D.(Oxon.), F.R.S.C.

Niky Kamran; B.Sc., M.Sc.(Brussels), Ph.D.(Wat.), F.R.S.C.

(*James McGill Professor*)

Olga Kharlampovich; M.A.(Ural State), Ph.D.(Leningrad),
 Dr.of.Sc.(Steklov Institute)

Alexei Miasnikov; M.Sc.(Novosibirsk), Ph.D., Dr.Sc.(Leningrad)

(*Canada Research Chair*)

Michael Makkai; M.A., Ph.D.(Bud.) (*Peter Redpath Professor of Pure Mathematics*)

Charles Roth; M.Sc.(McG.), Ph.D.(Hebrew)

Karl Peter Russell; Vor.Dip.(Hamburg), Ph.D.(Calif.)

Georg Schmidt; B.Sc.(Natal), M.Sc.(S.A.), Ph.D.(Stan.)

George P.H. Styan; M.A., Ph.D.(Col.)

Luc Vinet; B.Sc., M.Sc., Ph.D.(Montr.), Doctorat 3^e cycle (Paris VI)
 (*joint appoint. with Physics*)

David Wolfson; M.Sc.(Natal), Ph.D.(Purdue)

Keith J. Worsley; B.Sc., M.Sc., Ph.D.(Auckland), F.R.S.C. (*James McGill Professor*)

Jian-Ju Xu; B.Sc., M.Sc.(Beijing), M.Sc., Ph.D.(Renss.)

Sanjo Zlobec; M.Sc.(Zagreb), Ph.D.(Northwestern)

Associate Professors

Peter Bartello; B.Sc.(Tor.), M.Sc., Ph.D.(McG.) (*joint appoint. with Atmospheric and Oceanic Sciences*)

Eyal Z. Goren; B.A., M.S., Ph.D.(Hebrew)

Dmitry Jakobson; B.Sc.(M.I.T.), Ph.D.(Princeton) (*William Dawson Scholar*)

Vojkan Jaksic; B.S.(Belgrade), Ph.D.(Caltech)

Wilbur Jonsson; M.Sc.(Manit.), Dr.Rer.Nat.(Tubingen)

Antony Humphries; B.A., M.A.(Cambridge), Ph.D.(Bath)

Ivo Klemes; B.Sc.(Tor.), Ph.D.(Cal.Tech.)

John P. Labute; B.Sc.(Windsor), M.A., Ph.D.(Harv.)

James G. Loveys; B.A.(St.M.), M.Sc., Ph.D.(S.Fraser)

Roger Rigelhof; B.Sc.(Sask.), M.Sc.(Wat.), Ph.D.(McM.)

Neville G.F. Sancho; B.Sc., Ph.D.(Belf.)

John A. Toth; B.Sc., M.Sc.(McM.), Ph.D.(M.I.T.) (*William Dawson Scholar*)

Daniel T. Wise; B.A.(Yeshiva), Ph.D.(Princ.)

Assistant Professors

Masoud Asgharian; B.Sc.(Shahid Beheshti), M.Sc., Ph.D.(McG.)

David Bryant; B.Sc.Hons, Ph.D.(Canterbury) (*joint appoint. with Computer Science*)

Nilima Nigam; B.Sc.(I.I.T., Bombay), M.S., Ph.D.(Delaware)

Jonathan Pila; B.Sc.Hons.(Melbourne); Ph.D.(Stanford)

Russell Steele; B.S., M.S.(Carnegie Mellon), Ph.D.(Wash.)

Paul Tupper; B.Sc.(Simon Fraser); Ph.D.(Stanford)

Alain Vandal; B.Sc., M.Sc.(McG.), Ph.D.(Auckland)

Adrian Vetta; B.Sc., M.Sc.(London School of Economics),
 Ph.D.(M.I.T.)

Associate Members

Luc P. Devroye (*Computer Science*), P.R.L. Dutilleul (*Plant Science*), Leon Glass (*Physiology*), Jean-Louis Goffin

(*Management*), James A. Hanley (*Epidemiology & Biostatistics*),

Lawrence Joseph (*Epidemiology & Biostatistics*), Michael Mackey

(*Physiology*), Lawrence A. Mysak (A.O.S.), Prakash Panangaden

(*Computer Science*), James O. Ramsay (*Psychology*),

George Alexander Whitmore (*Management*), Peter Swain

(*Physiology*), Christina Wolfson (*Epidemiology & Biostatistics*)

Adjunct Professors

Donald A. Dawson; B.Sc., M.Sc.(McG.), Ph.D.(M.I.T.)
 Martin J. Gander; M.S.(ETH), M.S., Ph.D.(Stan.)
 M. Ram Murty; B.Sc.(Car.), Ph.D.(M.I.T.), F.R.S.C.
 Robert A. Seely; B.Sc.(McG.), Ph.D.(Cantab)

Faculty Lecturers

Jose A. Correa; M.Sc.(Wat.), Ph.D.(Carleton)
 Axel Hundemer; M.Sc., Ph.D.(Munich)

Mathematics has evolved to a discipline which is mainly characterized by its method of proof, its concern for a progressive broadening of its concepts, and by the search for mathematical entities and operations that represent aspects of reality. It is a subject which is pursued by many for its own sake, and regarded as part of the mainstream of human culture. Mathematics pervades modern society with an impact which, already immense, is rapidly growing.

The two principal divisions of mathematics are pure mathematics and applied mathematics. The pure mathematician is interested in abstract mathematical structures and in mathematics as an intellectual enterprise. The primary concern may not be with its utilitarian aspects or with the current needs of science and technology, although many problems in pure mathematics have developed from the sciences.

The applied mathematician is more interested in how mathematics can be used to study some aspects of the world. Mathematicians are engaged in the creation, study and application of advanced mathematical methods relevant to scientific problems. Statistical science and methodology today is concerned with phenomena in which there is a background of uncertainty arising from inherent variability and the investigator is obliged to arrive at decisions from limited data. A key tool in statistics is probability.

Some of the fields in which pure mathematicians work are algebra, analysis, geometry, topology, number theory and foundations. Applied mathematics, which once referred to the application of mathematics to such disciplines as mechanics and fluid dynamics, has currently assumed a much broader meaning and embraces such diverse fields as communication theory, theory of optimization, theory of games and numerical analysis.

Mathematics offers many vocational possibilities. Such fields as teaching, computing, applied statistics and actuarial science offer opportunities for B.Sc. graduates. Opportunities to do original research in pure and applied mathematics are available in universities and research institutions. Employment is to be found in financially or technologically oriented business firms. The Department of Mathematics and Statistics through its various programs attempts to provide courses to suit the diverse interests within mathematics and statistics.

The Honours Program in Mathematics demands of the student a talent for abstraction in addition to a high level of competence in the use of mathematical tools. This program is intended for students who plan to work in an area where mathematical innovations may be needed. It is almost essential for students contemplating a career in mathematical research.

The Major Program involves the same subjects as the Honours Program but is less demanding in terms of abstraction. It is designed primarily for students who will need mathematical tools in their work but whose creative activity will involve applications of mathematics to other areas. Within the framework of the Mathematics Major, various combinations of courses are suggested to meet the needs of different students. These include course suggestions for secondary school teachers, careers in management, and for careers in industry, government or actuarial sciences.

It is possible for Major students to include a number of Honours courses in their programs. This will be an advantage for those students who plan to use their mathematics in graduate studies.

Students interested in a less intensive mathematics program linked to other disciplines are advised to consider the available Faculty Programs.

In planning their programs students are advised to seriously consider developing some depth in another discipline – preferably one for which mathematics has some relevance and use. Mathematics has been closely linked to areas such as computer science, physics and engineering but has recently come to play an increas-

ingly important role in fields such as biology, linguistics, management and psychology. Students should consider completing the requirements for Minor programs such as those available in Cognitive Science, Computer Science and Statistics.

Students considering programs in Mathematics and Statistics should contact the Department to arrange for academic advising.

The student's attention is called to the fact that a B.Com. degree with a Major in Mathematics is available from the Faculty of Management. In addition the Faculty of Music offers the B.Mus. degree with Honours in Theory with Mathematics Option.

Internship Year for Engineering and Science (IYES)

IYES is a pre-graduate work experience program available to eligible students and normally taken between their U2 and U3 years. For more information, see "**IYES: Internship Year for Engineering and Science**", in section 8.2.8.

The following programs are also available with an Internship component:

- Major in Mathematics
- Honours in Mathematics
- Honours in Applied Mathematics
- Honours in Probability and Statistics
- Joint Majors in Mathematics and Computer Science
- Joint Honours in Mathematics and Computer Science

Note: Students entering a program listed below which has MATH222 (Calculus 3) as a required course and who have successfully completed a course equivalent to MATH222 prior to coming to McGill are given exemption from taking MATH222, but must replace it with a Complementary Mathematics course in the program of at least 3 credits.

MINOR IN 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 in Mathematics at the beginning of the penultimate year and should obtain approval for the selection of courses to fulfill the requirements for the Minor from the Departmental Chief Adviser (or delegate).

It is strongly recommended that students in the Minor Program take MATH323. 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 six credits may be allowed for appropriate courses from other departments.

All courses counted towards the Minor must be passed with a grade of C or better.

Generally no more than six 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 nine 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)

MATH222 (3) Calculus 3
 MATH223* (3) Linear Algebra
 MATH315 (3) Ordinary Differential Equations

*MATH223 may be replaced by MATH235 and MATH236. In this case the complementary credit requirement is reduced by three.

Complementary Courses (15 credits)

To be selected from the required and complementary courses for Majors and Honours students in Mathematics, with MATH323 strongly recommended; alternatively, up to 6 credits may be allowed for appropriate courses from other departments.

MINOR IN 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 in Statistics at the beginning of the penultimate year and must obtain approval for the selection of courses to fulfill

the requirements for the Minor from the Departmental Chief Adviser (or delegate).

All courses counted towards the Minor must be passed with a grade of C or better. Generally no more than six 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 nine credits for students whose primary program requires 60 credits or more and to 12 credits when the primary program requires 72 credits or more.

Required Courses (15 credits)

MATH222	(3)	Calculus 3
MATH223*	(3)	Linear Algebra
MATH323	(3)	Probability
MATH324	(3)	Statistics
MATH423	(3)	Regression and Analysis of Variance

*MATH223 may be replaced by MATH235 and MATH236. In this case the complementary credit requirement is reduced by three.

Complementary Courses (9 credits)

selected from:

CHEM593	(3)	Statistical Mechanics
GEOG351	(3)	Quantitative Methods
MATH447	(3)	Stochastic Processes
MATH523	(4)	Generalized Linear Models
MATH525	(4)	Sampling Theory and Applications
MATH556	(4)	Mathematical Statistics 1
MATH557	(4)	Mathematical Statistics 2
PHYS362	(3)	Statistical Mechanics
PHYS559	(3)	Advanced Statistical Mechanics
SOCI504	(3)	Quantitative Methods 1
SOCI505	(3)	Quantitative Methods 2

No more than 6 credits may be taken outside the Department of Mathematics and Statistics.

Further credits (if needed) may be freely chosen from the required and complementary courses for Majors and Honours students in Mathematics, with the obvious exception of courses that involve duplication of material.

FACULTY PROGRAMS

Programs linking mathematics and other disciplines are available. With careful selection of courses in U1, it is possible to transfer to a Major program in Mathematics in U2. Except where otherwise noted these Faculty Programs lead to a B.Sc. degree. Students interested in any of these Faculty Programs should consult the Department of Mathematics and Statistics for an adviser.

FACULTY PROGRAM IN BIOLOGY AND MATHEMATICS under "Biology (BIOL)", in section 12.12.4.

FACULTY PROGRAM IN CHEMISTRY AND MATHEMATICS under "Chemistry (CHEM)", in section 12.12.6.

FACULTY PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE (54 credits)

Required Courses (48 credits)

COMP202	(3)	Introduction to Computing 1
COMP203	(3)	Introduction to Computing 2
COMP206	(3)	Introduction to Software Systems
COMP251	(3)	Data Structures and Algorithms
COMP273	(3)	Introduction to Computer Systems
COMP302	(3)	Programming Languages and Paradigms
COMP310	(3)	Computer Systems and Organization
COMP330	(3)	Theoretical Aspects: Computer Science
COMP420	(3)	Files and Databases
MATH222	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH240	(3)	Discrete Structures 1
MATH315	(3)	Ordinary Differential Equations
MATH317	(3)	Numerical Analysis

MATH323	(3)	Probability
MATH324	(3)	Statistics

Complementary Courses (6 credits)

selected from:

MATH314	(3)	Advanced Calculus
MATH318	(3)	Mathematical Logic
MATH327	(3)	Matrix Numerical Analysis
MATH328	(3)	Computability and Mathematical Linguistics
MATH340	(3)	Discrete Structures 2
MATH407	(3)	Dynamic Programming
MATH417	(3)	Mathematical Programming

FACULTY PROGRAM IN MATHEMATICS, STATISTICS AND COMPUTER SCIENCE (54 credits)

Required Courses (33 credits)

COMP202	(3)	Introduction to Computing 1
COMP203	(3)	Introduction to Computing 2
COMP206	(3)	Introduction to Software Systems
COMP251	(3)	Data Structures and Algorithms
MATH222	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH240	(3)	Discrete Structures 1
MATH315	(3)	Ordinary Differential Equations
MATH323	(3)	Probability
MATH324	(3)	Statistics
MATH423	(3)	Regression and Analysis of Variance

Complementary Courses (21 credits)

at least 3 credits selected from:

MATH314	(3)	Advanced Calculus
MATH317	(3)	Numerical Analysis
MATH318	(3)	Mathematical Logic
MATH319	(3)	Partial Differential Equations
MATH327	(3)	Matrix Numerical Analysis
MATH328	(3)	Computability and Mathematical Linguistics
MATH340	(3)	Discrete Structures 2
MATH407	(3)	Dynamic Programming
MATH417	(3)	Mathematical Programming

at least 6 credits in Statistics selected from:

MATH329	(3)	Theory of Interest
MATH447	(3)	Stochastic Processes
MATH523	(4)	Generalized Linear Models
MATH525	(4)	Sampling Theory and Applications

at least 6 credits in Computer Science selected from:

COMP273	(3)	Introduction to Computer Systems
COMP302	(3)	Programming Languages and Paradigms
COMP310	(3)	Computer Systems and Organization
COMP420	(3)	Files and Databases

FACULTY PROGRAM IN MATHEMATICS, CHEMISTRY AND PHYSICS (56 credits)

Required Courses (47 credits)

CHEM201	(3)	Modern Inorganic Chemistry 1
		or CHEM281 (3) Inorganic Chemistry 1
CHEM204	(3)	Physical Chemistry/Biological Sciences 1
		or CHEM213 (3) Introductory Physical Chemistry
CHEM212	(4)	Introductory Organic Chemistry 1
CHEM214	(3)	Physical Chemistry/Biological Sciences 2
CHEM222	(4)	Introductory Organic Chemistry 2
MATH222	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH314	(3)	Advanced Calculus
MATH315	(3)	Ordinary Differential Equations
MATH319	(3)	Partial Differential Equations
PHYS230	(3)	Dynamics of Simple Systems
PHYS232	(3)	Heat and Waves
PHYS241	(3)	Signal Processing
PHYS340	(3)	Electricity and Magnetism
COMP202	(3)	Introduction to Computing 1

Complementary Courses (9 credits)

3 credits in Physics, 200 level or higher
6 credits in Mathematics, Chemistry or Physics, chosen in consultation with the adviser.

MAJOR IN MATHEMATICS (54 credits)

Students entering the Major program are normally expected to have completed MATH133, MATH140 and MATH141 or their equivalents. Otherwise they will be required to make up any deficiencies in these courses over and above the 54credits of required courses.

Major students who have done well in MATH242 and MATH235 are urged to consider, in consultation with their adviser and the instructors concerned, entering the Honours stream by registering for MATH251 and MATH255.

Guidelines for Selection of Courses in the Major Program

The following informal guidelines should be discussed with the student's adviser. Where appropriate, Honours courses may be substituted for equivalent Major courses. Students planning to pursue graduate studies are encouraged to make such substitutions.

Students interested in computer science are advised to choose courses from the following: MATH317, MATH318, MATH327, MATH328, MATH335, MATH340, MATH407, MATH417 and to complete the Computer Science Minor.

Students interested in probability and statistics are advised to take MATH204, MATH324, MATH407, MATH423, MATH447, MATH523, MATH525.

Students interested in applied mathematics should take MATH317, MATH319, MATH324, MATH326, MATH327, MATH407, MATH417.

Students considering a career in secondary school teaching are advised to take MATH318, MATH328, MATH338, MATH339, MATH346, MATH348.

Students interested in careers in business, industry or government are advised to select courses from the following list:

MATH317, MATH319, MATH327, MATH329, MATH407, MATH417, MATH423, MATH430, MATH447, MATH523, MATH525.

Required Courses (27 credits)

MATH222 (3) Calculus 3
MATH235 (3) Algebra 1
MATH236 (3) Algebra 2
MATH242 (3) Analysis 1
MATH243 (3) Analysis 2
MATH314 (3) Advanced Calculus
MATH315 (3) Ordinary Differential Equations
MATH316 (3) Complex Variables
or MATH249 (3) Honours Complex Variables
MATH323 (3) Probability

Complementary Courses (27 credits)

21 credits selected from the following list, with at least 6 credits selected from:

MATH317 (3) Numerical Analysis
MATH324 (3) Statistics
MATH335 (3) Computational Algebra
MATH340 (3) Discrete Structures 2

the remainder of the 21 credits to be selected from:

MATH204 (3) Principles of Statistics 2
MATH318 (3) Mathematical Logic
MATH319 (3) Partial Differential Equations
MATH320 (3) Differential Geometry
MATH326 (3) Nonlinear Dynamics and Chaos
MATH327 (3) Matrix Numerical Analysis
MATH328 (3) Computability and Mathematical Linguistics
MATH329 (3) Theory of Interest
MATH338 (3) History and Philosophy of Mathematics
MATH339 (3) Foundations of Mathematics
MATH346 (3) Number Theory
MATH348 (3) Topics in Geometry

MATH407 (3) Dynamic Programming
MATH410 (3) Majors Project
MATH417 (3) Mathematical Programming
MATH423 (3) Regression and Analysis of Variance
MATH430 (3) Mathematical Finance
MATH447 (3) Stochastic Processes
MATH523 (4) Generalized Linear Models
MATH525 (4) Sampling Theory and Applications
6additional credits in Mathematics or related disciplines selected in consultation with the adviser.

JOINT MAJOR IN MATHEMATICS AND COMPUTER SCIENCE (72 credits)**Required courses** (51 credits)

COMP206 (3) Introduction to Software Systems
COMP250* (3) Introduction to Computer Science
COMP251 (3) Data Structures and Algorithms
COMP273 (3) Introduction to Computer Systems
COMP302 (3) Programming Languages and Paradigms
COMP310 (3) Computer Systems and Organization
COMP330 (3) Theoretical Aspects: Computer Science
COMP360 (3) Algorithm Design Techniques
MATH222 (3) Calculus 3
MATH235 (3) Algebra 1
MATH236 (3) Algebra 2
MATH242 (3) Analysis 1
MATH315 (3) Ordinary Differential Equations
MATH317 (3) Numerical Analysis
MATH318 (3) Mathematical Logic
MATH323 (3) Probability
MATH340 (3) Discrete Structures 2

* Students with no basic knowledge of any high level programming language (e.g., Fortran, Basic, Pascal, C, C++, Java) may take COMP202 and have it count as a complementary course in Computer Science.

Complementary Courses (21 credits)

9 credits from the set of courses recommended for a Major or Honours Program in Mathematics.
12 credits from the set of courses recommended for a Major or Honours Program in Computer Science.

JOINT MAJOR IN PHYSIOLOGY AND MATHEMATICS under "Physiology (PHGY)", in section 12.12.26.

HONOURS PROGRAMS

The minimum requirement for entry into the Honours program is that the student has completed with high standing the following courses: MATH133, MATH140, MATH141, or their equivalents. In addition, a student who has not completed the equivalent of MATH222 must take it in the first term without receiving credits towards 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.

HONOURS IN MATHEMATICS (60 credits)**Required Courses** (45 credits)

MATH235 (3) Algebra 1
MATH242 (3) Analysis 1
MATH248* (3) Honours Advanced Calculus
MATH251 (3) Honours Algebra 2
MATH255 (3) Honours Analysis 2
MATH325 (3) Honours Ordinary Differential Equations
MATH354 (3) Honours Analysis 3
MATH355 (3) Honours Analysis 4
MATH356 (3) Honours Probability

MATH357	(3)	Honours Statistics
MATH366	(3)	Honours Complex Analysis
MATH370	(3)	Honours Algebra 3
MATH371	(3)	Honours Algebra 4
MATH375	(3)	Honours Partial Differential Equations
MATH380	(3)	Honours Differential Geometry

* MATH314 may be substituted for MATH248 if MATH222 had to be taken in the Fall.

Complementary Courses (15 credits)

15 credits selected from:

MATH350	(3)	Graph Theory and Combinatorics
MATH376	(3)	Honours Nonlinear Dynamics and Chaos
MATH377	(3)	Honours Number Theory
MATH387	(3)	Honours Numerical Analysis
MATH397	(3)	Honours Matrix Numerical Analysis
MATH470	(3)	Honours Project (highly recommended)
MATH480	(3)	Honours Independent Study
MATH487	(3)	Honours Mathematical Programming
MATH488	(3)	Set Theory

all MATH 500-level courses

Honours-level courses from related disciplines:

COMP250*	(3)	Introduction to Computer Science
COMP252	(3)	Algorithms and Data Structures

*COMP250 may be preceded by COMP202

no more than 6 credits from the following courses for which no

Honours equivalent exists:

MATH204	(3)	Principles of Statistics 2
MATH329	(3)	Theory of Interest
MATH338	(3)	History and Philosophy of Mathematics
MATH339	(3)	Foundations of Mathematics
MATH348	(3)	Topics in Geometry
MATH407	(3)	Dynamic Programming
MATH423	(3)	Regression and Analysis of Variance
MATH437	(3)	Mathematical Methods in Biology
MATH447	(3)	Stochastic Processes

Other courses with the permission of the Department.

HONOURS IN APPLIED MATHEMATICS (68credits)

Aside from seeking to develop a sound basis in Applied Mathematics, one of the objectives of the program is to kindle the students' interest in possible areas of application. The extra-mural courses are included to ensure that the student has some appreciation of the scope of Applied Mathematics and is familiar with at least one of the diverse areas in which applications can be found.

Required Courses (39credits)

COMP252	(3)	Algorithms and Data Structures
COMP250*	(3)	Introduction to Computer Science
MATH235	(3)	Algebra 1
MATH242	(3)	Analysis 1
MATH248	(3)	Honours Advanced Calculus
MATH251	(3)	Honours Algebra 2
MATH255	(3)	Honours Analysis 2
MATH325	(3)	Honours Ordinary Differential Equations
MATH356	(3)	Honours Probability
MATH357	(3)	Honours Statistics
MATH366	(3)	Honours Complex Analysis
or MATH249	(3)	Honours Complex Variables
MATH375	(3)	Honours Partial Differential Equations
MATH387	(3)	Honours Numerical Analysis

*COMP250 may be preceded by COMP202

Complementary Courses (29 credits)

at least 6 credits selected from:

MATH350	(3)	Graph Theory and Combinatorics
MATH354	(3)	Honours Analysis 3
MATH355	(3)	Honours Analysis 4
MATH370	(3)	Honours Algebra 3
MATH371	(3)	Honours Algebra 4
MATH380	(3)	Honours Differential Geometry

at least 9credits selected from:

MATH376	(3)	Honours Nonlinear Dynamics and Chaos
MATH397	(3)	Honours Matrix Numerical Analysis
MATH470	(3)	Honours Project
MATH487	(3)	Mathematical Programming
MATH490	(3)	Mathematics of Finance
MATH523	(4)	Generalized Linear Models
MATH525	(4)	Sampling Theory and Applications
MATH555	(4)	Fluid Dynamics
MATH556	(4)	Mathematical Statistics 1
MATH557	(4)	Mathematical Statistics 2
MATH560	(4)	Optimization
MATH561	(4)	Analytical Mechanics
MATH574	(4)	Ordinary Differential Equations
MATH575	(4)	Partial Differential Equations
MATH578	(4)	Numerical Analysis 1
MATH579	(4)	Numerical Differential Equations
MATH580	(4)	Applied Partial Differential Equations 1
MATH581	(4)	Applied Partial Differential Equations 2

and the following, for which **half credit only** may be counted:

MATH407	(3)	Dynamic Programming
MATH423	(3)	Regression and Analysis of Variance
MATH447	(3)	Stochastic Processes

12 credits of extra-mural courses:

chosen in consultation with the student's adviser from approved courses in other departments. A list of such courses is available from the Department of Mathematics and Statistics. Student initiative is encouraged in suggesting other courses that fulfill the intentions of this section as described above. Such suggestions must receive departmental approval. They must be in a field related to Applied Mathematics such as Atmospheric and Oceanic Science, Biology, Biochemistry, Chemistry, Computer Science, Earth and Planetary Science, Economics, Engineering, Management, Physics, Physiology and Psychology. At least 6credits must be chosen from a single department other than Computer Science.

HONOURS IN PROBABILITY AND STATISTICS (63credits)**Required Courses** (45 credits)

COMP250*	(3)	Introduction to Computer Science
MATH235	(3)	Algebra 1
MATH242	(3)	Analysis 1
MATH248	(3)	Honours Advanced Calculus
MATH251	(3)	Honours Algebra 2
or MATH247	(3)	Honours Applied Linear Algebra
MATH255	(3)	Honours Analysis 2
MATH354	(3)	Honours Analysis 3
MATH355	(3)	Honours Analysis 4
MATH356	(3)	Honours Probability
MATH357	(3)	Honours Statistics
MATH423	(3)	Regression and Analysis of Variance
MATH523	(4)	Generalized Linear Models
MATH556	(4)	Mathematical Statistics 1
MATH557	(4)	Mathematical Statistics 2

*COMP250 may be preceded by COMP202

Complementary Courses (18 credits)

selected from:

MATH325	(3)	Honours Ordinary Differential Equations
MATH350	(3)	Graph Theory and Combinatorics
MATH366	(3)	Honours Complex Analysis
MATH375	(3)	Honours Partial Differential Equations
MATH380	(3)	Honours Differential Geometry
MATH387	(3)	Honours Numerical Analysis
MATH397	(3)	Honours Matrix Numerical Analysis
MATH470	(3)	Honours Project
MATH490	(3)	Mathematics of Finance
MATH524	(4)	Nonparametric Statistics
MATH525	(4)	Sampling Theory and Applications
MATH550	(4)	Combinatorics

MATH587 (4) Advanced Probability Theory 1
 MATH589 (4) Advanced Probability Theory 2

with at most 3 credits for the following courses having no honours version:

MATH204 (3) Principles of Statistics 2
 MATH407 (3) Dynamic Programming
 MATH447 (3) Stochastic Processes

JOINT HONOURS IN MATHEMATICS AND COMPUTER SCIENCE (72credits)

Students must consult an Honours adviser in both departments.

Required Courses (42 credits)

COMP206 (3) Introduction to Software Systems
 COMP250* (3) Introduction to Computer Science
 COMP252 (3) Algorithms and Data Structures
 COMP273 (3) Introduction to Computer Systems
 COMP302 (3) Programming Languages and Paradigms
 COMP310 (3) Computer Systems and Organization
 COMP330 (3) Theoretical Aspects: Computer Science
 COMP362 (3) Honours Algorithm Design
 MATH235 (3) Algebra 1
 MATH242 (3) Analysis 1
 MATH248 (3) Honours Advanced Calculus
 MATH251 (3) Honours Algebra 2
 MATH255 (3) Honours Analysis 2
 MATH350 (3) Graph Theory and Combinatorics

* Students with no basic knowledge of any high level programming language (e.g. Fortran, Basic, Pascal, C, C++, Java) are advised to take COMP202 before COMP250. In this case COMP202 counts as an elective.

Complementary Courses (30 credits)

18 credits in Mathematics,

at least 12 credits selected from:

MATH354 (3) Honours Analysis 3
 MATH355 (3) Honours Analysis 4
 MATH356* (3) Honours Probability
 MATH370 (3) Honours Algebra 3
 MATH371 (3) Honours Algebra 4
 MATH387 (3) Honours Numerical Analysis

The remaining credits selected from honours courses given by the Department of Mathematics and Statistics.

*Students with appropriate background in probability may substitute MATH587 for MATH356 and must then also register for MATH355.

12 credits in Computer Science, selected from:

COMP303 (4) Programming Techniques
 COMP304 (3) Object-Oriented Design
 COMP335 (3) Software Engineering Methods
 400-level and 500-level Computer Science courses with the exception of COMP431.

JOINT HONOURS IN MATHEMATICS AND PHYSICS under "Physics (PHYS)", in section 12.12.25.

12.12.18 Microbiology and Immunology (MIMM)

Lyman Duff Medical Sciences Building, Room 511
 3775 University Street
 Montreal, QC H3A 2B4

Telephone: (514) 398-3915

Fax: (514) 398-7052

E-mail: office.microimm@mcgill.ca

Website: www.mcgill.ca/microimm

Chair — Greg J. Matlashewski

Emeritus Professor

Eddie C.S. Chan; M.A.(Texas), Ph.D.(Maryland)

Professors

Zafer Ali-Khan; B.Sc.(Bilar), M.Sc.(Karachi), Ph.D.(Tulane)

Malcolm G. Baines; B.Sc., M.Sc., Ph.D.(Queen's)
 James W. Coulton; B.Sc.(Tor.), M.Sc.(Calg.), Ph.D.(W.Ont.)
 John Hiscott; B.Sc., M.Sc.(W.Ont.), Ph.D.(N.Y.)
 Greg Matlashewski; B.Sc.(C'dia), Ph.D.(Ott.)
 Robert A. Murgita; B.Sc.(Me.), M.S.(Vt.), Ph.D.(McG.)
 Trevor Owens; B.Sc., M.Sc.(McG.), Ph.D.(Ott.)
 Mark A. Wainberg; B.Sc.(McG.), M.Sc., Ph.D.(Col.)

Associate Professors

Albert Berghuis; M.Sc.(The Netherlands), Ph.D.(Br.Col.)
 Dalius J. Briedis; B.A., M.D.(Johns H.)

Assistant Professors

Benoit Cousineau; B.Sc., M.Sc., Ph.D.(Montr.)
 Sylvie Fournier; Ph.D.(Montr.)
 Hervé Le Moual; Ph.D.(Montr.)
 Gregory T. Marczynski; B.Sc., Ph.D.(Illinois)
 Martin Olivier; B.Sc.(Montr.), Ph.D.(McG.)
 Ciriaco Piccirillo; B.Sc., Ph.D.(McG.)
 Donald Sheppard; M.D. (Tor.)

Associate Members

Institute of Parasitology: Gaetan Faubert, Armando Jardim, PaulaRibeiro, Terence Spithill
 Division of Experimental Medicine: Clement Couture
 Microbiology & Immunology: Lawrence Kleiman
 Medicine: Marcel Behr, Andre Dascal, Sabah Hussain, Richard Lalonde, Vivian Loo, J. Dick Maclean, Jack Mendelson, Mark A. Miller, Jay Nadeau, Marianna Newkirk, Roger G. E. Palfree, Kostas Pantopoulos, Joyce E. Rauch, Mary Stevenson, Christos Tsoukas, Bernard Turcotte, Brian J. Ward

Neuroimmunology: Amit Bar-Or

Neurology & Neurosurgery: Jack Antel

Oncology: Anne Gatignol, Matthias Gotte, Antonis E. Koromilas,

Andrew Moulant, Arnim Pause, Stephane Richard

Surgery: Nicholas V. Christou

Adjunct Professors

Vibhuti Dave; M.Sc., Ph.D.(Bombay)
 Albert Descoteaux; B.Sc., M.Sc.(Montr.), Ph.D.(McG.)
 Elias Haddad; B.Sc., M.Sc.(Beirut), Ph.D.(McG.)
 Taff Jones; B.Sc., Ph.D.(U. College Lond.)
 George Kukulj; B.Sc., Ph.D.(McG.)
 Peter Lau; Ph.D.(Ottawa)
 Andrew Makriganis; B.Sc., Ph.D.(Dalhousie)
 Allan M. Matte; B.Sc., M.Sc.(Guelph), Ph.D.(Sask.)
 Clement Rioux; B.Sc., M.Sc.(Laval), Ph.D.(Guelph)
 Rafick-P. Sekaly; B.A.(Stanislas), B.Sc., M.Sc.(Montr.), Ph.D.(Lausanne)
 Andre Veillette; Ph.D.(Montr.)

Affiliated Centre:

Centre for Host Resistance, Montreal General Hospital,
 1650 Cedar Avenue, Montreal, QC H3G 1A4
 Telephone: (514) 398-8038. Director: E. Skamene

Microbiology is the study of microorganisms such as bacteria, viruses, unicellular eukaryotes, and parasites. Microorganisms play an important role in human and animal disease, food production (bread, cheese, wine), decay and spoilage, contamination and purification of water and soil. Microbiologists study these tiny, self-replicating machines to understand the basic principles of life: growth, metabolism, cell division, control of gene expression, response to environmental stimuli. Microbiologists are also concerned with controlling or harnessing microorganisms for the benefit of people, by isolating antibiotics or producing vaccines to protect against disease, and by developing and perfecting microorganisms for industrial uses.

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 trans-

plants, 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 Faculty, Majors and Honours programs must have completed BIOL111, BIOL112, CHEM110 or CHEM111, CHEM120 or CHEM121, MATH112, MATH139 or MATH140, MATH141, PHYS101 and PHYS102 or their equivalent with an overall average of at least of 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 April 21. Students who want to transfer to Microbiology and Immunology should consider taking MIMM211 as a complementary course.

An Undergraduate Handbook, containing detailed course descriptions, a listing of faculty research interests, and information on careers in microbiology and immunology, is available from the Student Affairs Office in room 511 of the Lyman Duff Building and on the Web at www.mcgill.ca/microimm.

All students (U1, U2, U3) must attend an advising session. Please check www.mcgill.ca/microimm for dates.

A Science Major Concentration in Biomedical Sciences is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "Biomedical Sciences", in section 6.12.4 for details.

FACULTY PROGRAM IN MICROBIOLOGY AND IMMUNOLOGY (57 credits)

The Faculty Program is intended to offer a basic education in microbiology and immunology to undergraduate students who wish greater flexibility to choose a substantial number of courses from other departments or faculties within the University.

U1 Required Courses (18 credits)

BIOL200	(3)	Molecular Biology
BIOL201	(3)	Cell Biology and Metabolism
or BIOC212	(3)	Molecular Mechanisms of Cell Function
BIOL202	(3)	Basic Genetics
CHEM212	(4)	Introductory Organic Chemistry 1
MIMM211	(3)	Introductory Microbiology
MIMM212	(2)	Laboratory in Microbiology

U1, U2 or U3 Required Course (3 credits)

BIOL373	(3)	Biometry
or MATH203	(3)	Principles of Statistics 1
or PSYC204	(3)	Introduction to Psychological Statistics

U2 Required Courses (15 credits)

MIMM314	(3)	Immunology
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MIMM323	(3)	Microbial Physiology
MIMM324	(3)	Fundamental Virology
MIMM386D1	(3)	Laboratory in Microbiology and Immunology
MIMM386D2	(3)	Laboratory in Microbiology and Immunology

U3 Complementary Courses (6 credits)

6 credits selected from:

MIMM387	(3)	Applied Microbiology and Immunology
MIMM413	(3)	Parasitology
MIMM414	(3)	Advanced Immunology
MIMM465	(3)	Bacterial Pathogenesis
MIMM466	(3)	Viral Pathogenesis
MIMM509	(3)	Inflammatory Processes

U1, U2 or U3 Complementary Courses (15 credits)

15 credits selected from:

ANAT261	(4)	Introduction to Dynamic Histology
ANAT262	(3)	Introductory Molecular and Cell Biology
ANAT365	(3)	Cell Biology: Secretory Process
ANAT458	(3)	Membranes and Cellular Signalling
or BIOC458	(3)	Membranes and Cellular Signalling
BIOC311	(3)	Metabolic Biochemistry
BIOC312	(3)	Biochemistry of Macromolecules
BIOC450	(3)	Protein Structure and Function
BIOC454	(3)	Nucleic Acids
BIOL300	(3)	Molecular Biology of the Gene
BIOL314	(3)	Molecular Biology of Oncogenes
BIOT505	(3)	Selected Topics in Biotechnology
CHEM203	(3)	Survey of Physical Chemistry
or CHEM204	(3)	Physical Chemistry/Biological Sciences 1
CHEM222	(4)	Introductory Organic Chemistry 2
CHEM302	(3)	Introductory Organic Chemistry 3
EXMD504	(3)	Biology of Cancer
MIMM387	(3)	Applied Microbiology and Immunology
MIMM413	(3)	Parasitology
MIMM414	(3)	Advanced Immunology
MIMM465	(3)	Bacterial Pathogenesis
MIMM466	(3)	Viral Pathogenesis
MIMM509	(3)	Inflammatory Processes
PATH300	(3)	Human Disease
PHAR300	(3)	Drug Action
PHAR301	(3)	Drugs and Diseases
PHGY209	(3)	Mammalian Physiology 1 (Class Schedule conflict with MIMM324, if taken should be in U1 or U3)
PHGY210	(3)	Mammalian Physiology 2

MAJOR IN MICROBIOLOGY AND IMMUNOLOGY (67 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 (25 credits)

as for the Faculty Program, plus:

CHEM222	(4)	Introductory Organic Chemistry 2
CHEM203	(3)	Survey of Physical Chemistry
or CHEM204	(3)	Physical Chemistry/Biological Sciences 1

U1, U2 or U3 Required Statistics Courses (3 credits)

as for the Faculty Program

U2 Required Courses (21 credits)

as for the Faculty program, plus

BIOC311	(3)	Metabolic Biochemistry
BIOC312	(3)	Biochemistry of Macromolecules

U3 Required Courses (9 credits)

MIMM413	(3)	Parasitology
MIMM465	(3)	Bacterial Pathogenesis
MIMM466	(3)	Viral Pathogenesis

Complementary Courses (9 credits)

9 credits selected from:

ANAT261	(4)	Introduction to Dynamic Histology
ANAT262	(3)	Introductory Molecular and Cell Biology
ANAT458	(3)	Membranes and Cellular Signaling
or BIOC458	(3)	Membranes and Cellular Signaling
ANAT365	(3)	Cell Biology: Secretory Process
BIOC450	(3)	Protein Structure and Function
BIOC454	(3)	Nucleic Acids
BIOL300	(3)	Molecular Biology of the Gene
BIOL314	(3)	Molecular Biology of Oncogenes
BIOT505	(3)	Selected Topics in Biotechnology
CHEM302	(3)	Introductory Organic Chemistry 3
EXMD504	(3)	Biology of Cancer
MIMM387	(3)	Applied Microbiology and Immunology
MIMM414	(3)	Advanced Immunology
MIMM509	(3)	Inflammatory Processes
PATH300	(3)	Human Disease
PHAR300	(3)	Drug Action
PHAR301	(3)	Drugs and Diseases
PHGY209	(3)	Mammalian Physiology 1 (Class Schedule conflict with MIMM324, if taken should be in U1 or U3)
PHGY210	(3)	Mammalian Physiology 2

HONOURS IN MICROBIOLOGY AND IMMUNOLOGY

(73 required 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 3.30 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)

as for the Major Program

U1, U2 or U3 Required Statistics Courses (3 credits)

as for the Faculty Program

U2 Required Courses (21 credits)

as for the Major program

U3 Required Courses (21 credits)

as for the Major Program, plus:

MIMM502D1	(6)	Honours Research Project
MIMM502D2	(6)	Honours Research Project

Complementary Courses (3 credits)

3 credits selected from:

BIOL520	(3)	Gene Activity in Development
BIOT505	(3)	Selected Topics in Biotechnology
ANAT458	(3)	Membranes and Cellular Signalling
or BIOC458	(3)	Membranes and Cellular Signalling
BIOC404	(3)	Biophysical Chemistry
BIOC450	(3)	Protein Structure and Function
BIOC454	(3)	Nucleic Acids
BIOC455	(3)	Neurochemistry
MIMM414	(3)	Advanced Immunology
MIMM509	(3)	Inflammatory Processes
PHAR562	(3)	General Pharmacology 1
PHAR563	(3)	General Pharmacology 2

INTERDEPARTMENTAL HONOURS IN IMMUNOLOGY, under "Immunology Interdepartmental Honours", in section 12.12.14.

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 Baines in the Department of Microbiology and Immunology, Room 404, telephone (514) 398-4443 or 3928, e-mail malcolm.baines @mcgill.ca.

12.12.19 Music

Strathcona Music Building
555 Sherbrooke Street West
Montreal, QC H3A 1E3

Telephone: (514) 398-4535

Fax: (514) 398-8061

Website: www.mcgill.ca/music*Department of Theory* — TBA*Department of Performance* — Douglas McNabney (Chair)*Adviser (B.A./B.Sc. Music programs)* — B. Minorgan
(514)398-4535, ext. 6333**SCIENCE MINOR IN MUSIC TECHNOLOGY** (24 credits)

[Program registration done by Student Affairs Office]

Enrolment in the Minor in Music Technology program is highly restricted. Application forms will be available from the Department of Theory office of the Faculty of Music (Room E235, Strathcona Music Building, 555 Sherbrooke Street West) from February 1, 2005 and must be completed and returned to that office by May 15, 2005. No late applications will be accepted and no students will be admitted to the Minor in January.

Students will be selected on the basis of their previous background or experience in music technology and/or sound recording, their computer programming skills, their expressed interest in the program, and their Cumulative Grade Point Average. Successful applicants will be notified June 1, 2005.

Required Courses (24 credits)

MUHL342	(3)	History of Electroacoustic Music
MUMT202	(3)	Fundamentals of New Media
MUMT203	(3)	Introduction to Digital Audio
MUMT301	(3)	Music and the Internet
MUMT302	(3)	New Media Production 1
MUMT303	(3)	New Media Production 2
PHYS224	(3)	Physics and Psychophysics of Music
PHYS225	(3)	Musical Acoustics

Science students are eligible to take the Arts **Minor Concentration in Music**, see section 5.12.38 "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 12.3.6.3 "Courses outside the Faculties of Arts and Science" for the relevant regulations).

12.12.20 Neurology and Neurosurgery (NEUR)

There are no B.Sc. programs in Neurology and Neurosurgery, but the NEUR course listed in the Courses section of this Calendar, which is part of the Minor in Neuroscience, is considered as a course taught by the Faculty of Science.

12.12.21 Neuroscience

Minor Program in Neuroscience – Program Coordinator:

Professor Ellis Cooper, Department of Physiology
McIntyre Medical Sciences Building, Room 1127E-mail: ellis.cooper@mcgill.ca

Telephone: (514) 398-4334

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, with diverse approaches ranging from genetic, biochemical, anatomical, physiological, embryological and psychological. In addition, scientists are investigating the nervous system of many different animals, from simple invertebrates to humans. These wide-ranging investigations are providing a clearer understanding of how neurons work; how they communicate with one another; how they are organized into local or distributed networks; how the connections between neurons are established and change with experience; how neuronal functions are influenced by drugs, nutrients, toxins, and disease states. As a result, we are gaining deeper insights into the neural basis of mental activity, as well as developing new therapeutic approaches to alleviate neurological and psychological diseases.

MINOR IN NEUROSCIENCE (24 credits)

[Additions to the Area course lists are under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

The Minor in Neuroscience is a program designed for undergraduate students interested in how the nervous system functions. The program consists of courses from the departments of Anatomy and Cell Biology (ANAT), Biochemistry (BIOC), Biology (BIOL), Neurology and Neurosurgery (NEUR), Pharmacology and Therapeutics (PHAR), Physiology (PHGY), Psychiatry (PSYT), and Psychology (PSYC). The Minor is composed of 24 credits, 18 of which must be selected from two of the five topic areas listed below. Twelve credits of the 18 must be at the 400/500 level and from at least two different departments. A maximum of 6 credits can be counted both for the student's primary program and for the Minor in Neuroscience, where appropriate.

All course selections for the Minor in Neuroscience must be approved by the Program Coordinator.

Students should very carefully check the Calendar for restrictions for the following four courses: ANAT321, BIOL 306, PHGY 314, PSYC 308.

Complementary Courses (24 credits)

6 credits selected from:

ANAT321	(3)	Circuitry of the Human Brain
NEUR310	(3)	Cellular Neurobiology
PSYC308	(3)	Behavioural Neuroscience 1
or BIOL306	(3)	Neurobiology and Behaviour
or PHGY311	(3)	Intermediate Physiology 1

18 additional credits:

9 credits each from 2 of the 5 areas listed below, 6 credits in each area must be from 400- or 500-level courses

Neurobiology and Behaviour

BIOL306	(3)	Neurobiology and Behaviour
BIOL389	(3)	Laboratory in Neurobiology
BIOL530	(3)	Neural Basis of Behaviour
BIOL531	(3)	Neurobiology Learning Memory
PHGY311	(3)	Intermediate Physiology 1
PHGY556	(3)	Topics in Systems Neuroscience
PSYC318	(3)	Behavioural Neuroscience 2
PSYC427	(3)	Sensorimotor Behaviour
PSYC505	(3)	The Psychology of Pain
PSYC522	(3)	Neurochemistry and Behaviour
PSYT500	(3)	Advances: Neurobiology of Mental Disorders

Molecular and Developmental Neurobiology

ANAT321	(3)	Circuitry of the Human Brain
BIOC455	(3)	Neurochemistry
BIOL532	(3)	Developmental Neurobiology Seminar
BIOL588	(3)	Molecular/Cellular Neurobiology
NEUR310	(3)	Cellular Neurobiology
PHGY311	(3)	Intermediate Physiology 1

PHGY451 (3) Advanced Neurophysiology

Neurophysiology

ANAT322	(3)	Neuroendocrinology
BIOL389	(3)	Laboratory in Neurobiology
BIOL531	(3)	Neurobiology Learning Memory
BIOL588	(3)	Molecular/Cellular Neurobiology
PHGY311	(3)	Intermediate Physiology 1
PHGY451	(3)	Advanced Neurophysiology
PHGY520	(3)	Ion Channels
PHGY556	(3)	Topics in Systems Neuroscience
PSYC427	(3)	Sensorimotor Behaviour

Neuropsychology

ANAT321	(3)	Circuitry of the Human Brain
ANAT322	(3)	Neuroendocrinology
BIOL306	(3)	Neurobiology and Behaviour
PSYC311	(3)	Human Cognition and the Brain
PSYC318	(3)	Behavioural Neuroscience 2
PSYC410	(3)	Special Topics in Neuropsychology
PSYC470	(3)	Memory and Brain
PSYC505	(3)	The Psychology of Pain
PSYC522	(3)	Neurochemistry and Behaviour
PSYC526	(3)	Advances in Visual Perception

Neuropharmacology

ANAT321	(3)	Circuitry of the Human Brain
BIOC455	(3)	Neurochemistry
BIOL588	(3)	Molecular/Cellular Neurobiology
PHAR300	(3)	Drug Action
PHAR301	(3)	Drug and Disease
PHAR562	(3)	General Pharmacology 1
PHGY311	(3)	Intermediate Physiology 1
PHGY451	(3)	Advanced Neurophysiology
PHGY520	(3)	Ion Channels
PSYT301	(3)	Issues in Drug Dependence
PSYT500	(3)	Advances: Neurobiology of Mental Disorders

12.12.22 Nutrition (NUTR)

The School of Dietetics and Human Nutrition offers a Minor in Human Nutrition which can be taken by Science students, see [section 13.6.4 "School of Dietetics and Human Nutrition"](#).

NUTR307 is considered as a course taught by the Faculty of Science and is offered simultaneously on both campuses.

12.12.23 Pathology (PATH)

There are no B.Sc. programs in Pathology, but the PATH course listed in the Courses section of this Calendar is considered as one taught by the Faculty of Science.

12.12.24 Pharmacology and Therapeutics (PHAR)

McIntyre Medical Building
3655 Promenade Sir William Osler
Montreal, QC H3G 1Y6
Telephone: (514) 398-3623
Website: www.pharma.mcgill.ca

Chair — Hans H. Zingg

Emeritus Professor

Theodore Sourkes; Ph.D.(Cornell)

Professors

Guillermina Almazan; Ph.D.(McG.)

Radan Capek; M.D., Ph.D.(Prague)

Paul B.S. Clarke; M.A.(Cantab.), Ph.D.(Lond.)

Brian Collier; B.Sc., Ph.D.(Leeds)

A. Claudio Cuello; M.D.(Buenos Aires), M.A., D.Sc.(Oxon.)
F.R.S.C.

Barbara Hales; M.Sc.(Phil. Coll. of Pharmacy and Science),
Ph.D.(McG.)

Peter J. McLeod; M.D.(Manit.), F.R.C.P.(C.)

Alfredo Ribeiro-da-Silva; M.D., Ph.D.(Oporto)
Bernard Robaire; B.A.(Calif.), Ph.D.(McG.) (*James McGill Professor*)

Moshe Szyf; M.Sc., Ph.D.(Hebrew U.)
Jacquetta Trasler; M.D.C.M., Ph.D.(McG.)
Daya R. Varma; M.D.(Lucknow), Ph.D.(McG.)
Hans H. Zingg; M.D., Ph.D.(McG.)

Associate Professors

Barbara Esplin; M.D.(Warsaw)
Dusica Maysinger; Ph.D.(Los Angeles)
Anne McKinney; Ph.D.(Ulster)
Stanley Nattel; B.Sc., M.D.,C.M.(McG.)
Ante L. Padjen; M.D., M.Sc., D.Sc.(Zagreb)
H. Uri Saragovi; Ph.D.(Miami)
Betty I. Sasyniuk; B.S.P., Ph.D.(Man.)
Edith A. Zorychta; B.Sc.(F.X.), M.Sc., Ph.D.(McG.)

Assistant Professor

Derek Bowie; B.Sc., Ph.D.(Lond.)

Associate Members

Moulay Alaoui-Jamali; Ph.D.(Sorbonne)
Gerald Batist; M.D.,C.M.(McG.)
Giovanni Di Battista; B.Sc., Ph.D.(Montr.)
Pierre Fiset; M.D.(Laval), F.R.C.P.S.(C.)
Serge Gauthier; M.D.(Montr.)
Bertrand Jean-Claude; M.Sc.(Moncton), Ph.D.(McG.)
Roger Prichard; B.Sc., Ph.D.(N.S.W.)
Remi Quirion; M.Sc., Ph.D.(Sher.)

Adjunct Professors

Sylvain Chemtob; M.D.(Montr.), Ph.D.(McG.)
Yves De Koninck; Ph.D.(McG.)
Lorella Garofalo; Ph.D.(McG.)
Terence Hébert; M. Sc.(Windsor), Ph.D.(Toronto)
Jennifer M.A. Laird; Ph.D.(Bristol)
Joseph Mancini; M.Sc., Ph.D.(McG.)
Kathleen Metters; Ph.D.(London)

Pharmacology is the science which 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 offered. A course involving research projects in pharmacology is also available to provide the student with the opportunity to get first-hand experience in a pharmacology research laboratory. These courses provide students with knowledge concerning the actions of drugs on living systems and insight into approaches to basic pharmacological research.

A Science Major Concentration in Biomedical Sciences is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section

of the Calendar; see "[Biomedical Sciences](#)", in [section 6.12.4](#) for details.

MINOR IN PHARMACOLOGY (24 credits)

The Minor in 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.

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 (9 credits)

PHAR300 (3) Drug Action
PHAR562 (3) General Pharmacology 1
PHAR563 (3) General Pharmacology 2

Complementary Courses (15 credits)

3 credits, one of:

BIOL200 (3) Molecular Biology
BIOL201 (3) Cell Biology and Metabolism
BIOC212 (3) Molecular Mechanisms of Cell Function

3 credits, one of:

PHGY209 (3) Mammalian Physiology 1
PHGY210 (3) Mammalian Physiology 2

9 credits, chosen from

PHAR301 (3) Drugs and Diseases
PHAR303 (3) Principles of Toxicology
PHAR503 (3) Drug Design and Development 1
PHAR504* (3) Drug Design and Development 2
PHAR599 (6) Research Projects in Pharmacology

* can be taken with PHAR503 only.

12.12.25 Physics (PHYS)

Rutherford Physics Building, Room 108
3600 University Street
Montreal, QC H3A 2T8

Telephone: (514) 398-6485

Fax: (514) 398-8434

E-mail: secretariat@physics.mcgill.ca

Website: www.physics.mcgill.ca

Chair — M. Grant

Emeritus Professors

M.P. Langleben; B.Sc., M.Sc., Ph.D.(McG.), F.R.S.C.

Tommy S.K. Mark; B.Sc., M.Sc., Ph.D.(McG.) (*William C.*

Macdonald Emeritus Professor of Physics)

E.R. Pounder; B.Sc., Ph.D.(McG.), F.R.S.C. (*William C.*

Macdonald Emeritus Professor of Physics)

Douglas G. Stairs; B.Sc., M.Sc.(Queen's), Ph.D.(Harv.) (*William*

C. Macdonald Emeritus Professor of Physics)

Martin J. Zuckermann; M.A., D.Phil.(Oxf.), F.R.S.C. (*William C.*

Macdonald Emeritus Professor of Physics)

Post-Retirement

Andreas P. Contogouris; B.A.(Athens), Ph.D.(C'neil)

John E. Crawford; B.A., M.A.(Tor.), Ph.D.(McG.)

Subal Das Gupta; B.A., M.Sc.(Calc.), Ph.D.(McM.)

Harry C.S. Lam; B.Sc.(McG.), Ph.D.(M.I.T.)

Jonathan K.P. Lee; B.Eng., M.Sc., Ph.D.(McG.)

Robert B. Moore; B.Eng., M.Sc., Ph.D.(McG.)

John O. Strom-Olsen; B.A., M.S., Ph.D.(Cantab.)

Professors

Jean Barrette; B.Sc., M.Sc., Ph.D.(Montr.)

Robert Brandenberger; Dipl., A.M., Ph.D.(Harv.)

(*Canada Research Chair*)

Cliff Burgess; B.Sc.(Waterloo), Ph.D.(Texas) (*James McGill*

Professor)

François Corriveau; B.Sc.(Laval), M.Sc.(U.B.C.),

DocteurSc.Nat.(Zurich)

Nicholas DeTakacs; B.Sc., M.Sc.(Montr.), Ph.D.(McG.)

Charles Gale; B.Sc.(Ott.), M.Sc., Ph.D.(McG.) (*William C.*

Macdonald Professor of Physics)

Martin Grant; B.Sc.(P.E.I.), M.Sc., Ph.D.(Tor.) (*James McGill*

Professor)

Peter Grutter; Dipl., Ph.D.(Basel) (*William Dawson Scholar*)

Hong Guo; B.Sc.(Sichuan), M.Sc., Ph.D.(Pitt.)

David Hanna; B.Sc.(McG.), M.A., Ph.D.(Harv.)

Richard Harris; B.A.(Oxf.), D.Phil.(Sus.)

Harry C.S. Lam; B.Sc.(McG.), Ph.D.(M.I.T.) (*E. Rutherford*

Professor of Physics)

Shaun Lovejoy; B.A.(Cantab.), Ph.D.(McG.)

Robert B. Moore; B.Eng., M.Sc., Ph.D.(McG.)

Popat M. Patel; B.Sc., M.Sc.(Manc.), Ph.D.(Harv.)

Kenneth J. Ragan; B.Sc.(Alta.), Ph.D.(Geneva)

Dominic H. Ryan; B.A., Ph.D.(Trin.Coll.)

Mark Sutton; B.Sc., M.Sc., Ph.D.(Tor.) (*William C. Macdonald*

Professor of Physics)

Jorge Vinals; B.Sc., M.Sc., Ph.D.(Barcelona) (*Canada Research*

Chair)

Luc Vinet; B.Sc., M.Sc., Ph.D.(Montr.), Doctorat 3^e cycle (Paris VI)

(*joint appoint. with Mathematics & Statistics*)

Associate Professors

James M. Cline; B.Sc.(Calif.), M.Sc., Ph.D.(Cal Tech.)

Victoria Kaspi; B.Sc.(McG.), M.A., Ph.D.(Princ.) (*Canada*

Research Chair)

Assistant Professors

Roland Bennewitz; Dipl., Ph.D.(Freie Universität Berlin) (*Canada*

Research Chair)

Aashish Clerk; B.Sc.(Toronto), Ph.D.(C'neil) (*Canada Research*

Chair)

Andrew Cumming; B.A.(Camb.), Ph.D.(U. Cal., Berkeley)

Matt Dobbs; B.Sc.(McG.), Ph.D.(Victoria)

Guillaume Gervais; B.Sc.(Sherb.), M.Sc. (McM), Ph.D.(North Univ.)

Michael Hilke; B.Sc., M.Sc., Ph.D.(Geneva)

Gil Holder; B.Sc., M.Sc (Queen's), Ph.D.(U. of Chicago)

Maria Kilfoil; B.Sc.(New Brunswick), M.Sc., Ph.D.(Memorial)

Sangyong Jeon; B.Sc.(Seoul), M.Sc., Ph.D.(Wash.)

Guy Moore; B.Sc.(Calif.), Ph.D.(Prin.)

Steve Robertson; B.Sc.(Calgary), M.Sc.(Victoria), Ph.D.(Victoria)

Bob Rutledge; B.Sc.(Southern California), Ph.D.(MIT)

Andreas Warburton; B.Sc.(Vic.), M.Sc., Ph.D.(Tor.)

Paul Wiseman; B.Sc.(St.F.X.), Ph.D.(W.Ont.) (*joint appoint. with Chemistry*)

Brigitte Vachon; B.Sc (McG.), Ph.D.(Victoria)

Lecturers

Z. Altounian; B.Sc., M.Sc.(Cairo), Ph.D.(McM.)

F. Buchinger; Dipl.(Mainz), Ph.D.(Joh. Gutenberg U.)

Associate Members

B.C.Eu (*Chemistry*), P. Hayden (*Computer Science*),

M.Mackey (*Physiology*), J. Nadeau (*Biomedical Engineering*),

E.Podgorsak (*Radiation Oncology*), D.Ronis (*Chemistry*)

Curator (Rutherford Museum and McPherson Collection)

Jean Barrette; B.Sc., M.Sc., Ph.D.(Montr.)

Physics is in many ways the parent of the other natural sciences and its discoveries and laws continually affect their development. Its range and scope extend in space and time from subnuclear particles to the universe itself. The subfields of physics such as mechanics, thermodynamics, electricity, atomic physics and quantum mechanics, to mention but a few, permeate all other scientific disciplines. People trained in physics are employed in industry, government, and educational systems where they find many challenges as teachers, researchers, administrators and in the rapidly developing area of scientific business.

The two main undergraduate programs in Physics at McGill are the Honours and the Major. The Honours program is highly specialized and the courses are very demanding. This program is appropriate for students who wish to make an in-depth study of the subject in preparation for graduate work and an academic or professional career in physics. The two joint honours, one in Mathematics and Physics and the other in Physics and Chemistry, are even more specialized and demanding. They are intended for students who wish to develop a strong basis in both physics and the other discipline and are intended as preparation for graduate work and a professional or academic career. Although these two programs have a bias for theoretical work, they are broad enough and strong enough to prepare students for further study in either experimental physics or respectively mathematics or chemistry. High standing in CEGEP or Freshman-year mathematics and physics is a requirement for admission to these Honours programs.

The Major program, on the other hand, offers a broad training in classical and modern physics and yet leaves room for the student to take a meaningful sequence of courses in other areas. It is intended primarily for students who wish to pursue careers in fields for which physics provides a basis. However, this program also provides a preparation for graduate studies, especially if a student chooses, in consultation with the departmental adviser, a number of Honours Physics courses in the U2 and U3 years.

There are also a number of other Major programs: Atmospheric Sciences and Physics, Physics and Computer Science, Physics and Geophysics, and Physiology and Physics, offered jointly with other departments, and a Minor program in Electrical Engineering, available only to students in the Physics Major program. In addition, there is a Minor in Physics, a Faculty program in Physics and a Joint Faculty program in Mathematics, Chemistry and Physics, which provide a broad base for students less interested in a specialized education.

For those interested in a career as a high school science teacher, the concurrent program leading to both a B.Sc. and a B.Ed. degree provides several physics options. These combine physics courses from the Major and Minor programs with courses from either Biology or Chemistry and with Education courses. (For details, see "[Science for Teachers](#)", in [section 12.12.29](#).)

Students from outside of the Province of Quebec will ordinarily register in the Science Freshman program. Physics offers two sequences of courses for this program: they are described below.

The list of pre- and corequisites is not absolute. In many cases permission of the Department may be sought to have a specific prerequisite waived. The procedure is to ask the professor in charge of the course to review the request for such a waiver. The prerequisites of the 100-level courses are described in the following section entitled Science Freshman Program.

Students interested in any of the Physics programs should contact the Department for an Adviser.

A Science Major Concentration in Physics is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "[Physics \(PHYS\)](#)", in [section 12.12.25](#) for details.

Internship Year for Engineering and Science (IYES)

IYES is a pre-graduate work experience program available to eligible students and normally taken between their U2 and U3 years. For more information, see "[IYES: Internship Year for Engineering and Science](#)", in [section 8.2.8](#), under Faculty of Engineering.

The following programs are also available with an internship component:

Faculty Program in Physics

Major in Physics

Honours in Physics

Joint Honours Program in Physics and Chemistry

Joint Honours Program in Physics and Mathematics

Joint Faculty Program in Mathematics, Chemistry and Physics

Joint Major Program in Atmospheric Science and Physics

Joint Major Program in Physics and Computer Science

Joint Major Program in Physics and Geophysics

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 will normally take courses PHYS131 and PHYS142 if they have previously taken physics at the high school level and will be taking differential calculus concurrently with PHYS131 and integral calculus concurrently with PHYS142. Those students who have not previously taken physics at the high school level and who intend to do programs in the Biological Sciences may instead take courses PHYS101 and PHYS102. All students are expected to have reasonable fluency in algebra, geometry and trigonometry at the high school level. If this is not the case, then MATH112 should be taken concurrently with PHYS101. Those for whom this is not necessary are advised to take MATH139 concurrently with PHYS101.

MINOR IN 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 mathematical background.

Students in certain programs (e.g., the Major in Chemistry) will find that there are courses in the Minor which are already part of their program, or which they may not take for credit because of a substantial overlap of material with a course or courses in their program. After consultation with an adviser, such students may complete the Minor by substituting any other physics course(s) from the Major or Honours Physics programs.

Required Course (3 credits)

PHYS257 (3) Experimental Methods 1

Complementary Courses (15 credits)

15 credits to be selected as follows:

PHYS230 (3) Dynamics of Simple Systems

or PHYS251 (3) Classical Mechanics 1

PHYS232 (3) Heat and Waves

or PHYS253 (3) Thermal Physics

PHYS258 (3) Experimental Methods 2
or PHYS241 (3) Signal Processing
PHYS271 (3) Quantum Physics
or PHYS260 (3) Modern Physics and Relativity
or PHYS214 (3) Introductory Astrophysics
or PHYS225 (3) Musical Acoustics
PHYS340 (3) Electricity and Magnetism
or PHYS350 (3) Electromagnetism

FACULTY PROGRAM IN PHYSICS (54 credits)

Required Courses (36 credits)

MATH222 (3) Calculus 3
MATH223 (3) Linear Algebra
MATH314 (3) Advanced Calculus
MATH315 (3) Ordinary Differential Equations
PHYS230 (3) Dynamics of Simple Systems
PHYS232 (3) Heat and Waves
PHYS257 (3) Experimental Methods 1
PHYS258 (3) Experimental Methods 2
PHYS333 (3) Thermal and Statistical Physics
PHYS340 (3) Electricity and Magnetism
PHYS436 (3) Modern Physics
PHYS446 (3) Quantum Physics

Complementary Courses (18 credits)

at least 3 credits selected from:

PHYS241 (3) Signal Processing
PHYS434 (3) Optics
PHYS439 (3) Laboratory in Modern Physics

the remainder selected from:

COMP202 (3) Introduction to Computing 1
EPSC320 (3) Elementary Earth Physics
MATH316 (3) Complex Variables
MATH317 (3) Numerical Analysis
MATH319 (3) Partial Differential Equations
PHYS328 (3) Electronics
PHYS331 (3) Topics in Classical Mechanics
PHYS339 (3) Measurements Laboratory in General Physics
PHYS342 (3) Electromagnetic Waves

FACULTY PROGRAM IN MATHEMATICS, CHEMISTRY AND PHYSICS, see under [Mathematics and Statistics \(MATH\)](#), in [section 12.12.17](#).

MAJOR IN PHYSICS (60 credits)

U1 Required Courses (21 credits)

MATH222 (3) Calculus 3
MATH223 (3) Linear Algebra
PHYS230 (3) Dynamics of Simple Systems
PHYS232 (3) Heat and Waves
PHYS241 (3) Signal Processing
PHYS257 (3) Experimental Methods 1
PHYS258 (3) Experimental Methods 2

U2 Required courses (24 credits)

MATH314 (3) Advanced Calculus
MATH315 (3) Ordinary Differential Equations
PHYS328 (3) Electronics
PHYS331 (3) Topics in Classical Mechanics
PHYS333 (3) Thermal and Statistical Physics
PHYS339 (3) Measurements Laboratory in General Physics
PHYS340 (3) Electricity and Magnetism
PHYS342 (3) Electromagnetic Waves

U3 Required Courses (15 credits)

PHYS434 (3) Optics
PHYS436 (3) Modern Physics
PHYS439 (3) Laboratory in Modern Physics
PHYS446 (3) Quantum Physics

PHYS449 (3) Majors Research Project

JOINT MAJOR IN PHYSICS AND GEOPHYSICS (68 credits)

The Joint Major program in Physics and Geophysics provides a firm basis for graduate work in geophysics and related fields as well as a sound preparation for those who wish to embark on a career directly after the B.Sc.

U1 Required Courses (29 credits)

EPSC203 (3) Structural Geology 1
 EPSC210 (3) Introductory Mineralogy
 EPSC231 (2) Field School 1
 MATH222 (3) Calculus 3
 MATH223 (3) Linear Algebra
 MATH314 (3) Advanced Calculus
 PHYS230 (3) Dynamics of Simple Systems
 PHYS232 (3) Heat and Waves
 PHYS257 (3) Experimental Methods 1
 PHYS258 (3) Experimental Methods 2

U2 Required Courses (18 credits)

EPSC320 (3) Elementary Earth Physics
 EPSC350 (3) Tectonics
 MATH315 (3) Ordinary Differential Equations
 MATH319 (3) Partial Differential Equations
 PHYS339 (3) Measurements Laboratory in General Physics
 PHYS340 (3) Electricity and Magnetism

U2 or U3 Required Courses (6 credits)

EPSC330 (3) Earthquakes and Earth Structure
 EPSC510 (3) Geodynamics and Geomagnetism

U3 Required Courses (15 credits)

PHYS331 (3) Topics in Classical Mechanics
 PHYS332 (3) Physics of Fluids
 PHYS333 (3) Thermal and Statistical Physics
 PHYS342 (3) Electromagnetic Waves
 PHYS446 (3) Quantum Physics

JOINT MAJOR IN ATMOSPHERIC SCIENCE AND PHYSICS

under "Atmospheric and Oceanic Sciences (ATOC)", in section 12.12.2. 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.

JOINT MAJOR IN PHYSICS AND COMPUTER SCIENCE

(66credits)

The Joint Major in Physics and Computer Science is designed to give motivated students the opportunity to combine the two fields in a way that will distinguish them from the graduates of either field by itself. The two disciplines complement each other, with physics providing an analytic problem-solving outlook and basic understanding of nature, while computer science enhances the ability to make practical and marketable applications, in addition to having its own theoretical interest. Graduates of this program may be able to present themselves as being more immediately useful than a pure physics major, but with more breadth than just a programmer. They will be able to demonstrate their combined expertise in the Special Project course which is the centrepiece of the final year of the program.

U1 Required Courses (21 credits)

COMP250 (3) Introduction to Computer Science
 MATH222 (3) Calculus 3
 MATH223 (3) Linear Algebra
 MATH240 (3) Discrete Structures 1
 PHYS230 (3) Dynamics of Simple Systems
 PHYS257 (3) Experimental Methods 1
 PHYS258 (3) Experimental Methods 2

U2 Required Courses (24 credits)

COMP206 (3) Introduction to Software Systems
 COMP251 (3) Data Structures and Algorithms

COMP302 (3) Programming Languages and Paradigms
 COMP350 (3) Numerical Computing
 MATH314 (3) Advanced Calculus
 MATH315 (3) Ordinary Differential Equations
 PHYS232 (3) Heat and Waves
 PHYS241 (3) Signal Processing

U3 Required Courses (21 credits)

COMP360 (3) Algorithm Design Techniques
 MATH323 (3) Probability
 PHYS331 (3) Topics in Classical Mechanics
 PHYS339 (3) Measurements Laboratory in General Physics
 PHYS340 (3) Electricity and Magnetism
 PHYS446 (3) Quantum Physics
 PHYS489 (3) Special Project

JOINT MAJOR IN PHYSIOLOGY AND PHYSICS under "Physiology (PHGY)", in section 12.12.26. This program provides a firm basis for graduate work in bio-physics and other interdisciplinary fields involving the physical and biological sciences.

HONOURS IN 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 MATH222 must take it in the first term without receiving credits toward the 78credits 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 (in both the final examination and supplemental examination if taken), may not register in the Honours program the following year, or graduate with the Honours degree, except with the permission of the Department.

U1 Required Courses (27 credits)

MATH247 (3) Honours Applied Linear Algebra
 MATH248 (3) Honours Advanced Calculus
 MATH249 (3) Honours Advanced Calculus
 MATH325 (3) Honours Ordinary Differential Equations
 PHYS241 (3) Signal Processing
 PHYS251 (3) Classical Mechanics 1
 PHYS257 (3) Experimental Methods 1
 PHYS258 (3) Experimental Methods 2
 PHYS260 (3) Modern Physics and Relativity

U2 Required Courses (24credits)

MATH375 (3) Honours Partial Differential Equations
 PHYS253 (3) Thermal Physics
 PHYS350 (3) Electromagnetism
 PHYS357 (3) Quantum Physics
 PHYS359 (3) Laboratory in Modern Physics
 PHYS362 (3) Statistical Mechanics
 PHYS451 (3) Classical Mechanics
 PHYS457 (3) Quantum Physics

U3 Required Courses (6 credits)

PHYS551 (3) Quantum Theory
 PHYS352 (3) Electromagnetic Waves

U3 Complementary Courses (21credits)

6 credits selected from:

PHYS459D1 (3) Honours Research Thesis
 and PHYS459D2 (3) Honours Research Thesis
 PHYS469 (3) Laboratory in Modern Physics 2
 PHYS479 (3) Honours Research Project

15 credits selected from:

PHYS332 (3) Physics of Fluids
 PHYS434 (3) Optics
 PHYS479 (3) Honours Research Project
 PHYS514 (3) General Relativity
 PHYS521 (3) Astrophysics
 PHYS557 (3) Nuclear Physics

PHYS558 (3) Solid State Physics
 PHYS559 (3) Advanced Statistical Mechanics
 PHYS562 (3) Electromagnetic Theory
 PHYS567 (3) Particle Physics
 or other 3-credit course approved by the Department of Physics.

JOINT HONOURS IN 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. In addition, a student who has not completed the equivalent of MATH222 must take it in the first term without receiving credits toward the 81 credits required in the Joint 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 (in both the final examination and supplemental examination if taken), may not register in this Joint Honours program the following year, or graduate with the Joint Honours degree, except with permission of both Departments.

The student will have two advisers, one from Mathematics and the other from Physics.

U1 Required Courses (27 credits)

MATH235 (3) Algebra 1
 MATH248 (3) Honours Advanced Calculus
 MATH249 (3) Honours Complex Variables
 MATH325 (3) Honours Ordinary Differential Equations
 PHYS241 (3) Signal Processing
 PHYS251 (3) Classical Mechanics 1
 PHYS257 (3) Experimental Methods 1
 PHYS258 (3) Experimental Methods 2
 PHYS260 (3) Modern Physics and Relativity

U1 Complementary Course (3 credits)

3 credits selected from:

MATH251 (3) Algebra 2
 MATH247 (3) Honours Applied Linear Algebra

U2 Required Courses (27 credits)

MATH242 (3) Analysis 1
 MATH255 (3) Honours Analysis 2
 MATH375 (3) Honours Partial Differential Equations
 PHYS253 (3) Thermal Physics
 PHYS350 (3) Electromagnetism
 PHYS357 (3) Quantum Physics
 PHYS362 (3) Statistical Mechanics
 PHYS451 (3) Classical Mechanics
 PHYS457 (3) Quantum Physics

U3 Required Courses (12 credits)

MATH354 (3) Honours Analysis 3
 MATH380 (3) Honours Differential Geometry
 PHYS352 (3) Electromagnetic Waves
 PHYS359 (3) Laboratory in Modern Physics

U3 Complementary Courses (12 credits)

3 credits selected from:

MATH355 (3) Honours Analysis 4
 MATH370 (3) Honours Algebra 3

6 credits selected from:

PHYS479 (3) Honours Research Project
 PHYS514 (3) General Relativity
 PHYS551 (3) Quantum Theory
 PHYS521 (3) Astrophysics
 PHYS557 (3) Nuclear Physics

PHYS558 (3) Solid State Physics
 PHYS559 (3) Advanced Statistical Mechanics
 PHYS562 (3) Electromagnetic Theory
 PHYS567 (3) Particle Physics
 3 credits in Honours Mathematics

JOINT HONOURS IN PHYSICS AND CHEMISTRY (77 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 (in both the final examination and supplemental examination if taken), may not register in this Joint Honours program the following year, or graduate with the Joint Honours degree, except with permission of both Departments.

U1 Required Courses (28 credits)

CHEM213 (3) Introductory Physical Chemistry
 CHEM273 (1) Chemical Kinetics
 MATH247 (3) Honours Applied Linear Algebra
 MATH248 (3) Honours Advanced Calculus
 MATH249 (3) Honours Complex Variables
 MATH325 (3) Honours Ordinary Differential Equations
 PHYS241 (3) Signal Processing
 PHYS251 (3) Classical Mechanics 1
 PHYS257 (3) Experimental Methods 1
 PHYS258 (3) Experimental Methods 2

U2 Required Courses (26 credits)

CHEM212 (4) Introductory Organic Chemistry 1
 CHEM281 (3) Inorganic Chemistry 1
 CHEM355 (3) Molecular Properties and Structure 2
 CHEM363 (2) Physical Chemistry Laboratory 1
 CHEM365 (2) Statistical Thermodynamics
 COMP208 (3) Computers in Engineering
 PHYS350 (3) Electromagnetism
 PHYS357 (3) Quantum Physics
 PHYS457 (3) Quantum Physics

U3 Required Courses (14 credits)

CHEM393 (2) Physical Chemistry Laboratory 2
 CHEM455 (3) Introductory Polymer Chemistry
 CHEM556 (3) Advanced Quantum Mechanics
 PHYS352 (3) Electromagnetic Waves
 PHYS558 (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:

CHEM593 (3) Statistical Mechanics
 PHYS559 (3) Advanced Statistical Mechanics

9 credits selected from:

CHEM480 (3) Research Project
 and CHEM490 (3) Research Project
 CHEM531 (3) Chemistry of Inorganic Materials
 CHEM575 (3) Chemical Kinetics
 CHEM585 (3) Colloid Chemistry
 MATH375 (3) Honours Partial Differential Equations
 PHYS434 (3) Optics
 PHYS451 (3) Classical Mechanics
 PHYS469 (3) Laboratory in Modern Physics 2
 PHYS479 (3) Honours Research Project
 PHYS562 (3) Electromagnetic Theory

MINOR IN ELECTRICAL ENGINEERING (23 or 25 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 in Physics are eligible for this Minor. Students registered for this option cannot count PHYS241 towards the requirements of the Major in Physics, and should replace this course by another Physics or Mathematics course. Students who select ECSE334 in the Minor cannot count PHYS328 towards the requirements of the Major in Physics, and should replace this course by another Physics or Mathematics course.

Required Courses (17 or 19 credits)

ECSE200	(3)	Fundamentals of Electrical Engineering
ECSE210	(3)	Circuit Analysis
ECSE291	(2)	Electrical Measurements Laboratory
ECSE303	(3)	Signals and Systems 1
ECSE305	(3)	Probability and Random Sig. 1
or ECSE334	(5)	Introduction to Microelectronics
ECSE330	(3)	Introduction to Electronics

Complementary Courses (6 credits)**12.12.26 Physiology (PHGY)**

McIntyre Medical Sciences Building, Room 1021
3655 Promenade Sir William Osler
Montreal, QC H3G 1Y6

Telephone: (514) 398-4316

Fax: (514) 398-7452

Website: www.medicine.mcgill.ca/physio

Chair — Ellis Cooper, Acting Chair

Emeritus Professors

G. Melvill Jones; B.A., M.A., M.B., B.Ch., M.D.(Cantab.)
Kresmir Krnjevic; O.C., B.Sc., Ph.D., M.B., Ch.B.(Edin.), F.R.S.C.

Professors

Thomas M.S. Chang; B.Sc., M.D., C.M., Ph.D.(McG.), F.R.C.P.(C)
Monroe W. Cohen; B.Sc., Ph.D.(McG.)

Ellis J. Cooper; B.Eng.(Sir G.Wms.), M.Sc.(Surrey), Ph.D.(McM.)

Mony M. Frojmovic; B.Sc., Ph.D.(McG.)

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. (*joint appoint. with Medicine*)

David Goltzman; B.Sc., M.D., C.M.(McG.) (*Antoine G. Massabki
Professor of Medicine*) (*joint appoint. with Medicine*)

John Hanrahan; Ph.D.(U.B.C.)

Mortimer Levy; B.Sc., M.D., C.M.(McG.), F.R.C.P.(C) (*joint
appoint. with Medicine*)

Michael Mackey; B.A., Ph.D.(Wash.) (*Joseph Morley Drake
Professor of Physiology*)

Jacapo P. Mortola; M.D.(Milan)

John Orłowski; B.Sc.(McG.), M.Sc., Ph.D.(Queen's) (*James
McGill Professor*)

Premysl Ponka; M.D., Ph.D.(Prague)

Alvin Shrier; B.Sc.(C'dia), Ph.D.(Dal.) (*Hosmer Professor of
Physiology*)

Douglas G.D. Watt; M.D., Ph.D.(McG.)

Assistant Professors

Erik Cook; Ph.D.(Baylor College, Houston)

Julie Desbarats; Ph.D.(McG.)

Pejmun Haghighi; Ph.D.(McG.)

Julio Martinez-Trujillo; Ph.D.(Univ.Tübingen, Germany)

Peter Swain; Ph.D.(Univ. London)

Assistant Professor (Part Time)

Anne Marie Lauzon; B.Sc., M.Sc., Ph.D.(McG.)

Associate Professors

Kathleen Cullen; B.Sc.(Brown), Ph.D.(Chicago) (*William Dawson
Scholar*)

Riaz Farookhi; B.Sc., M.Sc.(M.I.T.), Ph.D.(Tufts)

Mladen Glavinovic; B.Sc.(Zagreb), M.Sc.(Tor.), Ph.D.(McG.)

Michael Guevara; B.Sc., M.Eng., Ph.D.(McG.)

Sheldon Magder; M.D.(Tor.) (*joint appoint. with Medicine*)

Ursula Stochaj; Ph.D.(Cologne)

Teresa Trippenbach; M.D., Ph.D.(Warsaw)

Ann Wechsler; B.A.(Tor.), M.Sc., Ph.D.(McG.)

John White; B.Sc., M.Sc.(Car.), Ph.D.(Harv.)

Associate Professor (Part Time)

Nicole Bernard; B.Sc.(McG.), Ph.D.(Duke)

Associate Members

Anaesthesia: Steven Backman

Biomedical Engineering: Robert E. Kearney, Satya Prakash,
Tomoko Takano

Dentistry: James Lund

Medicine: Albert Aguayo, Angel Alonso, AndreyCybulsky,
SamuelO.Freedman, AbrahamFuks, ClaudeGagnon,
RaymondeGagnon, HarryGoldsmith, GeoffreyHendy,
LouiseLarose, PeterMacklem, James Martin, ShreeMulya,
MarianaNewkirk, BarryPosner, Shafaat Rabbani,
J.EnriqueSilva, AlanSniderman, MaryStevenson,
SimonWing, HansZingg

Nephrology: Serge Lemay

Neurology: David Ragsdale

Neurology & Neurosurgery: MassimoAvoli, CharlesBourque,
SaT.Carbonetto, PierreDrapeau, DanielGuitton,
MichaelRasminsky

Ophthalmology: Curtis Baker

Otolaryngology: BernardSegal

Pediatrics: ImmanuelaMoss, CharlesRohlicek

Psychiatry:BernardoDubrovsky, ChristinaGianoulakis

Adjunct Professors

Roy Caplan, Montreal

Terence Hebert, Montreal

John Milton, Chicago

Serge Rossignol, Montreal

Malmur R.I. Sairam, Montreal

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, immunology, biophysics and biomathematics. Some faculty members have formal or informal links with the departments of mathematics, physics, electrical engineering, and chemistry, and with clinical departments (medicine, surgery, pediatrics, neurology, obstetrics, psychiatry, anesthesia), reflecting and reinforcing the close ties between physiology and other disciplines.

Graduates at the B.Sc. level have found rewarding careers in teaching, in secondary schools and CEGEPs, government service, and laboratory technical assistance, such as in pharmaceutical houses, hospitals, and institutions of higher learning. Moreover, physiology provides an excellent background for medicine, dentistry or other postgraduate work, in such fields as physiology, experimental medicine, pharmacology, biochemistry or physiological psychology.

The programs offered in Physiology differ in their orientation but they all have a common core of material covering cardiovascular, respiratory, gastrointestinal and renal physiology, neurophysiology, endocrinology and immunology. The specified U1 courses are identical for all programs except the Joint Major Programs in Physiology and Physics, Physiology and Mathematics, and the Joint Honours Program in Immunology and thus afford the student maximal flexibility before deciding on a particular program to follow in U2 and U3.

Academic advising is compulsory. All new students to the Department, Freshman and CEGEP, **must** see an adviser upon entering the program. Contact the Student Affairs Officer at (514)398-3689 for more information.

Returning students are required to consult with their advisers during the advising period for returning students, and regularly throughout the year. It is important that graduating students have their record checked by their adviser at the beginning of their final year.

PLEASE NOTE: Complementary courses are not electives.

The difference between Complementary courses and Required courses is that Complementary courses are defined as offering an element of choice, however small that choice may be. **Students may choose from the two (or more) courses specified within Complementary Course segments of a program description, but ONLY from those.** For further information, refer to "[Course Information, Regulations and Descriptions](#)", in [section 16](#).

A Science Major Concentration in Biomedical Sciences is available to students pursuing the B.A. & Sc. degree. This Major Concentration is described in the Bachelor of Arts and Science section of the Calendar; see "[Biomedical Sciences](#)", in [section 6.12.4](#) for details.

FACULTY PROGRAM IN PHYSIOLOGY (55 credits)

[A minor program revision is under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

If not previously taken CHEM212 Introductory Organic Chemistry 1 must be completed in addition to the 55 program credits.

Required Courses (34 credits)

BIOL200	(3)	Molecular Biology
BIOL202	(3)	Basic Genetics
BIOL301	(4)	Cell and Molecular Laboratory
CHEM222	(4)	Introductory Organic Chemistry 2
PHGY209	(4)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2
PHGY212D1	(1)	Introductory Physiology Laboratory
PHGY212D2	(1)	Introductory Physiology Laboratory
PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2
PHGY313	(3)	Intermediate Physiology 3
PHGY314	(3)	Integrative Neuroscience

Complementary Courses (21 credits)

6 credits selected from:

BIOL201	(3)	Cell Biology and Metabolism
or BIOC212	(3)	Molecular Mechanisms of Cell Function
BIOL373	(3)	Biometry
or BIOL309	(3)	Mathematical Models in Biology

6 credits selected from upper level physiology courses – see approved list on Department Website.

9 credits selected from upper level science courses – see approved list on Department Website.

MAJOR IN PHYSIOLOGY (64-65 credits)

[A minor program revision is under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

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 CHEM212 Introductory Organic Chemistry 1 must be completed in addition to the 64-65 program credits.

U1 Required Courses (18 credits)

BIOL200	(3)	Molecular Biology
BIOL202	(3)	Basic Genetics
CHEM222	(4)	Introductory Organic Chemistry 2
PHGY209	(3)	Mammalian Physiology 1

PHGY210	(3)	Mammalian Physiology 2
PHGY212D1	(1)	Introductory Physiology Laboratory
PHGY212D2	(1)	Introductory Physiology Laboratory

U2 and U3 Required Courses (19 credits)

PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2
PHGY313	(3)	Intermediate Physiology 3
PHGY314	(3)	Integrative Neuroscience
BIOL301	(4)	Cell and Molecular Laboratory
BIOC311	(3)	Metabolic Biochemistry

Complementary Courses (27-28 credits)

12-13 credits selected from:

BIOL201	(3)	Cell Biology and Metabolism
or BIOC212	(3)	Molecular Mechanisms of Cell Function
BIOL373	(3)	Biometry
or BIOL309	(3)	Mathematical Models in Biology
CHEM203	(3)	Survey of Physical Chemistry
or CHEM204	(3)	Physical Chemistry/Biological Sciences 1
ANAT214	(3)	Systemic Human Anatomy
or ANAT261	(4)	Introduction to Dynamic Histology

9 credits selected from upper level physiology courses – see approved list on Department Website.

6 credits selected from upper level science courses – see approved list on Department Website.

JOINT MAJOR IN PHYSIOLOGY AND MATHEMATICS (77 credits)

[A minor program revision is under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

U1 Required Courses (14 credits)

PHGY212D1	(1)	Introductory Physiology Laboratory
PHGY212D2	(1)	Introductory Physiology Laboratory
MATH222	(3)	Calculus 3
MATH247	(3)	Honours Applied Linear Algebra
or MATH223	(3)	Linear Algebra
BIOL200	(3)	Molecular Biology
BIOL309	(3)	Mathematical Models in Biology

U1 Complementary Courses (15 credits)

9 credits selected from:

BIOL201	(3)	Cell Biology and Metabolism
or BIOC212	(3)	Molecular Mechanisms of Cell Function
PHGY209	(3)	Mammalian Physiology 1
and PHGY210	(3)	Mammalian Physiology 2
or PHGY201	(3)	Human Physiology: Control Systems
and PHGY202	(3)	Human Physiology: Body Functions

6 credits selected from:

MATH248	(3)	Honours Advanced Calculus
or MATH314	(3)	Advanced Calculus
MATH325	(3)	Honours Ordinary Differential Equations
or MATH315	(3)	Ordinary Differential Equations

U2 Required Courses (24 credits)

MATH242	(3)	Analysis 1
MATH243	(3)	Analysis 2
MATH323	(3)	Probability
MATH326	(3)	Nonlinear Dynamics and Chaos
PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2
PHGY313	(3)	Intermediate Physiology 3
PHGY314	(3)	Integrative Neuroscience

U2 or U3 Required Courses (6 credits)

MATH437	(3)	Mathematical Methods in Biology
PHYS413	(3)	Physical Basis of Physiology

U3 Required Courses (18 credits)

BMDE519	(3)	Analysis of Biomedical Systems & Signals
MATH319	(3)	Partial Differential Equations
MATH324	(3)	Statistics
PHGY461D1	(4.5)	Experimental Physiology

PHGY461D2 (4.5) Experimental Physiology

JOINT MAJOR IN PHYSIOLOGY AND PHYSICS (80credits)

[A minor program revision is under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

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)

MATH222	(3)	Calculus 3
PHGY212D1*	(1)	Introductory Physiology Laboratory
PHGY212D2*	(1)	Introductory Physiology Laboratory
PHYS230	(3)	Dynamics of Simple Systems
PHYS232	(3)	Heat and Waves
PHYS257	(3)	Experimental Methods 1
PHYS258	(3)	Experimental Methods 2

U1 Complementary Courses (9 credits)

MATH223	(3)	Linear Algebra
or MATH247	(3)	Honours Applied Linear Algebra
PHGY209	(3)	Mammalian Physiology 1
and PHGY210*	(3)	Mammalian Physiology 2
or PHGY201	(3)	Human Physiology: Control Systems
and PHGY202	(3)	Human Physiology: Body Functions

* The corequisite BIOL200, BIOL201 is waived for this program.

U2 Required Courses (21 credits)

MATH326	(3)	Nonlinear Dynamics and Chaos
PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2
PHGY313	(3)	Intermediate Physiology 3
PHGY314	(3)	Integrative Neuroscience
PHYS328	(3)	Electronics
PHYS339	(3)	Measurements Laboratory in General Physics

U2 Complementary Course (6 credits)

MATH315	(3)	Ordinary Differential Equations
or MATH325	(3)	Honours Ordinary Differential Equations
MATH314	(3)	Advanced Calculus
or MATH248	(3)	Honours Advanced Calculus

U2 or U3 Required Courses (6 credits)

MATH437	(3)	Mathematical Methods in Biology
PHYS413	(3)	Physical Basis of Physiology

U3 Required Courses (21 credits)

BMDE519	(3)	Analysis of Biomedical Systems and Signals
PHGY461D1	(4.5)	Experimental Physiology
PHGY461D2	(4.5)	Experimental Physiology
PHYS333	(3)	Thermal and Statistical Physics
PHYS340	(3)	Electricity and Magnetism
PHYS446	(3)	Quantum Physics

HONOURS IN PHYSIOLOGY (75 credits)

[A minor program revision is under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

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 PHGY209 and PHGY210. 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 June 1. Application forms are available in McIntyre 1021. Students should include in their letters telephone numbers where they can be reached during the last week of August. Students are responsible

for picking up their letters of decision in McIntyre 1021 no later than one week before classes start.

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 CHEM212 Introductory Organic Chemistry 1 must be completed in addition to the 75 program credits.

Required Courses (60 credits)

ANAT261	(4)	Introduction to Dynamic Histology
BIOC311	(3)	Metabolic Biochemistry
BIOL200	(3)	Molecular Biology
BIOL202	(3)	Basic Genetics
BIOL301	(4)	Cell and Molecular Laboratory
CHEM222	(4)	Introductory Organic Chemistry 2
PHGY209	(3)	Mammalian Physiology 1
PHGY210	(3)	Mammalian Physiology 2
PHGY212D1	(1)	Introductory Physiology Laboratory
PHGY212D2	(1)	Introductory Physiology Laboratory
PHGY311	(3)	Intermediate Physiology 1
PHGY312	(3)	Intermediate Physiology 2
PHGY313	(3)	Intermediate Physiology 3
PHGY314	(3)	Integrative Neuroscience
PHGY351	(3)	Research Techniques: Physiology
PHGY359D1	(.5)	Tutorial in Physiology
PHGY359D2	(.5)	Tutorial in Physiology
PHGY459D1	(3)	Physiology Seminar
PHGY459D2	(3)	Physiology Seminar
PHGY461D1	(4.5)	Experimental Physiology
PHGY461D2	(4.5)	Experimental Physiology

Complementary Courses (15 credits)

9 credits selected from:

BIOL201	(3)	Cell Biology and Metabolism
or BIOC212	(3)	Molecular Mechanisms of Cell Function
BIOL373	(3)	Biometry
or BIOL309	(3)	Mathematical Models in Biology
CHEM203	(3)	Survey of Physical Chemistry
or CHEM204	(3)	Physical Chemistry/Biological Sciences 1

6 credits selected from upper level physiology courses – see approved list on Department Website.

INTERDEPARTMENTAL HONOURS IN IMMUNOLOGY, under "Immunology Interdepartmental Honours", in section 12.12.14.

This program is offered by the Departments of Biochemistry, Microbiology and Immunology, and Physiology. Physiology students interested in the program should contact Dr. W. S. Lapp.

12.12.27 Psychiatry (PSYT)

There are no B.Sc. programs in Psychiatry, but the PSYT courses listed in the Courses section of this Calendar are administered by the Faculty of Science and are not considered as courses outside of Arts and Science.

12.12.28 Psychology (PSYC)

Stewart Biological Sciences Building, Room W8/1
1205 Avenue Docteur Penfield
Montreal, QC, H3A1B1

Telephone: (514) 398-6100
Fax: (514) 398-4896
E-mail: info@psych.mcgill.ca
Website: www.psych.mcgill.ca

Chair — K.B.J. Franklin

Emeritus Professors

Albert S. Bregman; M.A.(Tor.), Ph.D.(Yale)
Virginia I. Douglas; B.A.(Qu.), M.A., M.S.W., Ph.D.(Mich.)
Wallace E. Lambert; M.A.(Colgate), Ph.D.(N.Carolina), F.R.S.C.
A.A.J. Marley; B.Sc.(Birm.), Ph.D.(Penn.)

Ronald Melzack; M.Sc., Ph.D.(McG.), F.R.S.C. (*E.P. Taylor Emeritus Professor of Psychology*)
Peter M. Milner; B.Sc.(Leeds), M.Sc., Ph.D.(McG.)

Professors

Frances E. Aboud; B.A.(Tor.), M.A., Ph.D.(McG.)
Irving M. Binik; B.A.(N.Y.U.), B.H.L.(Jewish Theological Seminary), M.A., Ph.D.(Penn.)
Avi Chaudhuri; B.Sc., M.Sc.(Tor.), Ph.D.(Berk.) (*James McGill Professor*)
Blaine Ditto; B.S.(Iowa), Ph.D.(Ind.)
Keith B.J. Franklin; B.A., M.A.(Auck.), Ph.D.(Lond.)
Fred H. Genesee; B.A.(W.Ont.), M.A., Ph.D.(McG.)
Jeffrey S. Mogil; B.Sc.(Tor.), Ph.D.(UCLA) (*E.P. Taylor Professor of Psychology and Canada Research Chair in Genetics of Pain*)
Debbie S. Moskowitz; B.S.(Kirkland), M.A., Ph.D.(Ct.)
Yuriko Oshima-Takane; B.A., M.A.(Tokyo), Ph.D.(McG.)
David J. Ostry; B.A.Sc., M.A.Sc., Ph.D.(Tor.)
Caroline Palmer; B.Sc.(Univ. of Michigan, Ann Arbor), M.Sc.(Rutgers), Ph.D.(Cornell) (*Canada Research Chair in Cognitive Neuropsychology of Performance*)
Michael Petrides; B.Sc., M.Sc.(Lond.), Ph.D.(Cantab.)
Robert O. Pihl; B.A.(Lawrence), Ph.D.(Ariz.)
James O. Ramsay; B.Ed.(Alta.), Ph.D.(Prin.)
Barbara B. Sherwin; B.A., M.A., Ph.D.(C'dia) (*James McGill Professor*)
Thomas R. Shultz; B.A.(Minn.), Ph.D.(Yale)
Yoshio Takane; B.L., M.A.(Tokyo), Ph.D.(N.Carolina)
Donald M. Taylor; B.A., M.A., Ph.D.(W.Ont.)
Norman M. White; B.A.(McG.), M.S., Ph.D.(Pitt.)
David C. Zuroff; B.A.(Harv.), M.A., Ph.D.(Conn.)

Associate Professors

John R.Z. Abela; B.A.(Brown), M.A., Ph.D.(Penn.)
A.G. Baker; B.A.(U.B.C.), M.A., Ph.D.(Dal.)
Evan S. Balaban; B.A.(Michigan State), Ph.D.(Rockefeller)
Mark Baldwin; B.A.(Tor.), M.A., Ph.D.(Waterloo)
Don C. Donderi; B.A., B.Sc.(Chic.), Ph.D.(C'neil)
Richard F. Koestner; B.A., Ph.D.(Roch.)
Daniel J. Levitin; A.B.(Stan.), M.S., Ph.D.(Oregon) (*Bell Professor of Psychology and E-Commerce*)
John Lydon; B.A.(Notre Dame), M.A., Ph.D.(Wat.)
James C. Macdougall; B.A.(Car.), M.A., Ph.D.(McG.) (part-time)
Morton J. Mendelson; B.Sc.(McG.), A.M., Ph.D.(Harv.)
Gillian A. O'Driscoll; B.A.(Wellesley), M.A., Ph.D.(Harv.) (*William Dawson Scholar*)

Assistant Professors

Ian F. Bradley; B.Sc., M.Sc.(Tor.), Ph.D.(Wat.) (part-time)
Moon-Ho R. Ho; B.Sc., M.Phil.(Chinese Univ. of Hong Kong), M.S., Ph.D.(Illinois)
Baerbel Knaeuper; Diploma, Dr. phil.(U. of Mannheim), Dr. phil. habil. (Free University of Berlin)
Karim Nader; B.Sc., Ph.D.(Tor.)
Kristine Onishi; B.A. (Brown), M.A., Ph.D.(Ill.)
Zeev Rosberger; B.Sc.(McG.), M.A., Ph.D.(C'dia) (part-time)
Debra Titone; B.A.(NY), M.A., Ph.D.(SUNY, Binghamton)
Athena Vouloumanos; B.Sc.(McG), Ph.D.(UBC)

Lecturers

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

Associate Members

Clinical Research Institute of Montreal: Terrance J.Coderre
Douglas Hospital: Howard Steiger
Faculty of Management (McG.): Ulf Bockenholt
Montreal Neurological Institute: Marilyn Jones-Gotman,
Brenda Milner, Tomas Paus, Wayne Sossin, Viviane Sziklas,
Robert Zatorre
Psychiatry: Frances Abbott
Vision Research Unit (Ophthalmology): Curtis Baker,
Robert Hess, Frederick A.A. Kingdom, Kathleen Mullen

Adjunct Professors

S. Bergeron; B.Sc.(U. of Montreal), Ph.D.(McG.)
S. Burstein; B.Sc.(McG.), M.A., Ph.D.(Wat.)

F. Cramer-Azima; B.A.(Queen's), M.A. (Cornell), Ph.D.(Mont.)
P. Delise; B.Sc., M.Ps., Ph.D.(Montr.)
C. Garson; B.A.,(C'dia), Ph.D.(McG.)
P. Gregoire; B.A.(College St. Marie), B.Ph., L.Ph., Ph.D.(Montr.)
A. Routtenberg; B.A.(McG.), M.A.(Northwestern), Ph.D.(Michigan)
D. Sookman; B.A.(McG.), M.A.(Guelph), Ph.D.(C'dia)
M. Spevack; B.Sc.(McG.), M.A.(Dal.), Ph.D.(McG.)
S. Stotland; B.A.(C'dia), M.A.(Tor.), Ph.D.(McG.)
A. Surkis; Ph.D.(Montr.)
P. Zelazo; B.A.(Amer.Int'l. Coll.), M.S.(N. Carolina), Ph.D.(Wat.)

Part-time Appointments

Jorge Armony; B.Sc.(Buenos Aires), M.Sc., Ph.D.(NYU)
Veronique Bohbot; B.A.(McG.), M.A., Ph.D.(Ariz.)
Pasqualina Di Dio; B.A.(McG.), M.A., Ph.D.(Roch.),
Judith LeGallais; B.A., M.A., Ph.D.(McG.)
Martin LePage; B.A.(C'dia), Ph.D.(UQAM)
Marco Leyton; B.Sc.(Memorial), M.A., Ph.D.(Conc.)
Sonia Lupien; B.Sc., M.Sc., Ph.D.(Montr.)
Zbigniew Pleszewski; M.A., Ph.D.(U. of Poznan)
Stephen Stotland; B.A.(C'dia), M.A.(Tor), Ph.D.(McG.)

The Department of Psychology offers programs in both Arts and Science. All B.A. programs in Psychology can be found in the Faculty of Arts entry, see section 5.12.43 "Psychology (PSYC)".

Psychology is the scientific study of mind and behaviour. It is both a social and a biological science. As a social science, psychology studies social interactions. As a biological science, it regards humans as the product of evolution and so studies them in biological perspective, comparing and contrasting human behaviour with that of other species.

The data of psychology are collected within the psychological laboratory by the use of experimental methods in the study of behaviour, and outside the laboratory by systematic observation of the behaviour of humans and animals. The aim is to formulate general principles of perception, learning, motivation, cognition and social psychology that are relevant to different aspects of human life. Experimentation, laboratory techniques, observational procedures, measurement, and statistical methods are important tools of the psychologist.

Psychology has many interdisciplinary aspects. The study of psychological problems often involves knowledge drawn from other disciplines such as biology, physiology, linguistics, sociology, philosophy, and mathematics. For this reason a student with varied interests can frequently find a place for these in psychology.

Psychology is a young science so that explanations of the processes underlying observed phenomena are often theoretical and speculative. The major objectives of psychological study are to reduce the discrepancy between theory and fact and to provide better answers about why humans think and behave as they do.

Although a number of undergraduate courses in psychology have applied implications, applied training is not the purpose of the undergraduate curriculum. Its purpose is to introduce the student to an understanding of the basic core of psychological knowledge, theory, and method, regardless of questions of practical application.

The B.Sc. or B.A. with a Major or Honours degree in psychology is not a professional qualification. It does not qualify the individual to carry on professional work in psychology. In the Province of Quebec the minimum requirement for membership in the Order of Psychologists, the professional association governing the work of psychologists in the province, is an M.A. or M.Sc. degree, or other equivalent degree. All students planning to practise in the Province of Quebec will be examined on their proficiency in French before being admitted to the professional association. Undergraduate courses in psychology may prove of considerable value 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, educational psychology, and others.

Requirements for admission to graduate studies in psychology vary from one university to another and from one country to another. Nonetheless, both the Honours and Major degrees in psychology may qualify the student for admission to many graduate schools, provided that sufficiently high grades are obtained. During the U2 year, undergraduate students are strongly advised to verify the admission requirements of various graduate programs. This is to ensure that sufficient time is available for students to complete all necessary requirements for admission to their preferred graduate programs.

The essential differences between the Honours and the Major program are an emphasis on research methodology courses and practice in the Honours program, and that higher academic standards are required of Honours students. Honours students also have an opportunity to work in small groups closely with staff members.

INFORMATION MEETINGS FOR NEW STUDENTS

All new students entering the Psychology undergraduate program are required to attend an Information Meeting prior to registration. Students who have been accepted into a Bachelor of Science program in Psychology must attend the meeting on August 26, 2005 at 13:00. The meeting will be held in Room S1/4 of the Stewart Biological Sciences Building. Students accepted into a Bachelor of Arts program must attend a separate information meeting. For details, consult the Psychology program listing in the Faculty of Arts section. At this meeting, Nicole Allard, the Academic Adviser, will explain the requirements of the Department's programs. Incoming students will have an opportunity to ask questions and receive advice on how to plan their courses. After this meeting students will make appointments for individual advising sessions, during which they will fill out their Study Plan form for registration.

Entering students must bring their letter of acceptance and a copy of their collegial transcript(s). They will also need this Calendar and a preliminary Class Schedule. Students will also find the Psychology Department Handbook helpful. It contains more detailed descriptions of psychology courses, as well as providing guidelines for how students might pursue particular areas of interest. The Handbook is available on the Department Website, www.psych.mcgill.ca/ugrad/ugradm.htm

Students entering the Psychology program in January are encouraged to call the academic adviser, Nicole Allard, in December to clarify their course selections.

MINOR IN 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. Please see section 5.12.43 "Psychology (PSYC)" in Faculty of Arts section for more information.

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 PSYC204 or equivalent, see section 12.3.6.1 "Course Overlap".

Complementary Courses (24 credits)

at least 3, but no more than 6, credits selected from:

- PSYC211 (3) Intro Behavioural Neuroscience
- PSYC212 (3) Perception
- PSYC213 (3) Cognition

- PSYC215 (3) Social Psychology
- 18-21 credits selected from among Psychology courses at the 300 level or above

FACULTY, MAJOR, HONOURS PROGRAMS IN PSYCHOLOGY

Recommended Background

It is expected that most students who enter a Major, Honours or Faculty Program in Psychology will have taken introductory psychology, biology and statistics at the collegial level. Recommended CEGEP courses include Psychology 350-101 or 350-102 or equivalent, Biology CEGEP objective 00UK, 00XU or equivalent, Statistics (Mathematics) 201-307 or 201-337 or equivalent. Students must obtain a minimum grade of 75% in their CEGEP level statistics course. In the first year those students who have not taken the recommended collegial level statistics course, or those who have obtained a grade below 75%, must take Psychology PSYC204. Those who have not taken the recommended collegial level biology must take BIOL111 or BIOL112, and those who have not taken Introductory Psychology in college must take PSYC100.

Course Groups: List A and List B

The study of psychology covers many fields. To develop a breadth of understanding in psychology, students are expected to obtain knowledge beyond the introductory level in two or more areas of psychology. To ensure this requirement is met, Psychology courses are divided into two lists. List A covers the areas of behavioural neuroscience, cognition and quantitative methods. List B covers social, health and developmental psychology.

List A

(Behavioural Neuroscience, Cognition and Quantitative Methods)

- PSYC301 (3) Learning
- PSYC308 (3) Behavioural Neuroscience 1
- PSYC310 (3) Human Intelligence
- PSYC311 (3) Human Cognition and the Brain
- PSYC317 (3) Genes and Behaviour
- PSYC318 (3) Behavioural Neuroscience 2
- PSYC334 (3) Computer Simulation - Psychological Processes
- PSYC335 (3) Formal Models: Psychological Processes
- PSYC336 (3) Measurement of Psychological Processes
- PSYC340 (3) Psychology of Language
- PSYC341 (3) The Psychology of Bilingualism
- PSYC342 (3) Hormones and Behaviour
- PSYC352 (3) Laboratory in Cognitive Psychology
- PSYC353 (3) Laboratory in Human Perception
- PSYC403 (3) Modern Psychology in Historical Perspective
- PSYC406 (3) Psychological Tests
- PSYC410 (3) Special Topics in Neuropsychology
- PSYC413 (3) Cognitive Development
- PSYC427 (3) Sensorimotor Behaviour
- PSYC451 (3) Human Factors Research and Techniques
- PSYC470 (3) Memory and Brain
- PSYC472 (3) Scientific Thinking and Reasoning
- PSYC503 (3) Computational Psychology
- PSYC505 (3) The Psychology of Pain
- PSYC510 (3) Statistical Analysis of Tests
- PSYC522 (3) Neurochemistry and Behaviour
- PSYC526 (3) Advances in Visual Perception
- PSYC529 (3) Music Cognition
- PSYC531 (3) Structural Equation Models
- PSYC532 (3) Cognitive Science
- PSYC536 (3) Correlational Techniques
- PSYC541 (3) Multilevel Modelling

List B (Social, Health and Developmental Psychology)

- PSYC304 (3) Child Development
- PSYC316 (3) Psychology of Deafness
- PSYC331 (3) Inter-Group Relations
- PSYC332 (3) Introduction to Personality
- PSYC333 (3) Personality and Social Psychology

PSYC337	(3)	Introduction: Abnormal Psychology 1
PSYC338	(3)	Introduction: Abnormal Psychology 2
PSYC343	(3)	Language Acquisition in Children
PSYC351	(3)	Research Methods in Social Psychology
PSYC408	(3)	Principles of Cognitive Behaviour Therapy
PSYC412	(3)	Deviations: Child Development
PSYC414	(3)	Social Development
PSYC416	(3)	Advanced Topics in Child Development
PSYC429	(3)	Health Psychology
PSYC436	(3)	Human Sexuality and its Problems
PSYC471	(3)	Human Motivation
PSYC473	(3)	Social Cognition and the Self
PSYC474	(3)	Interpersonal Relationships
PSYC491D1	(3)	Advanced Study: Behavioural Disorders
PSYC491D2	(3)	Advanced Study: Behavioural Disorders
PSYC511	(3)	Infant Competence
PSYC530	(3)	Applied Topics in Deafness
PSYC533	(3)	International Health Psychology
PSYC534	(3)	Community Psychology
PSYC535	(3)	Advanced Topics in Social Psychology

Unclassified Courses

PSYC395	(3)	Psychology Research Project 1
PSYC450D1	(3)	Research Project and Seminar
PSYC450D2	(3)	Research Project and Seminar
PSYC492	(3)	Special Topics Seminar 1
PSYC493	(3)	Special Topics Seminar 2
PSYC494D1	(3)	Psychology Research Project
PSYC494D2	(3)	Psychology Research Project
PSYC495	(3)	Psychology Research Project 2

B.Sc. FACULTY PROGRAM IN PSYCHOLOGY (54 credits)

Note: Students in the Faculty of Science who select Arts courses must have a total of at least 54 credits in Science courses among the 90 credits for the B.Sc. degree. Students are expected to have whatever prerequisites are described in this Calendar.

A Faculty Program in Psychology is a sequence of courses which represents a lesser degree of specialization than a Major or an Honours program. A minimum grade of C is required in all 54 program credits. Students completing the Faculty Program should have their complementary course selection approved by the Chief Academic Adviser of the Psychology Department.

U1 Required Courses (12 credits)

PSYC211	(3)	Intro Behavioural Neuroscience
PSYC212	(3)	Perception
PSYC213	(3)	Cognition
PSYC215	(3)	Social Psychology

Note: PSYC100 may be taken as a corequisite with these basic courses.

Complementary Courses (42 credits)

6 credits in Psychology from List A
6 credits in Psychology from List B
6 credits in Psychology at the 300 level or above
6 credits in Psychology 400 or 500 level
18 approved credits, at least 9 of which are at the 300 level or above

B.Sc. MAJOR IN PSYCHOLOGY (54 credits)

[Program revisions are under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

Students majoring in Psychology must obtain a minimum grade of C in all 54 credits of the program. A grade lower than C may be made up by taking another equivalent course (if there is one), by successfully repeating the course, or by successfully writing a supplemental examination (if there is one).

U1 Required Courses (12 credits)

PSYC211	(3)	Intro Behavioural Neuroscience
PSYC212	(3)	Perception
PSYC213	(3)	Cognition
PSYC215	(3)	Social Psychology

Note: PSYC100 may be taken as a corequisite with these basic courses.

U1 or U2 Required Course (3 credits)

PSYC305	(3)	Statistics for Experimental Design
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Complementary Courses (39 credits)

6 credits in Psychology from List A
6 credits in Psychology from List B
6 credits in Psychology at the 300 level or above
9 credits in Psychology 400 or 500 level
12 credits at the 300 level or above in one of the following disciplines: Psychology (PSYC), Anatomy and Cell Biology (ANAT), Biology (BIOL), Biochemistry (BIOC), Chemistry (CHEM), Computer Science (COMP), Mathematics (MATH), Physiology (PHGY), Psychiatry (PSYT).

B.Sc. HONOURS IN PSYCHOLOGY (54 credits)

[Program revisions are under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

Honours in Psychology prepares students for graduate study, and so emphasizes practice in the research techniques which are used in graduate school and professionally later on. Students are accepted into Honours at the beginning of their U2 year, and the two-year sequence of Honours courses continues through U3.

Admission to Honours is selective. Students with a cumulative grade point average of 3.00 or better are eligible to apply; since enrolment is limited the usual GPA for admission to this program is 3.50 (based on a 27-30 graded credit program over two terms). Students must complete the following courses in their U1 year to be eligible to apply to the Honours Program: PSYC204, PSYC211, PSYC212, PSYC213 and PSYC215. Students who have been exempted from PSYC204 due to previous courses completed in CEGEP are advised to complete PSYC305 in their U1 year. Once in the Honours Program, the student must obtain a GPA of 3.00 in the U2 year in order to continue in the program for U3. Students in the Honours Program are required to complete a minimum of 27 graded credits per academic year.

Applications can be obtained from the Undergraduate Office of the Department of Psychology, Room N7/9A, Stewart Biological Sciences Building. The applications must be completed and returned to the Undergraduate Office by August 15 for September admission and by December 1 for January admission. Candidates will be advised of the Department's decision through a notice posted in front of the Undergraduate Adviser's Office, N7/9, before classes begin in September or in January.

Students should note that awarding of the Honours degree will depend on both cumulative grade point average and a minimum grade of B on PSYC380D1/PSYC380D2, PSYC482, PSYC483. "First Class Honours" is awarded to students who obtain a minimum cumulative grade point average of 3.50 and a minimum CGPA of 3.50 in the three Honours courses of which 9 out of 12 credits received at least an A- grade. "Honours" is awarded to students with a minimum cumulative grade point average of 3.00 and a minimum program GPA of 3.00 on each of the three Honours courses. Moreover, the awarding of the Honours degree normally requires completion of two full years of study, U2 and U3, in the Psychology Department. 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.

U1 Required Courses (12 credits)

PSYC211	(3)	Intro Behavioural Neuroscience
PSYC212	(3)	Perception
PSYC213	(3)	Cognition
PSYC215	(3)	Social Psychology

Note: PSYC100 may be taken as a corequisite with these basic courses.

U1 or U2 Required Course (3 credits)

PSYC305	(3)	Statistics for Experimental Design
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U2 Required Courses (6 credits)

PSYC380D1 (3) Honours Research Project and Seminar
 PSYC380D2 (3) Honours Research Project and Seminar

U3 Required Courses (6 credits)

PSYC482 (3) Advanced Honours Seminar 1
 PSYC483 (3) Advanced Honours Seminar 2

Complementary Courses (27 credits)

6 credits to be selected from*:

PSYC481D1 (3) Honours Thesis Research
 PSYC481D2 (3) Honours Thesis Research
 PSYC492 (3) Special Topics Seminar 1
 PSYC493 (3) Special Topics Seminar 2
 PSYC495 (3) Psychology Research Project 2
 PSYC496 (3) Seniors Honours Research 1
 PSYC497 (3) Seniors Honours Research 2
 PSYC498D1 (3) Senior Honours Research
 PSYC498D2 (3) Senior Honours Research
 Any Psychology course at the 500 level.

6 credits in Psychology from List A

6 credits in Psychology from List B

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).

* Please see Faculty Regulations concerning "Project Courses", section 12.3.6.2.

12.12.29 Science for Teachers

Rutherford Physics Building
 3600 University Street
 Montreal, QC, H3A 2T8

Fax: (514) 398-8434

E-mail: bscbcd@physics.mcgill.ca

Coordinator - Science — R. Harris

Coordinator - Education — M. Schwartz

The training and certification of school teachers has traditionally been the responsibility of the Faculty of Education and normally requires the completion of a Bachelor of Education.

The Faculties of Education and of Science have introduced a number of measures to make the B.Ed. degree as accessible as possible to Science students, subject to Ministry of Education regulations. Two of these measures are the Minor in Education for Science Students and the Concurrent B.Sc./B.Ed. programs.

The Concurrent B.Sc./B.Ed. is intended as a very rigorous but rewarding alternative to taking the B.Sc. and the B.Ed. in sequence. The Concurrent program is specifically designed to train teacher/scientists. The program is rigidly structured and closely integrated so as to satisfy the academic requirements of both degrees.

Concurrency is an essential characteristic of the B.Sc./B.Ed.; it is not intended that the Science and Education components be taken separately and then combined. Normally students will be admitted to both components of the Concurrent Program simultaneously, but it is possible for Science students to opt into this program at any time during their B.Sc. program. However, because this is a concurrent program, both degrees must be granted at the same Convocation. It will not be possible to receive one degree first, and the other subsequently.

Students in the Concurrent Program may apply to transfer to either a conventional B.Sc. or a conventional B.Ed program. To do so, they must submit a Faculty Transfer Application to the appropriate Student Affairs Office. The decision will be based on their grades in the relevant component of the Concurrent Program. Students who do transfer to a conventional program may not transfer back to the Concurrent Program.

Students who receive an F or J in an Education Field Experience course are placed in unsatisfactory standing. Although they may complete their term, they are required to withdraw from the Concurrent Program. However, they may apply to transfer to a conventional B.Sc. program as outlined above.

To be admitted, candidates must satisfy the admission requirements of both faculties.

Students who wish to be registered in the Concurrent Program must contact one of the coordinators through the Student Affairs Office of either faculty.

MINOR IN EDUCATION FOR SCIENCE STUDENTS (18 credits)

[Program revisions are under consideration for September 2005. Go to www.mcgill.ca (Course Calendars) in July for details.]

Program Adviser —

Student Affairs Office, Faculty of Education
www.mcgill.ca/edu-sao/minors

This Minor allows Science students to develop or explore an interest in Education without committing themselves to completing a B.Ed. degree. Only a few students are prepared to commit to a teaching career at the start of university, but many students see it as a viable option toward the end of their B.Sc. program. At that time, Science students who have taken this Minor in Education will have completed a substantial number of the necessary credits for the B.Ed. degree. Students whose B.Sc. degree also substantially matches the content of one of the concurrent B.Sc./B.Ed. programs (see below) are likely eligible for the maximum number of 60 Advanced standing credits, as specified in the Faculty of Education section **Advanced Standing/Transfer Credits**, in section 7.2.1.10.

The 18 credits for the Minor are the same courses approved by the Faculty of Science as Education electives within the Concurrent B.Sc./B.Ed.

Required Courses (12 credits)

EDEC247 (3) Policy Issues in Quebec Education
 EDEC262 (3) Media, Technology and Education
 EDPE300 (3) Educational Psychology
 EDPI309* (3) Exceptional Students

* Students should consult the Program Adviser for clarification on the prerequisite for EDPI309.

Complementary Courses (6 credits)

3 credits from:

EDEC260 (3) Philosophical Foundations
 EDEC261 (3) Philosophy of Catholic Education

3 credits from:

EDEC233 (3) First Nations and Inuit Education
 EDEC410 (3) Multi-Cultured/Multi-Racial Class
 EDER464 (3) Intercultural Education

CONCURRENT B.SC./B.ED.PROGRAM

This program has been designed to provide students with the opportunity to attain a Bachelor of Science degree and a Bachelor of Education degree after **135 credits of study (165 credits for students who have not completed the basic sciences)**.

The two components of the Concurrent Program are the B.Ed. Secondary Program and one of the B.Sc. programs for teachers. These two components are described in what follows, including an identification of the elements that are counted towards the requirements of both degrees. These provisions are exceptional and apply exclusively to the Concurrent Program.

The following Science components have been approved for the Concurrent Program:

- biology, with chemistry
- biology, with physics
- chemistry, with biology
- chemistry, with physics
- physics, with biology
- physics, with chemistry
- mathematics.

Bachelor of Education Secondary Program (120 credits)

The aim of this B.Ed. is to prepare teachers for the secondary school level through a program of academic studies and professional studies centred on school-based practicum components supported by courses in pedagogy, curriculum and educational foundations. In the case of the Concurrent Program, the academic component must be chosen from those listed above.

See the Faculty of Education for a full description of the **Bachelor of Education Secondary Program**, in section 7.5.1.1. In summary, it consists of the following:

Academic components (54 credits): in the present case these courses will be selected from the B.Sc. components of the Concurrent Program, and will count towards both degrees.

Professional components (60 credits): these include professional seminars, field experiences, foundation courses, pedagogy courses, and pedagogical support courses.

Pedagogy courses for the Concurrent program must include EDES370 Teaching General Science and EDEC335 Teaching Secondary Science, or, if Mathematics is the academic component chosen, EDES353 Secondary School Mathematics 1 and EDEC 338 Secondary School - Mathematics 2.

The following 18 credits can be included as electives in the B.Sc. component of the Concurrent program, and will count towards both degrees: EDEC247, EDEC262, EDPI309, EDPE300, either EDEC260 or EDEC261, and one of EDEC410, EDPE300, or EDPI309.

Electives (6 credits).

Bachelor of Science Major or Major Concentration with a Minor for Teachers (120credits)

These B.Sc. programs, with the exception of the Major in Mathematics, are designed specifically as the Science component of the Concurrent B.Sc./B.Ed. Program. The general structure of these B.Sc. programs is as follows:

Basic sciences (30 credits). 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 statistics, and physics. Students with satisfactory results in International Baccalaureate, French Baccalaureate and Advanced Levels, and Advanced Placement tests may be exempt from some or all of the basic science courses.

Required and complementary courses (54-70 credits).

The details of these programs are given below. Note that 54 of these credits can be counted towards the academic component of the B.Ed. program, but only for students in the Concurrent Program.

Elective courses (20-36 credits). These are electives from the B.Sc. perspective, but they must be suitably chosen if the student wishes to complete the Concurrent Program with the minimum of 135 credits. The following Education courses can count towards both the B.Sc. and the B.Ed. components of the Concurrent Program.

EDEC247	(3)	Policy issues in Quebec Education
EDEC260	(3)	Philosophical Foundations
or EDEC261	(3)	Philosophy of Catholic Education
EDEC262	(3)	Media, Technology and Education
EDEC410	(3)	Multi-Cultured/Multi-Racial Class
or EDEC233	(3)	First Nations and Inuit Education
or EDER464	(3)	Intercultural Education
EDPE300	(3)	Educational Psychology
EDPI309	(3)	Exceptional Students

MAJOR CONCENTRATION IN BIOLOGY WITH A MINOR IN CHEMISTRY FOR TEACHERS (69 or 70 credits)

This program includes the 36 credits of the **MAJOR CONCENTRATION IN BIOLOGY - CELL/ MOLECULAR OPTION**, under "Biology (BIOL)", in section 6.12.3 or the 37 credits of the **MAJOR CONCENTRATION IN BIOLOGY - ORGANISMAL OPTION**, under "Biology (BIOL)", in section 6.12.3 and the 18 credits of the

MINOR IN CHEMISTRY, under "Chemistry (CHEM)", in section 12.12.6, as well as the 15 credits of Science courses listed below.

Additional Science courses (15 credits)

BIOL210	(3)	Perspectives of Science
CHEM381	(3)	Inorganic Chemistry 2
MATH203	(3)	Principles of Statistics 1
MATH222	(3)	Calculus 3
plus 3 credits, one of:		
CHEM150	(3)	World of Chemistry: Food
CHEM160	(3)	World of Chemistry: Technology
CHEM170	(3)	World of Chemistry: Drugs
CHEM180	(3)	World of Chemistry: Environment

Note: Students must take one additional BIOL course (3 credits) to be approved by the Biology Department. This course is required because both the Major Concentration and the Minor include CHEM212 Introductory Organic Chemistry 1.

MAJOR CONCENTRATION IN BIOLOGY WITH A MINOR IN PHYSICS FOR TEACHERS (69 or 70 credits)

This program includes the 36 credits of the **MAJOR CONCENTRATION IN BIOLOGY - CELL/ MOLECULAR OPTION**, "Biology (BIOL)", in section 6.12.3 or the 37 credits of the **MAJOR CONCENTRATION IN BIOLOGY - ORGANISMAL OPTION**, under "Biology (BIOL)", in section 6.12.3, and the 18 credits of the **MINOR IN PHYSICS**, under "Physics (PHYS)", in section 12.12.25, as well as the 15 credits of Science courses listed below.

Additional Science courses (15 credits)

BIOL210	(3)	Perspectives of Science
MATH203	(3)	Principles of Statistics 1
MATH222	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH314	(3)	Advanced Calculus

MAJOR CONCENTRATION IN CHEMISTRY WITH A MINOR IN BIOLOGY FOR TEACHERS (69 credits)

This program includes the 36 credits of the **MAJOR CONCENTRATION IN CHEMISTRY**, under "Chemistry (CHEM)", in section 6.12.5, the 24 credits of the **MINOR IN BIOLOGY**, under "Biology (BIOL)", in section 12.12.4 and the 9 credits of Science courses listed below.

Additional Science courses (9 credits)

BIOL210	(3)	Perspectives of Science
MATH203	(3)	Principles of Statistics 1
MATH222	(3)	Calculus 3

MAJOR CONCENTRATION IN CHEMISTRY WITH A MINOR IN PHYSICS FOR TEACHERS (69 credits)

This program includes the 36 credits of the **MAJOR CONCENTRATION IN CHEMISTRY**, under "Chemistry (CHEM)", in section 6.12.5, the 18 credits of the **MINOR IN PHYSICS**, under "Physics (PHYS)", in section 12.12.25, and the 15 credits of Science courses listed below.

Additional Science courses (15 credits)

BIOL210	(3)	Perspectives of Science
MATH203	(3)	Principles of Statistics 1
MATH222	(3)	Calculus 3
MATH223	(3)	Linear Algebra
MATH314	(3)	Advanced Calculus

MAJOR CONCENTRATION IN PHYSICS WITH A MINOR IN BIOLOGY FOR TEACHERS (69 credits)

This program includes the 36 credits of the **MAJOR CONCENTRATION IN PHYSICS**, under "Physics (PHYS)", in section 12.12.25, the 24 credits of the **MINOR IN BIOLOGY**, under "Biology (BIOL)", in section 12.12.4, and the 9 credits of Science courses listed below.

Additional Science courses (9 credits)

BIOL210 (3) Perspectives of Science
MATH203 (3) Principles of Statistics 1
plus 3 credits, one additional Physics course approved by the Physics Department.

Complementary Courses (3 credits)

one of the following courses:
MGCR320 (3) Managing Human Resources
ORGB321 (3) Leadership

MAJOR CONCENTRATION IN PHYSICS WITH A MINOR IN CHEMISTRY FOR TEACHERS (69 credits)

This program includes the 36 credits of the **MAJOR CONCENTRATION IN PHYSICS**, under "**Physics (PHYS)**", in **section 12.12.25**, the 18 credits of the **MINOR IN CHEMISTRY**, under "**Chemistry (CHEM)**", in **section 12.12.6** and the 15 credits of Science courses listed below.

Additional Science courses (15 credits)

BIOL210 (3) Perspectives of Science
CHEM381 (3) Inorganic Chemistry 2
MATH203 (3) Principles of Statistics 1
plus 3 credits, one of:
CHEM150 (3) World of Chemistry: Food
CHEM160 (3) World of Chemistry: Technology
CHEM170 (3) World of Chemistry: Drugs
CHEM180 (3) World of Chemistry: Environment
plus 3 credits, one additional Physics course approved by the Physics Department.

MAJOR IN MATHEMATICS FOR TEACHERS (54 credits)

This program includes the 54 credits of the **MAJOR IN MATHEMATICS**, under "**Mathematics and Statistics (MATH)**", in **section 12.12.17**. Students taking the Major in Mathematics as part of the Concurrent Program are **required** to include the following courses as part of the Major.

COMP202* (3) Introduction to Computing 1
MATH324 (3) Statistics
MATH338 (3) History and Philosophy of Mathematics
MATH348 (3) Topics in Geometry

* or equivalent

12.12.30 Technological Entrepreneurship for Science Students

Science students who wish to become entrepreneurs or to enter small to medium-sized companies in the high technology sector will find within this Minor a set of six (6) courses that cover relevant management concepts and skills.

Also available to Science students is the **Minor in Management**, under "**Kinesiology for Science Students**", in **section 12.12.15**.

Acceptance to the program is both competitive and restricted. Application procedures will be announced in September. Please consult Ron Critchley, Student Adviser, Faculty of Management Student Affairs Office, Bronfman 110, for details.

Students registered in the Minor in 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.

Please note: the courses must be taken sequentially over five terms, as follows: ACCT210, MRKT360 and either MGCR320 or ORGB321, BUSA465, MGPO562, BUSA466.

MINOR IN TECHNOLOGICAL ENTREPRENEURSHIP FOR SCIENCE STUDENTS (18 credits)**Required Courses** (15 credits)

ACCT210 (3) Accounting for Managers
MRKT360 (3) Marketing of Technology
BUSA465 (3) Technological Entrepreneurship
MGPO562 (3) Seminar in Organizational Strategy
BUSA466 (3) Technological Entrepreneurship Project