

## Table of Contents

1. The Faculty, page 245
  - 1.1 Location
  - 1.2 Faculty Administrative Officers
  - 1.3 Programs and Teaching in Science
  - 1.4 Student Affairs Office
2. Faculty Admission Requirements, page 246
3. Faculty Degree Requirements, page 246
  - 3.1 Minimum Credit Requirement
  - 3.2 Residency
  - 3.3 Cumulative Grade Point Average (CGPA)
  - 3.4 Time Limit for the Completion of the Degree
  - 3.5 Program Requirements
    - 3.5.1 Freshman Program and Basic Science Requirements
    - 3.5.2 Faculty, Major, and Honours Programs
    - 3.5.3 Minor and Minor Concentration Programs
    - 3.5.4 Other Second Programs
    - 3.5.5 Concurrent B.Sc./B.Ed. program
    - 3.5.6 Internship Program for Engineering and Science (IYES)
    - 3.5.7 McGill School of Environment
    - 3.5.8 Bachelor of Software Engineering and B.Sc. in Software Engineering
  - 3.6 Course Requirements
    - 3.6.1 Course Overlap
    - 3.6.2 Project Courses
    - 3.6.3 Courses outside the Faculties of Arts and Science
    - 3.6.4 Courses taken under the Satisfactory/Unsatisfactory Option
    - 3.6.5 Courses in English as a Second Language (ESL)
    - 3.6.6 Auditing of Courses
    - 3.6.7 Course Credit Weight
4. Advising, page 249
5. Registration, page 249
  - 5.1 Program Registration
  - 5.2 Course Registration
    - 5.2.1 Registration for First-Year Seminars
  - 5.3 Registration for Graduation
6. Grading and Credit, page 250
  - 6.1 Incomplete Grades
7. Examinations, page 250
8. Supplemental Assessments, page 250
  - 8.1 Supplemental Examinations
  - 8.2 Additional Work
  - 8.3 Reassessments and Rereads
9. Academic Standing, page 251
10. Awards and Honourary Designations, page 252
  - 10.1 Honours and First-Class Honours
  - 10.2 Distinction or Great Distinction
  - 10.3 Dean's Honour List
  - 10.4 Medals and Prizes
11. Lists of Programs Offered, page 253
  - 11.1 Faculty Programs, page 253
  - 11.2 Major Programs, page 253
  - 11.3 Joint Major Programs, page 253
  - 11.4 Honours Programs, page 253
  - 11.5 Joint Honours Programs, page 254
  - 11.6 Minor Programs, page 254
  - 11.7 Internship Programs – Internship Year For Engineering and Science (IYES)
  - 11.8 Faculty of Arts Major and Minor Concentration Programs available to Science students
12. Academic Programs, page 255
  - 12.1 Anatomy and Cell Biology (ANAT)
  - 12.2 Atmospheric and Oceanic Sciences (ATOC)
  - 12.3 Biochemistry (BIOC)
  - 12.4 Biology (BIOL)
  - 12.5 Biotechnology (BIOT)
  - 12.6 Chemistry (CHEM)
  - 12.7 Cognitive Science
  - 12.8 Computer Science (COMP)
  - 12.9 Earth and Planetary Sciences (EPSC)
  - 12.10 Environment
  - 12.11 Experimental Medicine (EXMD)
  - 12.12 Geography (GEOG)
  - 12.13 Immunology Interdepartmental Honours
  - 12.14 Kinesiology for Science Students
  - 12.15 Management Minor Program
  - 12.16 Mathematics and Statistics (MATH)
  - 12.17 Microbiology and Immunology (MIMM)
  - 12.18 Music
  - 12.19 Neurology and Neurosurgery (NEUR)
  - 12.20 Neuroscience
  - 12.21 Nutrition (NUTR)
  - 12.22 Pathology (PATH)
  - 12.23 Pharmacology and Therapeutics (PHAR)
  - 12.24 Physics (PHYS)
  - 12.25 Physiology (PHGY)
  - 12.26 Psychiatry (PSYT)
  - 12.27 Psychology (PSYC)
  - 12.28 Science for Teachers
  - 12.29 Technological Entrepreneurship for Science Students

## 1 The Faculty

### 1.1 Location

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

Telephone: (514) 398-4210

Faculty Website: [www.mcgill.ca/science](http://www.mcgill.ca/science)

Student Affairs Office Website: [www.mcgill.ca/artscisao](http://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.

### 1.2 Faculty Administrative Officers

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

Morton J. Mendelson; B.Sc.(McG.), A.M., Ph.D.(Harv.)  
**Associate Dean (Academic and Student Affairs)**

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

Josie D'Amico **Assistant to the Dean**

Sharon Bezeau; B.A.(Tor.), M.A.(C'dia) **Recorder and Chief Invigilator**

Donald Sedgwick; B.Sc., M.Sc.(McG.) **Senior Adviser**

### 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 "[Admission Requirements](#)" on page 13.

There are also two Diploma programs offered in Science. The [Diploma in Environment](#), see page 343 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 12.2 "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 12.28 "Science for Teachers"](#) and "[Concurrent Bachelor of Science \(Major in Two Subjects for Teachers\) and Bachelor of Education \(General Secondary Two-Subject Option\) Program](#)" on page 149, 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](#) on page 175.

#### 1.4 Student Affairs Office

The Student Affairs Office, located in Dawson Hall, 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 (Academic and 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.

## 2 Faculty Admission Requirements

For information about admission requirements for the B.Sc., please refer to "[Admission Requirements](#)" on page 13.

For information about inter-faculty transfers, please refer to the General University Information and Regulations, "[Inter-Faculty Transfer](#)" on page 29, as well as the relevant information posted on the Student Affairs Office Website at [www.mcgill.ca/artscisao](http://www.mcgill.ca/artscisao), and in the Student Affairs Office, Dawson Hall, Room 110.

## 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 3.1

[Residency](#), see section 3.2

[Cumulative Grade Point Average \(CGPA\)](#), see section 3.3

[Time Limit for the Completion of the Degree](#), see section 3.4

[Program Requirements](#), see section 3.5

[Course Requirements](#), see section 3.6

### 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 and 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.

### 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.

### 3.3 Cumulative Grade Point Average (CGPA)

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

### 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 Faculty to continue their studies. 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.

### 3.5 Program Requirements

#### 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](http://www.mcgill.ca/artscisao).

#### 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 in two subjects that can constitute the Science component of the Concurrent B.Sc./B.Ed. Program. For more information about this joint degree, refer to [section 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.

#### 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 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 11.6](#); for Minor Concentrations that are approved for Science students, see [section 11.8 "Faculty of Arts Major and Minor Concentration Programs available to Science students"](#).

#### 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.

#### 3.5.5 Concurrent B.Sc./B.Ed. program

The Concurrent B.Sc./B.Ed. Program described in [section 12.28 "Science for Teachers"](#), applies only to students who were already registered in it as of September 2002.

Admission into the program is closed for September 2003, because the program is under review and revision. A new program may be offered in September 2004, subject to University and Ministry of Education (MEQ) approval.

Science students who might want to enter the program in 2004-05 should seek advice about appropriate course choices for 2003-04 by visiting the B.Sc./B.Ed. Web site at [www.physics.mcgill.ca/~bscbcd](http://www.physics.mcgill.ca/~bscbcd) or by contacting Prof. Dik Harris, e-mail: [dik.harris@mcgill.ca](mailto:dik.harris@mcgill.ca).

#### 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 11.7 "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" on page 165.

#### 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 [page 327](#).

#### 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, offer 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 on page 175](#).

The School of Computer Science also offer a B.Sc. Major program in Software Engineering. For details of the B.Sc. Major, students should refer to [section 12.8 "Computer Science \(COMP\)"](#). The B.Sc. program **does not** lead to accreditation.

### 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 sup-

plemental 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.

### 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 CHEM XYZ and PHYS XYZ, Chemistry students would take CHEM XYZ and the Physics students would take PHYS XYZ. 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 (Academic and 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: AEMA 310, BIOL 373, ECON 227D1/ECON 227D2, ECON 257D1/ECON 257D2, EPSC 215, GEOG 202, MATH 203, MGCR 271, PSYC 204, SOCI 350.
2. Credit will be given for ONLY ONE of the following intermediate statistics courses: AEMA 411, ECON 227D1/ECON 227D2, ECON 257D1/ECON 257D2, GEOG 351, MATH 204, MGCR 272, PSYC 305, SOCI 461.
3. Students in Mathematics or Computer Science programs, and students who have already received credit for MATH 324 will NOT receive credit for any of the following: AEMA 310, AEMA 411, BIOL 373, ECON 227D1/ECON 227D2, ECON 257D1/ECON 257D2, EPSC 215, MATH 203, MATH 204, MGCR 271, MGCR 272, PSYC 204, PSYC 305, SOCI 350.
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 (Academic and 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.

### 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.

### 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, Dawson Hall, and on the Student Affairs Website, [www.mcgill.ca/artscisao](http://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. Request 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.
- Credit for computer and statistics courses offered by faculties other than Arts and Science requires the permission of the Associate Dean of Science 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 taking the Minor in Management may take 21 credits of courses outside of 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 Agriculture and Environmental Sciences.

### 3.6.4 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. For more information, students should consult “[Courses taken under the Satisfactory/Unsatisfactory Option](#)” on page 28.

### 3.6.5 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.

### 3.6.6 Auditing of Courses

No auditing of courses is permitted at McGill.

### 3.6.7 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.

## 4 Advising

Fall-term 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](http://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](http://www.mcgill.ca/artscisao).

Advising for all returning students takes place in March for the coming academic year. For more information, students should refer to the information on the Student Affairs Website [www.mcgill.ca/artscisao](http://www.mcgill.ca/artscisao).

Advising is also available by e-mail. The address is [adviser.artsci@mcgill.ca](mailto:adviser.artsci@mcgill.ca).

## 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](#)” on page 27, *Welcome to McGill*, to the information on the Student Affairs Website, [www.mcgill.ca/artscisao](http://www.mcgill.ca/artscisao), and to the Minerva Website, [www.mcgill.ca/minerva](http://www.mcgill.ca/minerva).

Returning students register at the end of April and in May for the coming academic year. For detailed information about registration, students should refer to “[Registration](#)” on page 27, and to the information on the Student Affairs Website [www.mcgill.ca/artscisao](http://www.mcgill.ca/artscisao), and to the Minerva Website, [www.mcgill.ca/minerva](http://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 reregister 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 for readmission. For more information, students should consult the Student Affairs Office, Dawson Hall, or read the information on the Student Affairs Website [www.mcgill.ca/artscisao](http://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 reregister. 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 in Dawson Hall, for further information.

### 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](http://www.mcgill.ca/artscisao), or the Minerva Website, [www.mcgill.ca/minerva](http://www.mcgill.ca/minerva).

See section 11 “[Lists of Programs Offered](#)” for a list of programs that can be taken by Science students.

### 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 (Academic and 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.

### 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.

CHEM 199 FYS: Why Chemistry?

GEOG 199 FYS: Geo-Environments

PHGY 199 FYS: History of Genetic Engineering

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" on page 56](#).

## 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 verification forms. 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 (Academic and 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.

## 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.

### 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 courses, winter courses,  
and courses spanning fall/winter: April 30

- non-graduating students:  
fall courses: April 30  
winter courses, and courses spanning fall/winter: 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. 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 courses and courses spanning fall/winter, the K is automatically changed to a KF and counts as an F in the GPA. Please refer to ["Grading and Grade Point Averages \(GPA\)" on page 33](#) for more information about grading and credit.

## 7 Examinations

Students should refer to ["Examinations" on page 35](#) for information about final examinations and deferred examinations. Note that for the Faculty of Science, ["University Regulations Concerning Final Examinations" on page 36](#) applies to courses up to and including the 500 level.

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

## 8 Supplemental Assessments

### 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 change of course 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 applications are available at 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 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.

## 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.

## 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 course work (i.e., of term papers, mid-terms, assignments, quizzes, etc.) and rereads of final examinations. **In both cases, rather than reconfirm 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 Course Work

Reassessments of course work 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.**

## 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 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 (Academic and 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 (Academic and 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 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. In the summer term such students will be placed in continuing unsatisfactory readmitted standing provided their CGPA is between 1.50 and 1.99.
- 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 12.28 "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 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 6.1 "Incomplete Grades"](#).

## 10 Awards and Honourary Designations

### 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.

### 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.



### 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.

### 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](http://www.mcgill.ca). No application is required except in the case of the Moyses Travelling Scholarships.

## 11 Lists of Programs Offered

### 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

### 11.2 Major Programs

Anatomy and Cell Biology  
 Atmospheric Science  
 Biochemistry  
 Biology  
 Biology and Chemistry for Teachers – see Science for Teachers.  
 Biology and Geography for Teachers – see Science for Teachers.  
 Biology and Mathematics for Teachers – see Science for Teachers.  
 Chemistry  
 Chemistry (Bio-organic option)  
 Chemistry (Environmental Chemistry option)  
 Chemistry (Materials)  
 Chemistry and Physics for Teachers – see Science for Teachers.

Computer Science – application required, see unit entry for information.

Earth and Planetary Sciences  
 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  
 Mathematics and Chemistry for Teachers – see Science for Teachers.  
 Mathematics and Physics for Teachers – see Science for Teachers.  
 Microbiology and Immunology – application required, see departmental entry for information.  
 Physics  
 Physiology  
 Psychology  
 Software Engineering – application required, see unit entry for information

### 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

### 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 – application required, see unit entry for information.  
 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

### 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

### 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

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.

### 11.7 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](#)” on page 165.

#### 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 & Geophysics

Joint Honours Program in Physics and Chemistry

Joint Honours Program in Physics and Mathematics

### 11.8 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 – Literature

English – Drama and Theatre

English – Cultural Studies

Langue et littérature françaises – Léttrés

Langue et littérature françaises – Léttrés et traduction

Langue et littérature françaises – Linguistique du français

Geography (Urban Systems)

German Language and Literature – see German Studies.

German Literature and Culture – see German Studies.

Contemporary German Studies – see German Studies.

Hispanic Literature and Culture – see Hispanic Studies.

Hispanic Languages – see Hispanic Studies.

History

Humanistic Studies

International Development Studies

Italian Studies

Italian Studies (Medieval and Renaissance)

Jewish Studies

Latin-American Studies

Linguistics

Middle East Studies

Music

North American Studies

Philosophy

Political Science

Québec Studies

Religious Studies – Scriptures and Interpretation

Religious Studies – World Religions

Russian

Sociology

Women's Studies

#### Minor Concentrations

African Studies

Anthropological Archaeology – see Anthropology

Anthropology, Socio-Cultural

Art History

Canadian Ethnic Studies

Canadian Studies

Catholic Studies

Classics

East Asian Language and Literature

East Asian Cultural Studies

East Asian Studies, Advanced

Economics

English – Literature

English – Drama and Theatre

English – Cultural Studies

Langue et littérature françaises – Léttrés

Langue et littérature françaises – Létres et traduction  
 Langue et littérature françaises – Langue et traduction  
 Langue et littérature françaises – Langue française  
 Langue et littérature françaises – Théorie et critique littéraires  
 Geographical Information Systems – see Geography.  
 Geography  
 German Language – see German Studies  
 German Literature – see German Studies  
 German Literature and Culture in Translation – see German Studies.  
 Hispanic Languages – see Hispanic Studies.  
 History  
 History and Philosophy of Science  
 Humanistic Studies  
 International Development Studies  
 Italian Studies  
 Italian Civilization – see Italian Studies  
 Jewish Studies  
 Linguistics, Applied  
 Linguistics, Theoretical  
 Middle East Studies  
 Middle East Languages – see Middle East Studies.  
 Music  
 North American Studies  
 Philosophy  
 Political Science  
 Political Science: Canada/Québec  
 Comparative Politics – see Political Science.  
 International Relations – see Political Science.  
 Political Economy – see Political Science.  
 Politics, Law and Society – see Political Science.  
 South Asia – see Political Science.  
 Québec Studies  
 Religious Studies – World Religions  
 Religious Studies – Scriptural Languages  
 Russian – see Russian and Slavic Studies.  
 Russian Civilization – see Russian and Slavic Studies.  
 Social Studies of Medicine  
 Sociology  
 Spanish Literature and Culture – see Hispanic Studies.  
 Spanish-American Literature and Culture – see Hispanic Studies.  
 Women's Studies

## 12 Academic Programs

### 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](http://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.(Brist.), 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. Brawer; B.S.(Tufts), Ph.D.(Harv.)  
 M. 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*)  
 Charles E. Smith; D.D.S., Ph.D.(McG.) (*joint appoint. with  
 Dentistry*)

#### *Associate Professors*

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*)  
 Paul F. Lasko; A.B.(Harv.), Ph.D.(M.I.T) (*joint appoint. with  
 Biology*)  
 Martin Laterich; 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*)  
 Alfredo Riberio-da-Silva; M.D., Ph.D.(Oporto) (*joint appoint. with  
 Pharmacology and Therapeutics*)  
 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*

Chantel Autexier; B.Sc.(C'dia), Ph.D.(McG.)  
 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*)  
 Nathalie Lamarche; B.Sc., Ph.D.(Montr.)  
 Craig Mandato; B.Sc., Ph.D.(Wat.)  
 John F. Presley; B.A., Ph.D.(Texas)  
 Wayne Sossin; S.B.(M.I.T.), Ph.D.(Stan.) (*joint appoint. with  
 Neurology & Neurosurgery*)  
 Stefano Stifani; Ph.D.(Rome), Ph.D.(Alta.) (*joint appoint. with  
 Neurology & Neurosurgery*)  
 Gary E. Wild; B.Sc., Ph.D., M.D., C.M.(McG.) (*joint appoint. with  
 Medicine*)

#### *Associate Member*

David Y. Thomas (*Biochemistry*)

#### *Adjunct Professors*

Daniel Cyr; B.Sc., M.Sc.(C'dia), Ph.D.(Manit.)  
 Jacques Drouin; B.Sc., D.Sc.(Laval)  
 Sadayuki Inoue; M.Sc., Ph.D.(Hok. U.)  
 André Nantel; B.Sc., M.Sc.(Laval), Ph.D.(Chapel Hill)  
 Jackson G. Snipes; Ph.D., M.D.(Vanderbilt)

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 background 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.

### FACULTY PROGRAM IN ANATOMY AND CELL BIOLOGY

(57 credits)

[Changes to Complementary Courses under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

#### Required Courses (39 credits)

|             |     |  |
|-------------|-----|--|
| ANAT 212    | (3) | Molecular Mechanisms of Cell Function                      |
| ANAT 214    | (3) | Systemic Human Anatomy                                     |
| ANAT 261    | (4) | Introduction to Dynamic Histology<br>(must be taken in U1) |
| ANAT 262    | (3) | Introductory Molecular and Cell Biology                    |
| ANAT 321    | (3) | Circuitry of the Human Brain                               |
| BIOL 200    | (3) | Molecular Biology  |
| BIOL 202    | (3) | Basic Genetics   |
| CHEM 212*   | (4) | Introductory Organic Chemistry 1                           |
| CHEM 222*   | (4) | Introductory Organic Chemistry 2                           |
| PHGY 209    | (3) | Mammalian Physiology 1                                     |
| PHGY 210    | (3) | Mammalian Physiology 2                                     |
| MATH 203*   | (3) | Principles of Statistics 1                                 |
| or PSYC 204 | (3) | Introduction to Psychological Statistics                   |
| or BIOL 373 | (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:

|          |     |                                  |
|----------|-----|----------------------------------|
| ANAT 322 | (3) | Neuroendocrinology               |
| ANAT 365 | (3) | Cell Biology: Secretory Process  |
| ANAT 381 | (3) | Experimental Basis of Embryology |
| ANAT 458 | (3) | Membranes and Cellular Signaling |

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

BIOL 300, BIOL 301, BIOL 303, BIOL 306, BIOL 313, BIOL 314, BIOL 357, BIOL 370, BIOL 389, BIOL 468, BIOL 475, BIOL 516, BIOL 518, BIOL 520, BIOL 522, BIOL 524, BIOL 530, BIOL 531, BIOL 532, BIOL 551, BIOL 572, BIOL 588.

ANAT 322, ANAT 365, ANAT 381, ANAT 432, ANAT 541;

BIOC 311, BIOC 312, BIOC 450, BIOC 454, BIOC 455, BIOC 503.

BIOT 505.

EXMD 401, EXMD 502, EXMD 503, EXMD 504, EXMD 506, EXMD 507, EXMD 508, EXMD 509, EXMD 510, EXMD 511, EXMD 512D1/EXMD 512D2.

MIMM 314, MIMM 323, MIMM 324, MIMM 386D1/MIMM 386D2, MIMM 387, MIMM 413, MIMM 414, MIMM 465, MIMM 466, MIMM 509.

NEUR 310.

NUTR 307.

PATH 300.

PHAR 300, PHAR 301, PHAR 562, PHAR 563.

PHGY 311, PHGY 312, PHGY 313, PHGY 423, PHGY 444, PHGY 451, PHGY 502, PHGY 508, PHGY 513, PHGY 515, PHGY 516, PHGY 517, PHGY 518, PHGY 520, PHGY 531, PHGY 552, PHGY 556.

PSYT 500.

### MAJOR PROGRAM IN ANATOMY AND CELL BIOLOGY

(69 credits)

#### Required Courses (60 credits)

all Faculty Program required courses, plus:

|            |     |                                    |
|------------|-----|------------------------------------|
| ANAT 322   | (3) | Neuroendocrinology                 |
| ANAT 365   | (3) | Cell Biology: Secretory Process    |
| ANAT 381   | (3) | Experimental Basis of Embryology   |
| ANAT 458   | (3) | Membranes and Cellular Signaling   |
| BIOL 301   | (4) | Cell and Molecular Laboratory      |
| MIMM 314   | (3) | Immunology                         |
| PHGY 212D1 | (1) | Introductory Physiology Laboratory |
| PHGY 212D2 | (1) | Introductory Physiology Laboratory |

#### Complementary Courses (9 credits)

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

### HONOURS PROGRAM IN ANATOMY AND CELL BIOLOGY

(81 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 (78 credits)

all Major Program required courses, plus:

|          |     |                                      |
|----------|-----|--------------------------------------|
| ANAT 432 | (9) | Research Project: Anatomical Science |
| ANAT 541 | (3) | Cell and Molecular Biology of Aging  |
| BIOC 311 | (3) | Metabolic Biochemistry               |
| BIOC 312 | (3) | Biochemistry of Macromolecules       |

#### Complementary Courses (3 credits)

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

## 12.2 Atmospheric and Oceanic Sciences (ATOC)

Burnside Hall, Room 945  
805 Sherbrooke Street West  
Montreal, QC H3A 2K6

Telephone: (514) 398-3764

Fax: (514) 398-6115

E-mail: [undergraduateinfo.aos@mcgill.ca](mailto:undergraduateinfo.aos@mcgill.ca)

Website: [www.mcgill.ca/meteo](http://www.mcgill.ca/meteo)

*Chair* — Charles A. Lin

#### *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 Professor**

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*)

**Lecturer**

Alan P. Schwartz

**Adjunct Professors**

Gilbert Brunet, R.Grant Ingram, René Laprise, Stéphane Laroche

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 (for example 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" on page 165](#).

The following programs are also available with an Internship component:

- Major in Atmospheric Science
- Honours in Atmospheric Science

**MINOR PROGRAM IN ATMOSPHERIC SCIENCE (18 credits)**

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

**Required Courses (15 credits)**

|             |     |   |
|-------------|-----|---|
| ATOC 214    | (3) | Introduction: Physics of the Atmosphere |
| ATOC 215    | (3) | Weather Systems and Climate             |
| ATOC 219    | (3) | Introduction to Atmospheric Chemistry   |
| or CHEM 219 | (3) | Introduction to Atmospheric Chemistry   |
| ATOC 308    | (3) | Principles of Remote Sensing            |
| or GEOG 308 | (3) | Principles of Remote Sensing            |
| ATOC 315    | (3) | Water in the Atmosphere                 |

**Complementary Course (3 credits)**

|             |     |                             |
|-------------|-----|-----------------------------|
| ATOC 402    | (3) | Atmosphere-Ocean Transports |
| or ATOC 540 | (3) | Synoptic Meteorology 1      |

**MAJOR PROGRAM IN ATMOSPHERIC SCIENCE (61 credits)****Required Courses (49 credits)**

|             |     |   |
|-------------|-----|---|
| ATOC 214    | (3) | Introduction: Physics of the Atmosphere |
| ATOC 215    | (3) | Weather Systems and Climate             |
| ATOC 308    | (3) | Principles of Remote Sensing            |
| or GEOG 308 | (3) | Principles of Remote Sensing            |
| ATOC 315    | (3) | Water in the Atmosphere                 |
| ATOC 512    | (3) | Atmospheric and Oceanic Dynamics        |
| ATOC 513    | (3) | Waves and Stability                     |
| ATOC 540    | (3) | Synoptic Meteorology 1                  |
| ATOC 541    | (3) | Synoptic Meteorology 2                  |
| ATOC 546    | (1) | Current Weather Discussion              |
| COMP 208    | (3) | Computers in Engineering                |
| MATH 222    | (3) | Calculus 3                              |
| MATH 223    | (3) | Linear Algebra                          |
| MATH 314    | (3) | Advanced Calculus                       |
| MATH 315    | (3) | Ordinary Differential Equations         |
| PHYS 230    | (3) | Dynamics of Simple Systems              |
| PHYS 232    | (3) | Heat and Waves                          |
| PHYS 257    | (3) | Experimental Methods 1                  |

**Complementary Courses (12 credits)**

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

|              |     |                            |
|--------------|-----|----------------------------|
| MATH 203     | (3) | Principles of Statistics 1 |
| or MATH 323  | (3) | Probability Theory         |
| and MATH 324 | (3) | Statistics                 |

3 credits selected from:

|          |     |                                 |
|----------|-----|---------------------------------|
| PHYS 333 | (3) | Thermal and Statistical Physics |
| PHYS 340 | (3) | Electricity and Magnetism       |

3 - 6 credits ordinarily selected from:

|             |     |                                     |
|-------------|-----|-------------------------------------|
| ATOC 414    | (3) | Applications of Remote Sensing      |
| ATOC 419    | (3) | Advances in Chemistry of Atmosphere |
| or CHEM 419 | (3) | Advances in Chemistry of Atmosphere |
| ATOC 515    | (3) | Turbulence in Atmosphere and Oceans |
| GEOG 522    | (3) | Advanced Environmental Hydrology    |
| MATH 317    | (3) | Numerical Analysis                  |
| MATH 319    | (3) | Partial Differential Equations      |
| PHYS 241    | (3) | Signal Processing                   |
| PHYS 248    | (3) | Physics of Energy                   |
| PHYS 331    | (3) | Topics in Classical Mechanics       |
| PHYS 332    | (3) | Physics of Fluids                   |
| or MECH 331 | (3) | Fluid Mechanics 1                   |
| PHYS 340    | (3) | Electricity and Magnetism           |
| PHYS 342    | (3) | Electromagnetic Waves               |

**JOINT MAJOR PROGRAM IN ATMOSPHERIC SCIENCE AND PHYSICS (70 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 (67 credits)

|             |     |  |
|-------------|-----|--|
| ATOC 214    | (3) | Introduction: Physics of the Atmosphere    |
| ATOC 215    | (3) | Weather Systems and Climate                |
| ATOC 308    | (3) | Principles of Remote Sensing               |
| or GEOG 308 | (3) | Principles of Remote Sensing               |
| ATOC 315    | (3) | Water in the Atmosphere                    |
| ATOC 512    | (3) | Atmospheric and Oceanic Dynamics           |
| ATOC 513    | (3) | Waves and Stability                        |
| ATOC 540    | (3) | Synoptic Meteorology 1                     |
| ATOC 541    | (3) | Synoptic Meteorology 2                     |
| ATOC 546    | (1) | Current Weather Discussion                 |
| MATH 222    | (3) | Calculus 3                                 |
| MATH 223    | (3) | Linear Algebra                             |
| MATH 314    | (3) | Advanced Calculus                          |
| MATH 315    | (3) | Ordinary Differential Equations            |
| PHYS 230    | (3) | Dynamics of Simple Systems                 |
| PHYS 232    | (3) | Heat and Waves                             |
| PHYS 257    | (3) | Experimental Methods 1                     |
| PHYS 258    | (3) | Experimental Methods 2                     |
| PHYS 331    | (3) | Topics in Classical Mechanics              |
| PHYS 333    | (3) | Thermal and Statistical Physics            |
| PHYS 339    | (3) | Measurements Laboratory in General Physics |
| PHYS 340    | (3) | Electricity and Magnetism                  |
| PHYS 342    | (3) | Electromagnetic Waves                      |
| PHYS 446    | (3) | Quantum Physics                            |

#### Complementary Course (3 credits)

|             |     |                              |
|-------------|-----|------------------------------|
| PHYS 434    | (3) | Optics                       |
| or PHYS 439 | (3) | Laboratory in Modern Physics |

#### HONOURS PROGRAM 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 (58 credits)

|             |     |   |
|-------------|-----|---|
| ATOC 214    | (3) | Introduction: Physics of the Atmosphere |
| ATOC 215    | (3) | Weather Systems and Climate             |
| ATOC 308    | (3) | Principles of Remote Sensing            |
| or GEOG 308 | (3) | Principles of Remote Sensing            |
| ATOC 315    | (3) | Water in the Atmosphere                 |
| ATOC 480    | (3) | Honours Research Project                |
| ATOC 512    | (3) | Atmospheric and Oceanic Dynamics        |
| ATOC 513    | (3) | Waves and Stability                     |
| ATOC 530    | (3) | Climate Dynamics 1                      |
| ATOC 540    | (3) | Synoptic Meteorology 1                  |
| ATOC 541    | (3) | Synoptic Meteorology 2                  |
| ATOC 546    | (1) | Current Weather Discussion              |
| COMP 208    | (3) | Computers in Engineering                |
| MATH 222    | (3) | Calculus 3                              |
| MATH 223    | (3) | Linear Algebra                          |
| MATH 314    | (3) | Advanced Calculus                       |
| MATH 315    | (3) | Ordinary Differential Equations         |
| MATH 319    | (3) | Partial Differential Equations          |
| PHYS 230    | (3) | Dynamics of Simple Systems              |
| PHYS 232    | (3) | Heat and Waves                          |
| PHYS 257    | (3) | Experimental Methods 1                  |

#### Complementary Courses (12 credits)

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

|              |     |                            |
|--------------|-----|----------------------------|
| MATH 203     | (3) | Principles of Statistics 1 |
| or MATH 323  | (3) | Probability Theory         |
| and MATH 324 | (3) | Statistics                 |

3 credits selected from:

|          |     |                                 |
|----------|-----|---------------------------------|
| PHYS 333 | (3) | Thermal and Statistical Physics |
| PHYS 340 | (3) | Electricity and Magnetism       |

3-6 credits ordinarily selected from:

|             |     |                                     |
|-------------|-----|-------------------------------------|
| ATOC 414    | (3) | Applications of Remote Sensing      |
| ATOC 419    | (3) | Advances in Chemistry of Atmosphere |
| or CHEM 419 |     |                                     |
| ATOC 515    | (3) | Turbulence in Atmosphere and Oceans |
| GEOG 522    | (3) | Advanced Environmental Hydrology    |
| MATH 317    | (3) | Numerical Analysis                  |
| PHYS 241    | (3) | Signal Processing                   |
| PHYS 248    | (3) | Physics of Energy                   |
| PHYS 331    | (3) | Topics in Classical Mechanics       |
| PHYS 332    | (3) | Physics of Fluids                   |
| or MECH 331 | (3) | Fluid Mechanics 1                   |
| PHYS 340    | (3) | Electricity and Magnetism           |
| PHYS 342    | (3) | Electromagnetic Waves               |

#### 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)

|          |     |                                |
|----------|-----|--------------------------------|
| ATOC 512 | (3) | Atmospheric & Oceanic Dynamics |
| ATOC 513 | (3) | Waves and Stability            |
| ATOC 530 | (3) | Climate Dynamics 1             |
| ATOC 531 | (3) | Climate Dynamics 2             |
| ATOC 540 | (3) | Synoptic Meteorology 1         |
| ATOC 541 | (3) | Synoptic Meteorology 2         |

#### Complementary Courses (12 credits)

6 credits selected from:

|             |     |                                     |
|-------------|-----|-------------------------------------|
| ATOC 308    | (3) | Principles of Remote Sensing        |
| or GEOG 308 | (3) | Principles of Remote Sensing        |
| ATOC 315    | (3) | Water in the Atmosphere             |
| ATOC 414    | (3) | Applications of Remote Sensing      |
| ATOC 419    | (3) | Advances in Chemistry of Atmosphere |
| or CHEM 419 |     |                                     |

6 credits ordinarily selected from:

|             |     |                                     |
|-------------|-----|-------------------------------------|
| ATOC 515    | (3) | Turbulence in Atmosphere and Oceans |
| GEOG 522    | (3) | Advanced Environmental Hydrology    |
| MATH 317    | (3) | Numerical Analysis                  |
| MATH 319    | (3) | Partial Differential Equations      |
| PHYS 331    | (3) | Topics in Classical Mechanics       |
| PHYS 340    | (3) | Electricity and Magnetism           |
| PHYS 342    | (3) | Electromagnetic Waves               |
| PHYS 332    | (3) | Physics of Fluids                   |
| or MECH 331 | (3) | Fluid Mechanics 1                   |

## 12.3 Biochemistry (BIOC)

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

Telephone: (514) 398-7266

Fax: (514) 398-7384

E-mail: [maureen.caron@mcgill.ca](mailto:maureen.caron@mcgill.ca)

Website: [www.medicine.mcgill.ca/biochem](http://www.medicine.mcgill.ca/biochem)

Chair — David Y. Thomas

### Emeritus Professors

Angus F. Graham; B.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

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

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

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'neil.)

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. Silviu; 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 Professor

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

### Associate Members

Karine Auclair (*Chemistry*), John J. Bergeron (*Anatomy & Cell Biology*); Katherine Cianflone (*Exp. Medicine, RVH*);

Mark S. Featherstone (*Oncology*); William C. Galley (*Chemistry*);

Michael Hallett (*Computer Science*); Peter J. Roughley (*Shriners Hospital*);

Erwin Schurr (*Exp. Medicine, RVH*); Charles Scriver (*Pediatrics, MCH*);

Bernard Turcotte (*Exp. Medicine, RVH*); Simon Wing (*Medicine*); Xiang-Jiao Yang (*Molecular Oncology, RVH*)

### Adjunct Professors

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

Mirek Cygler (*B.R.I.*); Jacques Drouin (*Clin. Res. Inst.*);

Feng Ni (*B.R.I.*); Donald Nicholson (*Merck Frosst*);

Maureen D. O'Connor-McCourt (*B.R.I.*); Enrico Purisima (*B.R.I.*);

Sophie Roy (*Merck Frosst*); Andrew C. Storer (*B.R.I.*);

Marc Therrien (*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 post graduate 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. The rigorous training in chemistry, which distinguishes the Biochemistry program from Biological Sciences, can lead to admission to the Professional Order of Chemists – a requirement needed to function as a recognized chemist in the Province of Québec.

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, 8-9 credits in physics.

### ADVISERS

New students interested in Biochemistry should call (514) 398-7266 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.

### FACULTY PROGRAM IN BIOCHEMISTRY (55 credits)

#### U1 Required Courses (16 credits)

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

**U1 Complementary Courses** (9 credits)

6 credits selected from:

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

3 credits selected from:

|          |     |  |
|----------|-----|--|
| BIOL 373 | (3) | Biometry                                 |
| COMP 202 | (3) | Introduction to Computing 1              |
| MATH 222 | (3) | Calculus 3                               |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

**U2 Required Courses** (15 credits)

|            |     |                                  |
|------------|-----|----------------------------------|
| BIOC 300D1 | (3) | Laboratory in Biochemistry       |
| BIOC 300D2 | (3) | Laboratory in Biochemistry       |
| BIOC 311   | (3) | Metabolic Biochemistry           |
| BIOC 312   | (3) | Biochemistry of Macromolecules   |
| CHEM 302   | (3) | Introductory Organic Chemistry 3 |

**U2 Complementary Courses** (3 credits)

3 credits selected from:

|          |     |   |
|----------|-----|---|
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| BIOL 303 | (3) | Developmental Biology                   |
| BIOL 313 | (3) | Structure and Function of Cells         |
| CHEM 352 | (3) | Structural Organic Chemistry            |
| CHEM 382 | (3) | Organic Chemistry: Natural Products     |
| MIMM 314 | (3) | Immunology                              |

**U3 Complementary Courses** (12 credits)

at least 3 credits selected from:

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

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

|            |     |  |
|------------|-----|--|
| ANAT 261   | (4) | Introduction to Dynamic Histology        |
| BIOC 404   | (3) | Biophysical Chemistry                    |
| BIOC 455   | (3) | Neurochemistry                           |
| BIOC 458   | (3) | Membranes and Cellular Signaling         |
| BIOL 205   | (3) | Biology of Organisms                     |
| BIOL 300   | (3) | Molecular Biology of the Gene            |
| BIOL 303   | (3) | Developmental Biology                    |
| BIOL 304   | (3) | Evolution                                |
| BIOL 314   | (3) | Molecular Biology of Oncogenes           |
| CHEM 214   | (3) | Physical Chemistry/Biological Sciences 2 |
| CHEM 257D1 | (2) | Introductory Analytical Chemistry        |
| CHEM 257D2 | (2) | Introductory Analytical Chemistry        |
| CHEM 352   | (3) | Structural Organic Chemistry             |
| CHEM 362   | (2) | Advanced Organic Chemistry Laboratory    |
| CHEM 382   | (3) | Organic Chemistry: Natural Products      |
| CHEM 402   | (3) | Advanced Bio-organic Chemistry           |
| CHEM 572   | (3) | Synthetic Organic Chemistry              |
| MIMM 211   | (3) | Introductory Microbiology                |
| MIMM 314   | (3) | Immunology                               |
| PHAR 300   | (3) | Drug Action                              |
| PHAR 301   | (3) | Drugs and Disease                        |
| PHGY 209   | (3) | Mammalian Physiology 1                   |
| PHGY 210   | (3) | Mammalian Physiology 2                   |

**MAJOR PROGRAM 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)

|            |     |  |
|------------|-----|--|
| BIOC 212   | (3) | Molecular Mechanisms of Cell Function    |
| BIOL 200   | (3) | Molecular Biology                        |
| BIOL 202   | (3) | Basic Genetics                           |
| CHEM 204   | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 222   | (4) | Introductory Organic Chemistry 2         |
| CHEM 257D1 | (2) | Introductory Analytical Chemistry        |
| CHEM 257D2 | (2) | Introductory Analytical Chemistry        |

**U1 Complementary Courses** (9 credits)

6 credits, selected from:

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

3 credits selected from:

|          |     |  |
|----------|-----|--|
| BIOL 309 | (3) | Mathematical Models in Biology           |
| BIOL 373 | (3) | Biometry                                 |
| COMP 202 | (3) | Introduction to Computing 1              |
| MATH 203 | (3) | Principles of Statistics 1               |
| MATH 222 | (3) | Calculus 3                               |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

**U2 Required Courses** (23 credits)

all Faculty Program U2 Required Courses, plus:

|          |     |  |
|----------|-----|--|
| ANAT 262 | (3) | Introductory Molecular and Cell Biology  |
| CHEM 214 | (3) | Physical Chemistry/Biological Sciences 2 |
| CHEM 362 | (2) | Advanced Organic Chemistry Laboratory    |

**U2 Complementary Courses** (3 credits)

3 credits selected from:

|          |     |                                     |
|----------|-----|-------------------------------------|
| BIOL 303 | (3) | Developmental Biology               |
| BIOL 313 | (3) | Structure and Function of Cells     |
| CHEM 352 | (3) | Structural Organic Chemistry        |
| CHEM 382 | (3) | Organic Chemistry: Natural Products |
| MIMM 314 | (3) | Immunology                          |

**U3 Required Courses** (6 credits)

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

**U3 Complementary Courses** (6 or 9\* credits)

at least 3 credits selected from:

|           |     |                                   |
|-----------|-----|-----------------------------------|
| BIOC 404  | (3) | Biophysical Chemistry             |
| BIOC 455  | (3) | Neurochemistry                    |
| BIOC 458  | (3) | Membranes and Cellular Signalling |
| BIOC 460* | (6) | Advanced Lab in Biochemistry      |
| BIOC 503  | (3) | Immunochemistry                   |

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

|          |     |                                     |
|----------|-----|-------------------------------------|
| BIOL 300 | (3) | Molecular Biology of the Gene       |
| BIOL 303 | (3) | Developmental Biology               |
| BIOL 304 | (3) | Evolution                           |
| BIOL 313 | (3) | Structure and Function of Cells     |
| BIOL 314 | (3) | Molecular Biology of Oncogenes      |
| CHEM 352 | (3) | Structural Organic Chemistry        |
| CHEM 382 | (3) | Organic Chemistry: Natural Products |
| CHEM 402 | (3) | Advanced Bio-organic Chemistry      |
| CHEM 552 | (3) | Physical Organic Chemistry          |
| CHEM 572 | (3) | Synthetic Organic Chemistry         |
| EXMD 502 | (3) | Advanced Endocrinology              |
| EXMD 503 | (3) | Advanced Endocrinology              |
| MIMM 314 | (3) | Immunology                          |
| MIMM 324 | (3) | Fundamental Virology                |
| PHAR 300 | (3) | Drug Action                         |
| PHAR 301 | (3) | Drugs and Disease                   |
| PHGY 311 | (3) | Intermediate Physiology 1           |
| PHGY 312 | (3) | Intermediate Physiology 2           |

\* Students who are given special permission to take BIOC 460 are required to complete 9 credits of complementary courses in U3.

**HONOURS PROGRAM 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 BIOC 311 and BIOC 312 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)

|          |     |                                |
|----------|-----|--------------------------------|
| BIOC 404 | (3) | Biophysical Chemistry          |
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 454 | (3) | Nucleic Acids                  |
| BIOC 460 | (6) | Advanced Lab in Biochemistry   |

#### U3 Complementary Courses (6 credits)

at least 3 credits selected from:

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

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

|          |     |                                     |
|----------|-----|-------------------------------------|
| BIOL 300 | (3) | Molecular Biology of the Gene       |
| BIOL 303 | (3) | Developmental Biology               |
| BIOL 304 | (3) | Evolution                           |
| BIOL 313 | (3) | Structure and Function of Cells     |
| BIOL 314 | (3) | Molecular Biology of Oncogenes      |
| CHEM 352 | (3) | Structural Organic Chemistry        |
| CHEM 382 | (3) | Organic Chemistry: Natural Products |
| CHEM 402 | (3) | Advanced Bio-organic Chemistry      |
| CHEM 552 | (3) | Physical Organic Chemistry          |
| CHEM 572 | (3) | Synthetic Organic Chemistry         |
| EXMD 502 | (3) | Advanced Endocrinology              |
| EXMD 503 | (3) | Advanced Endocrinology              |
| MIMM 314 | (3) | Immunology                          |
| MIMM 324 | (3) | Fundamental Virology                |
| PHAR 300 | (3) | Drug Action                         |
| PHAR 301 | (3) | Drugs and Disease                   |
| PHGY 311 | (3) | Intermediate Physiology 1           |
| PHGY 312 | (3) | Intermediate Physiology 2           |

**INTERDEPARTMENTAL HONOURS PROGRAM IN IMMUNOLOGY**, see page 277. This program offered by the Departments of Biochemistry, Microbiology and Immunology, and Physiology.

## 12.4 Biology (BIOL)

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Montreal, QC H3A 1B1

Telephone: (514) 398-6400

Fax: (514) 398-5069

Website: [www.mcgill.ca/Biology/biology1.htm](http://www.mcgill.ca/Biology/biology1.htm)

Chair — Paul F. Lasko

#### Emeritus Professors

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'neil), 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. (*on leave*)

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.)

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.) (*on leave  
winter term*)

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

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

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

Joseph Rasmussen; B.Sc., M.Sc.(Alta.), Ph.D.(Calg.)

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)

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

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

Yutaka Nishioka; B.A., M.A.(Tokyo), Ph.D.(Col.)

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

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

Beat Suter; Dip., Ph.D.(Zür.) (*on leave*)

#### Assistant Professors

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

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

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

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

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

Kevin McCann; B.A.(Dart), M.Sc., Ph.D.(Guelph)

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

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

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

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

#### Associate Members

Allan Memorial Institute: Roberta Palmour

Biochemistry: David Y. Thomas

MGH: Sal Carbonetto, Pierre Drapeau, Guy Rouleau

MNI: Kenneth Hastings, Paul Holland

Neurology and Neurosurgery: Michael Ferns

Neuroscience: Robert Dunn

Paediatrics: David Rosenblatt, Charles R. Scriver,

Harriet S. Tenenhouse

RVH: Hugh J. Clarke, Teruko Taketo

Redpath Museum: David Green, Anthony Ricciardi

#### Adjunct Professors

DNA Landmarks: Wing Cheung, Benoit S. Landry

NRC Lab: Malcolm S. Whiteway

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

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 (BIOL 112) 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 post-graduate 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, post-doctoral 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 Tropic 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 2003-2004 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/biology1.htm](http://www.mcgill.ca/biology/biology1.htm) or for sale in the Biology Department, Room W4/8.

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

#### MINOR PROGRAM 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 (18 credits)

|          |     |                             |
|----------|-----|-----------------------------|
| BIOL 200 | (3) | Molecular Biology           |
| BIOL 201 | (3) | Cell Biology and Metabolism |
| BIOL 202 | (3) | Basic Genetics              |

|          |     |                         |
|----------|-----|-------------------------|
| BIOL 205 | (3) | Biology of Organisms    |
| BIOL 208 | (3) | Introduction to Ecology |
| BIOL 304 | (3) | Evolution               |

#### Complementary Courses (6 credits)

6 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 (18 credits)

|          |     |                             |
|----------|-----|-----------------------------|
| BIOL 200 | (3) | Molecular Biology           |
| BIOL 201 | (3) | Cell Biology and Metabolism |
| BIOL 202 | (3) | Basic Genetics              |
| BIOL 205 | (3) | Biology of Organisms        |
| BIOL 208 | (3) | Introduction to Ecology     |
| BIOL 304 | (3) | Evolution                   |

##### Complementary Courses (36 or 37 credits)

18 or 19 credits of Biology courses, including

3 or 4 credits selected from:

|          |     |                                 |
|----------|-----|---------------------------------|
| BIOL 206 | (3) | Methods in Biology of Organisms |
| BIOL 301 | (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 15 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)

##### Required Courses (21 credits)

|          |     |                                 |
|----------|-----|---------------------------------|
| COMP 202 | (3) | Introduction to Computing 1     |
| MATH 133 | (3) | Vectors, Matrices and Geometry  |
| MATH 222 | (3) | Calculus 3                      |
| MATH 223 | (3) | Linear Algebra                  |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 323 | (3) | Probability Theory              |
| MATH 324 | (3) | Statistics                      |

##### Complementary Courses (36 credits)

21 credits in Biology including

12 credits selected from:

|          |     |                                 |
|----------|-----|---------------------------------|
| BIOL 200 | (3) | Molecular Biology               |
| BIOL 201 | (3) | Cell Biology and Metabolism     |
| BIOL 202 | (3) | Basic Genetics                  |
| BIOL 205 | (3) | Biology of Organisms            |
| BIOL 206 | (3) | Methods in Biology of Organisms |
| BIOL 208 | (3) | Introduction to Ecology         |
| PHGY 209 | (3) | Mammalian Physiology 1          |
| PHGY 210 | (3) | Mammalian Physiology 2          |

and 9 credits selected from:

|          |     |                                  |
|----------|-----|----------------------------------|
| BIOL 303 | (3) | Developmental Biology            |
| BIOL 304 | (3) | Evolution                        |
| BIOL 306 | (3) | Neurobiology and Behaviour       |
| BIOL 307 | (3) | Behavioural Ecology/Sociobiology |
| BIOL 324 | (3) | Ecological Genetics              |
| BIOL 370 | (3) | Human Genetics Applied           |

BIOL 473 (3) Ecology of Aquatic Invertebrates  
 BIOL 520 (3) Gene Activity in Development  
 BIOL 530 (3) Neural Basis of Behaviour  
 BIOL 531 (3) Neurobiology Learning Memory  
 6 credits of any other Biological Sciences courses  
 9 credits of Mathematics  
 including at least 3 credits selected from:  
 BIOL 309 (3) Mathematical Models in Biology  
 PHYS 413 (3) Physical Basis of Physiology  
 and at least 3 credits selected from:  
 MATH 314 (3) Advanced Calculus  
 MATH 317 (3) Numerical Analysis  
 MATH 319 (3) Partial Differential Equations  
 MATH 327 (3) Matrix Numerical Analysis  
 MATH 407 (3) Dynamic Programming  
 MATH 423 (3) Regression and Analysis of Variance  
 MATH 447 (3) Stochastic Processes  
 MATH 525 (3) Sampling Theory and Applications  
 or other suitable mathematics courses chosen in consultation  
 with the adviser.

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

### MAJOR PROGRAM 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)

BIOL 200 (3) Molecular Biology  
 BIOL 201 (3) Cell Biology and Metabolism  
 BIOL 202 (3) Basic Genetics  
 BIOL 205 (3) Biology of Organisms  
 BIOL 206 (3) Methods in Biology of Organisms  
 BIOL 208 (3) Introduction to Ecology

#### U2 or U3 Required Courses (7 credits)

BIOL 301 (4) Cell and Molecular Laboratory  
 BIOL 304 (3) Evolution

#### U2 or U3 Complementary Courses (9 credits)

9 credits selected from:  
 BIOL 300 (3) Molecular Biology of the Gene  
 BIOL 303 (3) Developmental Biology  
 BIOL 305 (3) Diversity of Life  
 BIOL 306 (3) Neurobiology and Behaviour

#### 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 special-  
 ized training. They do not constitute sets of requirements. Stu-  
 dents interested in advanced studies in any biological discipline  
 are strongly advised to develop their skills in computing as appro-  
 priate. As an aid to students wishing to specialize, the concentra-  
 tions 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, communi-  
 cate, 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:

BIOL 305, BIOL 306, BIOL 307, BIOL 331 or BIOL 334 or another  
 field course with a significant behavioural component, BIOL 373.

#### Other suggested courses:

BIOL 377, BIOL 471D1/BIOL 471D2, BIOL 477, BIOL 478

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 WILD 420),  
 amphibians and reptiles (BIOL 327) and marine mammals  
 (BIOL 335) include a significant amount of behaviour.

#### Biological Diversity and Systematics

The study of biological diversity deals with the maintenance, emer-  
 gence, and history of the inexhaustible variety of different kinds of  
 organisms. It is deeply concerned with the particular characteris-  
 tics of different organisms and therefore emphasizes the detailed  
 study of particular groups and forms the basis of comparative biol-  
 ogy. 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. Apprecia-  
 tion 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:

BIOL 305

#### Other suggested courses:

BIOL 240, BIOL 324, BIOL 327, BIOL 331 or BIOL 334, BIOL 335,  
 BIOL 341, BIOL 350, BIOL 351, BIOL 352, BIOL 358, BIOL 373,  
 BIOL 465, BIOL 471D1/BIOL 471D2, BIOL 477 or BIOL 478,  
 BIOL 555, BIOL 560

#### Macdonald Campus:

PLNT 356, PLNT 451; ENTO 440; WILD 420; ZOOL 307,  
 ZOOL 312, ZOOL 313, ZOOL 316, ZOOL 424

#### Evolutionary Biology Concentration

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

#### Key courses:

BIOL 305, BIOL 307, BIOL 324, BIOL 331, BIOL 352,  
 BIOL 471D1/BIOL 471D2, BIOL 477 or BIOL 478, BIOL 555,  
 BIOL 570, BIOL 572

#### Other suggested courses in Organismal Biology:

BIOL 327, BIOL 335, BIOL 350, BIOL 351, BIOL 358, BIOL 373

#### Macdonald Campus: WILD 420

Genetics and Development: BIOL 300, BIOL 303

Ecology and Behaviour: BIOL 309, BIOL 341

#### Experimental Plant Biology Concentration

Research interests span modern molecular genetics, plant physi-  
 ology and biochemistry, plant ecology and genetics, plant morpho-  
 genesis, and the adaptation and evolution of plant form and  
 function. Research is carried out in the field and in the Depart-  
 ment'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:

BIOL 300, BIOL 303, BIOL 305, BIOL 358, BIOL 485

#### Other suggested courses:

BIOL 373, BIOL 465, BIOL 471D1/BIOL 471D2, BIOL 477,  
 BIOL 478, BIOL 526, BIOL 555

#### Human Genetics Concentration

The courses recommended for students interested in Human  
 Genetics are designed to offer a broad perspective in this rapidly  
 advancing area of biology. Genetics is covered at all levels of

organization (the gene, the chromosome, the cell, the organism and the population), using pertinent examples from all species, but with special emphasis on humans.

**Key courses:**

BIOL 301, BIOL 370, BIOL 373, BIOL 468, BIOL 475, BIOL 516 or BIOL 520

**Other suggested courses:**

BIOC 311; BIOL 314, BIOL 471D1/BIOL 471D2, BIOL 477, BIOL 478, BIOL 551; CHEM 222, CHEM 203 or CHEM 204 and CHEM 214; MIMM 314

**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:**

BIOL 313, BIOL 300, BIOL 301, BIOL 303, BIOL 373, BIOL 551; CHEM 222, CHEM 203 or CHEM 204 and CHEM 214

**Other suggested courses:**

BIOL 314, BIOL 471D1/BIOL 471D2, BIOL 477, BIOL 478, BIOL 516, BIOL 518, BIOL 520, BIOL 524 or BIOL 544

**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 discipline Neurobiology, 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:**

BIOL 306, BIOL 389, BIOL 530, BIOL 531, BIOL 532, BIOL 588

**Other suggested courses:**

ANAT 321, ANAT 322; BIOC 455; BIOL 300, BIOL 303, BIOL 373 or equivalent, BIOL 471D1/BIOL 471D2, BIOL 477, BIOL 478; NEUR 310; PHAR 562; PHGY 451, PHGY 520, PHGY 556; PSYC 311, PSYC 318, PSYC 342, PSYC 410, PSYC 422, PSYC 470; PSYT 500

**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 BIOL 331 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:**

BIOL 305, BIOL 331 or another field course, BIOL 373, BIOL 432, BIOL 441 or BIOL 442, BIOL 560; COMP 202 or COMP 273

**Other suggested courses:**

BIOL 307; GEOG 305, GEOG 306, GEOG 308, GEOG 332

**Macdonald Campus:**

ZOOL 315

**General and Applied Ecology Concentration**

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

**Key courses:**

BIOL 305, BIOL 331 or BIOL 334, BIOL 350, BIOL 373; COMP 202 or COMP 273

**Other suggested courses:**

BIOL 307, BIOL 324, BIOL 327, BIOL 345, BIOL 432, BIOL 441 or BIOL 442, BIOL 540; Geography GEOG 302

**Macdonald Campus:** PLNT 451; WILD 420

**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:**

ATOC 310; BIOL 305, BIOL 335, BIOL 351, BIOL 373, BIOL 441, BIOL 442

**Other suggested courses:**

ATOC 220, ATOC 512, ATOC 550, ATOC 551, ATOC 561; BIOL 331, BIOL 334, BIOL 432; EPSC 542

For students intending to proceed to graduate work, one independent studies course (BIOL 471D1/BIOL 471D2, BIOL 477 or BIOL 478) is recommended. Because of the importance of numerical analyses in all fields of Ecology, courses in Biometry (e.g. BIOL 373) and Computer Science (COMP 202 or COMP 273) are recommended.

**HONOURS PROGRAM 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 3.20 and approval of a 9 or 12-credit Independent Studies proposal (see listing of BIOL 479 and BIOL 480 for details). For an Honours degree, a minimum CGPA of 3.20 in the U3 year and adherence to the program as outlined below are the additional requirements.

**U1 Required Courses (18 credits)**

as for the Major program

**U2 and U3 Required Courses** (10 credits)

|          |     |                               |
|----------|-----|-------------------------------|
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 304 | (3) | Evolution                     |
| BIOL 373 | (3) | Biometry                      |

**U2 and U3 Complementary Courses** (27 credits)

9 credits selected from:

|          |     |                               |
|----------|-----|-------------------------------|
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 303 | (3) | Developmental Biology         |
| BIOL 305 | (3) | Diversity of Life             |
| BIOL 306 | (3) | Neurobiology and Behaviour    |

18 credits in Biology at the 300 level or higher

**U3 Required Courses** (13 or 16 credits)

either:

|            |       |                                |
|------------|-------|--------------------------------|
| BIOL 499D1 | (2)   | Honours Seminar in Biology     |
| BIOL 499D2 | (2)   | Honours Seminar in Biology     |
| BIOL 479D1 | (4.5) | Independent Studies in Biology |
| BIOL 479D2 | (4.5) | Independent Studies in Biology |

or:

|            |     |                                |
|------------|-----|--------------------------------|
| BIOL 480D1 | (6) | Independent Studies in Biology |
| BIOL 480D2 | (6) | Independent Studies in Biology |

**PANAMA FIELD STUDY SEMESTER**, see page 344 under the McGill School of Environment for details of the 15-credit interdisciplinary PFSS.

**AFRICAN FIELD STUDY SEMESTER**, see page 276 under Geography for details of the 15-credit interdisciplinary AFSS.

**Note: The AFSS will only be offered in 2003-04 pending approval by the Dean of Science.**

Also available is a **Minor Program in Computational Molecular Biology**, see page 270 under Computer Science.

## 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 Program 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 emphasises 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 PROGRAM IN BIOTECHNOLOGY** (24 credits)**PROGRAM FOR STUDENTS IN THE FACULTY OF SCIENCE\*****Required Courses** (15 credits)

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

|          |     |                                      |
|----------|-----|--------------------------------------|
| BIOT 505 | (3) | Selected Topics in Biotechnology     |
| CHEE 200 | (3) | Introduction to Chemical Engineering |
| CHEE 204 | (3) | Chemical Manufacturing Processes     |
| CHEE 474 | (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**

|          |                                     |
|----------|-------------------------------------|
| ANAT 541 | Cell and Molecular Biology of Aging |
| EXMD 504 | Biology of Cancer                   |
| PATH 300 | Human Disease                       |

**Chemistry**

|          |                                     |
|----------|-------------------------------------|
| CHEM 382 | Organic Chemistry: Natural Products |
| CHEM 402 | Advanced Bio-organic Chemistry      |
| CHEM 552 | Physical Organic Chemistry          |

**Immunology**

|          |                                   |
|----------|-----------------------------------|
| ANAT 261 | Introduction to Dynamic Histology |
| BIOC 503 | Immunochemistry                   |
| MIMM 314 | Immunology                        |
| MIMM 414 | Advanced Immunology               |
| PHGY 513 | Cellular Immunology               |

**Management\***

|          |  |
|----------|--|
| ECON 208 | Microeconomics Analysis and Applications |
| MGCR 211 | Introduction to Financial Accounting     |
| MGCR 341 | Finance 1                                |
| MGCR 352 | Marketing Management 1                   |
| MGCR 472 | Operations Management                    |

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

**Microbiology**

|          |                        |
|----------|------------------------|
| MIMM 323 | Microbial Physiology   |
| MIMM 324 | Fundamental Virology   |
| MIMM 413 | Parasitology           |
| MIMM 465 | Bacterial Pathogenesis |
| MIMM 466 | Viral Pathogenesis     |

**Molecular Biology (Biology)**

|          |                                |
|----------|--------------------------------|
| BIOL 300 | Molecular Biology of the Gene  |
| BIOL 314 | Molecular Biology of Oncogenes |
| BIOL 520 | Gene Activity in Development   |
| BIOL 551 | Molecular Biology: Cell Cycle  |
| BIOL 524 | Topics in Molecular Biology    |

**Molecular Biology (Biochemistry)**

|          |                                |
|----------|--------------------------------|
| BIOC 311 | Metabolic Biochemistry         |
| BIOC 312 | Biochemistry of Macromolecules |
| BIOC 450 | Protein Structure and Function |
| BIOC 454 | Nucleic Acids                  |
| BIOC 455 | Neurochemistry                 |

**Physiology**

|          |   |
|----------|---|
| EXMD 401 | Physiology and Biochemistry Endocrine Systems |
| EXMD 502 | Advanced Endocrinology                        |
| EXMD 503 | Advanced Endocrinology                        |
| PHAR 562 | General Pharmacology 1                        |
| PHAR 563 | General Pharmacology 2                        |
| PHGY 517 | Artificial Internal Organs                    |
| PHGY 518 | Artificial Cells                              |

**Plant Biology**

|          |                                 |
|----------|---------------------------------|
| BIOL 357 | Plant Physiology                |
| BIOL 526 | Plants and Extreme Environments |

**Pollution\***

|          |                                       |
|----------|---------------------------------------|
| CHEE 471 | Industrial Water Pollution Control    |
| CIVE 225 | Environmental Engineering             |
| CIVE 430 | Water Treatment and Pollution Control |
| CIVE 526 | Solid Waste Management                |
| CIVE 553 | Stream Pollution and Control          |

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

**General**

|          |                     |
|----------|---------------------|
| MIME 310 | Engineering Economy |
|----------|---------------------|

**12.6 Chemistry (CHEM)**

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

Website: [www.mcgill.ca/chemistry](http://www.mcgill.ca/chemistry)

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

Chair — R. Bruce Lennox

**Emeritus Professors**

Byung Chan Eu; B.Sc.(Seoul), Ph.D.(Brown)  
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*)  
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.)  
Ian S. Butler; B.Sc., Ph.D.(Brist.), F.C.I.C., C.Chem.,  
F.R.S.C.(U.K.)  
Tak-Hang Chan; B.Sc.(Tor.), M.A., Ph.D.(Prin.), F.C.I.C., F.R.S.C.  
(*Tomlinson Professor of Chemistry*)  
Masad J. Damha; B.Sc., Ph.D.(McG.)  
Adi Eisenberg; B.S.(Worcester Polytech.), M.A., Ph.D.(Prin.),  
F.C.I.C. (*Otto Maass Professor of Chemistry*)

Patrick G. Farrell; B.Sc., Ph.D., D.Sc.(Exe.)  
Denis F.R. Gilson; B.Sc.(Lond.), M.Sc., Ph.D.(U.B.C.), F.C.I.C.  
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*)  
Romas Kazlauskas; B.Sc.(Clev.St.), Ph.D.(M.I.T.)  
R. Bruce Lennox; B.Sc., M.Sc., Ph.D.(Tor.)  
Robert H. Marchessault; B.Sc.(Loyola), Ph.D.(McG.), D.Sc.  
(C'dia), F.R.S.C. (*E.B. Eddy Professor of Industrial Chemistry*)  
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.)

**Associate Professors**

Mark P. Andrews; B.Sc., M.Sc., Ph.D.(Tor.)  
Bruce Arndtsen; B.A.(Car.), 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; Ph.D.(Wat.)  
Joan F. Power; B.Sc., Ph.D.(C'dia)  
Linda Reven; B.A.(Car.), 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)  
Hanadi Sleiman; B.Sc.(A.U.B.), Ph.D.(Stan.)  
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*)  
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.  
Youla Tsantrizos; B.Sc., Ph.D.(McG.)  
Ivor Wharf; B.Sc., Ph.D.(Lond.), A.R.C.S., D.I.C.  
Robert Zamboni; B.Sc., Ph.D.(McG.)

**PAPRICAN Adjunct Professors**

Dimitris Argyropoulos; B.Sc.(South Bank Poly.), Ph.D.(McG.)  
Derek G. Gray; B.Sc.(Belf.), M.Sc., Ph.D.(Man.), F.C.I.C.  
R. St. John Manley; B.Sc., Ph.D.(McG.), D.Sc.(Uppsala)  
Theo G.M. van de Ven; Kand. Doc.(Utrecht), Ph.D.(McG.)

**Office for Chemistry and Society**

The Office for Chemistry 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 funda-

mental 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, nuclear, theoretical, radio- 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](http://www.mcgill.ca/chemistry/advising).

### PRE-PROGRAM REQUIREMENTS

Students entering from the Freshman program must have included CHEM 121/CHEM 111 or CHEM 120/CHEM 110, BIOL 111 or BIOL 112, MATH 140/MATH 141, PHYS 131/PHYS 142, 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 COMP 102 or COMP 202, will be required during U1 for students who have no previous introduction to computer *programming*. Students are required to contact their adviser on this matter. Completion of Mathematics MATH 222 and MATH 315 during U1 is strongly recommended. Physics PHYS 242 should be completed during U2.

### Chemistry Majors and Honours Programs

#### Required Courses (56 credits)

|            |       |   |
|------------|-------|---|
| CHEM 212*  | (4)   | Introductory Organic Chemistry 1        |
| CHEM 213   | (3)   | Introductory Physical Chemistry         |
| CHEM 222*  | (4)   | Introductory Organic Chemistry 2        |
| CHEM 273   | (1)   | Chemical Kinetics                       |
| CHEM 277D1 | (1.5) | Analytical Chemistry                    |
| CHEM 277D2 | (1.5) | Analytical Chemistry                    |
| CHEM 281   | (3)   | Inorganic Chemistry 1                   |
| CHEM 302   | (3)   | Introductory Organic Chemistry 3        |
| CHEM 345   | (3)   | Molecular Properties and Structure 3    |
| CHEM 355   | (3)   | Molecular Properties and Structure 2    |
| CHEM 363   | (2)   | Physical Chemistry Laboratory 1         |
| CHEM 365   | (2)   | Statistical Thermodynamics              |
| CHEM 367   | (3)   | Instrumental Analysis 1                 |
| CHEM 377   | (3)   | Instrumental Analysis 2                 |
| CHEM 381   | (3)   | Chemistry of Transition Elements        |
| CHEM 392   | (3)   | Integrated Inorganic/Organic Laboratory |
| CHEM 393   | (2)   | Physical Chemistry Laboratory 2         |
| MATH 133*  | (3)   | Vectors, Matrices and Geometry          |
| MATH 222*  | (3)   | Calculus 3                              |
| MATH 315   | (3)   | Ordinary Differential Equations         |
| PHYS 242   | (2)   | Electricity and Magnetism               |

\* asterisks denote courses with CEGEP equivalents

### HONOURS PROGRAM IN CHEMISTRY (74 credits)

#### Required Courses (56 credits)

56 credits as listed above

#### Complementary Courses (18 credits)

6 credits of research:

|              |     |                  |
|--------------|-----|------------------|
| CHEM 470     | (6) | Research Project |
| or CHEM 480  | (3) | Research Project |
| and CHEM 490 | (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

**Note:** 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 (78 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

The Bio-organic Option of Honours in Chemistry consists of the requirements for Honours in Chemistry with replacement of PHYS 242 by BIOL 200 and BIOL 201, and replacement of the 6 complementary credits of Chemistry at the 300 level with 6 credits chosen from the following: BIOL 202, BIOL 301, CHEM 402, MIMM 211, MIMM 314, MIMM 323, PHGY 201, PHGY 202, PHGY 209, PHGY 210.

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

### HONOURS IN CHEMISTRY: ENVIRONMENTAL CHEMISTRY OPTION (77 credits)

The Environmental Chemistry Option of Honours in Chemistry consists of the requirements for Honours in Chemistry with replacement of 6 complementary credits of Chemistry at the 300 level or higher and 6 credits at the 400 level or higher by CHEM 219, CHEM 307, CHEM 419 plus 6 credits chosen from the following: ATOC 220, CHEM 352, CHEM 575, CHEM 597, EPSC 542.

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

### HONOURS WITH MATERIALS OPTION (77 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

The Materials Option of Honours in Chemistry consists of the requirements for Honours in Chemistry with replacement of the 6 credits at the 300 level or higher and the 6 credits at the 400 level or higher by CHEM 455 and CHEM 531, plus 9 credits chosen from the following: CHEE 487, CHEM 543, CHEM 571, CHEM 585, MIME 260, MIME 367.

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

**JOINT HONOURS PROGRAM IN PHYSICS AND CHEMISTRY**, see page 291 under Physics.

**MAJOR PROGRAM 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)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

The Bio-organic Option of Major in Chemistry is the Honours program with Bio-Organic Option less the 6 credit Research Project and the 6 complementary credits at the 400 level or higher.

Attainment of the Major degree requires a CGPA of 2.00.

**MAJOR IN CHEMISTRY: ENVIRONMENTAL CHEMISTRY OPTION** (65 credits)

The Environmental Chemistry Option of Major in Chemistry is the 56 credits of Required Courses, to which are added CHEM 219, CHEM 307, CHEM 419.

Attainment of the Major degree requires a CGPA of 2.00.

**MAJOR WITH MATERIALS OPTION** (65 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

The Materials Option of Major in Chemistry is the 56 credits of Required Courses, to which are added CHEM 455, CHEM 531 plus 3 credits chosen from the following: CHEE 487, CHEM 543, CHEM 571, CHEM 585, MIME 260, MIME 367.

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 COMP 102 or COMP 202, will be required during U1 for students who have no previous introduction to computer programming.

**FACULTY PROGRAM IN CHEMISTRY** (52 credits)

CHEM 212, CHEM 222 or equivalent, CHEM 204 and CHEM 214, or CHEM 213 and CHEM 355, CHEM 201 or CHEM 281, CHEM 277, CHEM 301 or CHEM 381, CHEM 302, CHEM 345, CHEM 367 and CHEM 377; MATH 222, MATH 315; PHYS 242.

Nine additional credits from any of the following: CHEM 352, CHEM 355, CHEM 363, CHEM 382, CHEM 392, CHEM 393 and any 400-level courses in Chemistry for which the prerequisites are satisfied.

**FACULTY PROGRAM IN CHEMISTRY AND BIOLOGICAL SCIENCES** (55 credits)

BIOL 200 and BIOL 201, BIOL 205, BIOL 301, BIOL 304; CHEM 204, CHEM 214, CHEM 222, CHEM 257D1/ CHEM 257D2, CHEM 302, CHEM 352, CHEM 362, CHEM 382; PHGY 209, PHGY 210; PHYS 242. Plus 6 approved credits.

**FACULTY PROGRAM IN CHEMISTRY AND MATHEMATICS** (52 credits)

CHEM 204 and CHEM 214 or CHEM 213 and CHEM 365, CHEM 212, CHEM 222, CHEM 281, CHEM 277, CHEM 345, CHEM 355; MATH 222, MATH 223, MATH 314, MATH 315, MATH 317, MATH 319, MATH 323, MATH 324; PHYS 242.

**FACULTY PROGRAM IN MATHEMATICS, CHEMISTRY AND PHYSICS**, see page 281 under Mathematics and Statistics.

**MINOR PROGRAM IN CHEMISTRY** (18 credits)

A Minor in Chemistry which comprises 18 credits of chemistry courses taken at McGill, including CHEM 203, CHEM 212, CHEM 222, CHEM 281 and CHEM 257D1/CHEM 257D2. Substitutions for these by more advanced courses may be made at the discretion of the adviser.

**MINOR IN CHEMICAL ENGINEERING**

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.

The Minor requires 24 credits as follows: 7 credits in CHEE 200 and CHEE 204; at least one of CHEE 220 or CHEE 314; at least 13 credits from the following: MATH 314, CHEE 230, CHEE 315, CHEE 351, CHEE 370, CHEE 380, CHEE 438, CHEE 392 and 393, CHEE 452, CHEE 471, CHEE 472, CHEE 481, CHEE 487, and either CHEE 494 or CHEE 495.

**12.7 Cognitive Science**

*Program Director* — Professor James McGilvray

Website: [www.cogsci.mcgill.ca](http://www.cogsci.mcgill.ca)

Cognitive Science is the multi-disciplinary 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 PROGRAM IN COGNITIVE SCIENCE** (27 credits)

**Required Course** (3 credits)

PSYC 532 (3) Cognitive Science

**Complementary Courses** (24 credits)

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

*Computer Science*

COMP 424 (3) Topics: Artificial Intelligence 1

COMP 426 (3) Automated Reasoning

COMP 558 (3) Fundamentals of Computer Vision

*Educational Psychology*

EDPE 555 (3) Applied Cognitive Science

*Linguistics*

LING 331 (3) Phonology 1

LING 355 (3) Language Acquisition 1

LING 370 (3) Introduction to Semantics and Pragmatics

LING 371 (3) Syntax 1

LING 419 (3) Linguistic Theory 1

LING 440 (3) Morphology

LING 531 (3) Phonology 2

LING 555 (3) Language Acquisition 2

LING 571 (3) Syntax 2

LING 590 (3) Introduction to Neurolinguistics



**Mathematics**

- MATH 318 (3) Mathematical Logic  
 MATH 328 (3) Computability and Mathematical Linguistics

**Philosophy**

- PHIL 210 (3) Introduction to Deductive Logic 1  
 PHIL 304 (3) Chomsky  
 PHIL 306 (3) Philosophy of Mind  
 PHIL 310 (3) Intermediate Logic  
 PHIL 410 (3) Topics in Advanced Logic 1  
 PHIL 415 (3) Philosophy of Language  
 PHIL 419 (3) Epistemology  
 PHIL 506 (3) Seminar: Philosophy of Mind  
 PHIL 507 (3) Seminar: Cognitive Science

**Psychology**

- PSYC 311 (3) Human Cognition and the Brain  
 PSYC 314 (3) Thinking and Concepts  
 PSYC 334 (3) Computer Simulation - Psychological Processes  
 PSYC 335 (3) Formal Models: Psychological Processes  
 PSYC 343 (3) Language Acquisition in Children  
 PSYC 352 (3) Laboratory in Cognitive Psychology  
 PSYC 353 (3) Laboratory in Human Perception  
 PSYC 413 (3) Cognitive Development  
 PSYC 470 (3) Memory and Brain  
 PSYC 472 (3) Scientific Thinking and Reasoning

**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

E-mail: judy.kenigsberg@mcgill.ca

Website: [www.cs.mcgill.ca/acadpages/undergrad](http://www.cs.mcgill.ca/acadpages/undergrad)

*Director* — Denis Thérien

**Emeritus Professor**

Christopher Paige

**Professors**

- David M. Avis; B.Sc.(Wat.), Ph.D.(Stan.)  
 Luc P. Devroye; M.S.(Louvain), Ph.D.(Texas)  
 Komei Fukuda; M.Sc., Ph.D.(Admin.Eng., Keio), Ph.D.(Wat.)  
 Laurie Hendren; B.Sc., M.Sc.(Queen's), Ph.D.(Cornell) (*on leave 2003-04*)  
 Tim H. Merrett; B.Sc.(Queen's), D.Phil.(Oxon.)  
 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.) (*on leave 2003-04*)  
 Gerald F.G. Ratzler; B.Sc.(Glas.), M.Sc.(McG.)(*on leave 2003-04*)  
 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**

- Claude Crepeau; B.Sc., M.Sc.(Montr.) Ph.D.(M.I.T.)  
 Gregory Dudek; B.Sc.(Queen's), M.Sc., Ph.D.(Tor.)  
 Nathan Friedman; B.Sc., M.Sc.(Nanjing), Ph.D.(Tor.)  
 Kaleem Siddiqi; B.Sc.(Lafayette), M.Sc., Ph.D.(Brown)  
 Carl Tropper; B.Sc.(McG.), Ph.D.(Brooklyn Poly.)

**Assistant Professors**

- Mathieu Blanchette; B.A., M.Sc.(Montr.), Ph.D.(Wash.)  
 David Bryant; B.Sc., Ph.D.(U. of Canterbury)  
 Xiao-Wen Chang; B.Sc., M.Sc.(Nanjing), Ph.D.(McG.)  
 Karel Driesen; Licentiate, Masters (Free Brussels Univ.),  
 Ph.D.(U.C. Santa-Barbara)  
 Michael Trevor Hallett; B.Sc.(Queen's), Ph.D.(Victoria)  
 Bettina Kemme; B.Sc.(U. of Seville), M.Sc.(UC Santa Barbara),  
 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.C. Santa Barbara),  
 Ph.D.(McG.)  
 Muthucumar Maheswaran, B.Sc.(U. Peradeniya), M.Sc.,  
 Ph.D.(Purdue)  
 Doina Precup; B.Sc.(Tech. U. of Cluj-Napoca), M.Sc.,  
 Ph.D.(Mass.)  
 Hans Vangheluwe; B.Sc., M.Sc., Ph.D.(Ghent)  
 Clarke Verbrugge; B.A.(Queen's), Ph.D.(McG.)

**Faculty Lecturer**

Joseph Vybinal; M.Sc.(McG.)

**Associate Member**

Thomas Richard Shultz (*Psychology*)

**Adjunct Professors**

Stefan Brands, Renato De Mori, Khaled El Emam, Syed Hyder,  
 Keith Paton, Jean-Marc Robert, François Laviolette

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 seven dedicated laboratories for research in computational geometry and robotics, parallel processing, compilers, concurrent programming, software engineering, database systems, mobile robotics, and cellular automata.

The teaching facility consists of a network of over 140 Pentium III and IV workstations running FREEBSD, FreeBSD 4.6, Linux (Red Hat 8.0), and Windows 2000. The facility also includes several general compute engines including 3 SUN sparc20 servers, 2 SUN Ultrasparc and 2 SUN Enterprise 250s. Dialup access is provided through the Computing Centre along with PPP network connections. For introductory courses most work is completed using the Windows 2000 workstations and computer engines. All other courses use UNIX as a development environment.

The School of Computer Science offers a Majors program and an Honours program through the Faculty of Science, and a Minor program through the Faculties of Science and Engineering. The School also offers Major and Minor Concentrations through the Faculty of Arts. In conjunction with the Department of Mathematics and Statistics, the School offers a Joint Honours program, a Joint Majors program and two Faculty programs through the Faculty of Science. Special programs involving Computer Science are also available in the Faculties of Management, Engineering, and Music. For further details on programs outside the Faculty of Science, consult the other faculties' sections of this Calendar.

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

**Software Engineering Programs**

The School offers a B.Sc. **Major Program in Software Engineering**, see page 271.

The School, jointly with the Department of Electrical and Computer Engineering, offers a Bachelor of Software Engineering (B.S.E.) program. The B.S.E. is offered through the Faculty of Engineering and details can be found under the **Department of Electrical and Computer Engineering on page 175**.

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**" on page 186 in the Faculty of Engineering section.

**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**" on page 165.

The following programs are also available with an Internship component:

- Major in Computer Science
- Honours in Computer Science

**Admission to Computer Science and Software Engineering Programs is limited.**

Students intending to pursue a Major in Computer Science or Software Engineering should have a reasonable mathematical background and should have completed MATH 140 (or MATH 150), MATH 141 (or MATH 151) and MATH 133, 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 COMP 202. However, taking COMP 202 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](http://www.cs.mcgill.ca).

**MINOR PROGRAM IN COMPUTER SCIENCE** (24 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

The Computer Science Minor may be taken in conjunction with any program in the Faculties of Science and Engineering (with the exception of the other programs based on Computer Science) with the approval of the Adviser of the student's main program and the School of Computer Science. By the time of registration in the penultimate year, students must declare their intent to receive a Computer Science Minor and approval must be given by the School for the particular sequence of courses the student wishes to call the Computer Science Minor. 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)

- COMP 202 (3) Introduction to Computing 1
- COMP 203 (3) Introduction to Computing 2
- COMP 206 (3) Introduction to Software Systems
- COMP 302 (3) Programming Languages and Paradigms

**Complementary Courses** (12 credits)

selected from:

- COMP 251 (3) Data Structures and Algorithms
- COMP 273 (3) Introduction to Computer Systems
- COMP 303 (4) Programming Techniques
- COMP 304 (3) Object-oriented Design
- COMP 310 (3) Computer Systems and Organization
- COMP 330 (3) Theoretical Aspects: Computer Science
- COMP 335 (3) Software Engineering Methods
- COMP 350 (3) Numerical Computing
- or MATH 317 (3) Numerical Analysis
- COMP 360 (3) Algorithm Design Techniques
- COMP 409 (3) Concurrent Programming
- COMP 410 (3) Mobile Computing
- COMP 412 (3) Software for E-commerce
- COMP 420 (3) Files and Databases
- COMP 421 (3) Database Systems
- COMP 423 (3) Data Compression
- COMP 424 (3) Topics: Artificial Intelligence 1

- COMP 426 (3) Automated Reasoning
- COMP 433 (3) Personal Software Engineering
- COMP 435 (3) Basics of Computer Networks
- COMP 490 (3) Intro to Probabilistic Analysis Algorithms
- COMP 505 (3) Advanced Computer Architecture
- COMP 506 (3) Advanced Analysis of Algorithms
- COMP 507 (3) Computational Geometry
- COMP 520 (4) Compiler Design
- COMP 522 (4) Modelling and Simulation
- COMP 524 (3) Theoretical Foundations of Programming Languages

- COMP 526 (3) Probabilistic Reasoning and AI
- COMP 534 (3) Team Software Engineering
- COMP 535 (3) Computer Networks 1
- COMP 537 (3) Internet Programming
- COMP 538 (3) Person-Machine Communication
- COMP 540 (3) Matrix Computations
- COMP 557 (3) Computer Graphics
- COMP 558 (3) Fund. of Computer Vision
- COMP 560 (3) Graph Algorithms and Applications
- COMP 562 (3) Computational Biology Methods
- COMP 566 (3) Discrete Optimization 1
- COMP 567 (3) Discrete Optimization 2
- COMP 573 (3) Microcomputers
- COMP 575 (3) Fundamentals of Distributed Algorithms
- COMP 577 (3) Distributed Database Systems

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

**MINOR PROGRAM IN COMPUTATIONAL MOLECULAR BIOLOGY** (24 credits)

Computational molecular biology is the subdiscipline 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 to provide students with the necessary skills to build software tools from these algorithms.

**Required Courses** (21 credits)

- COMP 202 (3) Introduction to Computing 1
- COMP 203 (3) Introduction to Computing 2
- COMP 251 (3) Data Structures and Algorithms
- COMP 330 (3) Theoretical Aspects: Computer Science
- COMP 360 (3) Algorithm Design Techniques
- COMP 562 (3) Computational Biology Methods
- MATH 240 (3) Discrete Structures 1

**Complementary Course** (3 credits)

one of:

- COMP 350 (3) Numerical Computing
- COMP 421 (3) Database Systems
- COMP 424 (3) Topics: Artificial Intelligence 1
- COMP 522 (4) Modelling and Simulation
- COMP 526 (3) Probabilistic Reasoning and AI

**FACULTY PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE**, see page 280 under Mathematics and Statistics.

**FACULTY PROGRAM IN MATHEMATICS, STATISTICS AND COMPUTER SCIENCE**, see page 281 under Mathematics and Statistics.

**MAJOR PROGRAM IN COMPUTER SCIENCE** (60 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

Freshman Program students interested in Computer Science should try to take COMP 202 if possible, but it is not required for entry to the Major. A student entering with insufficient programming background may take COMP 202 but it will not count for program credit.

**Required Courses** (42 credits)

|          |     |                                       |
|----------|-----|---------------------------------------|
| COMP 250 | (3) | Introduction to Computer Science      |
| COMP 251 | (3) | Data Structures and Algorithms        |
| COMP 206 | (3) | Introduction to Software Systems      |
| COMP 273 | (3) | Introduction to Computer Systems      |
| COMP 302 | (3) | Programming Languages and Paradigms   |
| COMP 310 | (3) | Computer Systems and Organization     |
| COMP 330 | (3) | Theoretical Aspects: Computer Science |
| COMP 350 | (3) | Numerical Computing                   |
| COMP 360 | (3) | Algorithm Design Techniques           |
| MATH 222 | (3) | Calculus 3                            |
| MATH 223 | (3) | Linear Algebra                        |
| MATH 240 | (3) | Discrete Structures 1                 |
| MATH 323 | (3) | Probability Theory                    |
| MATH 340 | (3) | Abstract Algebra and Computing        |

**Complementary Courses** (18 credits)

15 credits from:

|          |     |  |
|----------|-----|--|
| COMP 303 | (4) | Programming Techniques                           |
| COMP 304 | (3) | Object-oriented Design                           |
| COMP 335 | (3) | Software Engineering Methods                     |
| COMP 361 | (3) | Systems Development Project                      |
| COMP 409 | (3) | Concurrent Programming                           |
| COMP 410 | (3) | Mobile Computing                                 |
| COMP 412 | (3) | Software for E-commerce                          |
| COMP 420 | (3) | Files and Databases                              |
| COMP 421 | (3) | Database Systems                                 |
| COMP 423 | (3) | Data Compression                                 |
| COMP 424 | (3) | Topics: Artificial Intelligence 1                |
| COMP 426 | (3) | Automated Reasoning                              |
| COMP 433 | (3) | Personal Software Engineering                    |
| COMP 435 | (3) | Basics of Computer Networks                      |
| COMP 490 | (3) | Intro to Probabilistic Analysis Algorithms       |
| COMP 505 | (3) | Advanced Computer Architecture                   |
| COMP 506 | (3) | Advanced Analysis of Algorithms                  |
| COMP 507 | (3) | Computational Geometry                           |
| COMP 520 | (4) | Compiler Design                                  |
| COMP 522 | (4) | Modelling and Simulation                         |
| COMP 524 | (3) | Theoretical Foundations of Programming Languages |
| COMP 525 | (3) | Formal Verification                              |
| COMP 526 | (3) | Probabilistic Reasoning and AI                   |
| COMP 531 | (3) | Theory of Computation                            |
| COMP 534 | (3) | Team Software Engineering                        |
| COMP 535 | (3) | Computer Networks 1                              |
| COMP 537 | (3) | Internet Programming                             |
| COMP 538 | (3) | Person-Machine Communication                     |
| COMP 540 | (3) | Matrix Computations                              |
| COMP 547 | (3) | Cryptography and Data Security                   |
| COMP 557 | (3) | Computer Graphics                                |
| COMP 558 | (3) | Fundamentals of Computer Vision                  |
| COMP 560 | (3) | Graph Algorithms and Applications                |
| COMP 562 | (3) | Computational Biology Methods                    |
| COMP 566 | (3) | Discrete Optimization 1                          |
| COMP 567 | (3) | Discrete Optimization 2                          |
| COMP 573 | (3) | Microcomputers                                   |
| COMP 575 | (3) | Fundamentals of Distributed Algorithms           |
| COMP 577 | (3) | Distributed Database Systems                     |
| ECSE 323 | (3) | Digital System Design                            |
| ECSE 426 | (3) | Microprocessor Systems                           |
| ECSE 531 | (3) | Real Time Systems                                |
| ECSE 548 | (3) | Introduction to VLSI Systems                     |

3 credits from Mathematics selected from:

|          |     |               |
|----------|-----|---------------|
| MATH 242 | (3) | Analysis 1    |
| MATH 243 | (3) | Real Analysis |
| MATH 255 | (3) | Analysis 2    |

or any 300-level or above Mathematics course  
(excluding MATH 338, MATH 323, MATH 340)**JOINT MAJOR PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE**, see page 282 under Mathematics and Statistics.**JOINT MAJOR PROGRAM IN PHYSICS AND COMPUTER SCIENCE**, see page 290 under Physics.**MAJOR PROGRAM IN SOFTWARE ENGINEERING** (72 credits)[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]**Required Courses** (63 credits)

|          |     |                                       |
|----------|-----|---------------------------------------|
| COMP 202 | (3) | Introduction to Computing 1           |
| COMP 206 | (3) | Introduction to Software Systems      |
| COMP 250 | (3) | Introduction to Computer Science      |
| COMP 251 | (3) | Data Structures and Algorithms        |
| COMP 273 | (3) | Introduction to Computer Systems      |
| COMP 302 | (3) | Programming Languages and Paradigms   |
| COMP 304 | (3) | Object-oriented Design                |
| COMP 330 | (3) | Theoretical Aspects: Computer Science |
| COMP 360 | (3) | Algorithm Design Techniques           |
| COMP 361 | (3) | Systems Development Project           |
| ECSE 221 | (3) | Introduction to Computer Engineering  |
| ECSE 321 | (3) | Introduction to Software Engineering  |
| ECSE 427 | (3) | Operating Systems                     |
| ECSE 428 | (3) | Software Engineering Practice         |
| ECSE 429 | (3) | Software Validation                   |
| ECSE 495 | (3) | Software Engineering Design Project   |
| MATH 223 | (3) | Linear Algebra                        |
| MATH 240 | (3) | Discrete Structures 1                 |
| MATH 260 | (3) | Intermediate Calculus                 |
| MATH 323 | (3) | Probability Theory                    |
| MATH 324 | (3) | Statistics                            |

**Complementary Courses** (9 credits)

selected from the following:

|          |     |  |
|----------|-----|--|
| COMP 303 | (4) | Programming Techniques                 |
| COMP 335 | (3) | Software Engineering Methods           |
| COMP 350 | (3) | Numerical Computing                    |
| COMP 409 | (3) | Concurrent Programming                 |
| COMP 410 | (3) | Mobile Computing                       |
| COMP 412 | (3) | Software for E-commerce                |
| COMP 420 | (3) | Files and Databases                    |
| COMP 421 | (3) | Database Systems                       |
| COMP 424 | (3) | Topics: Artificial Intelligence 1      |
| COMP 433 | (3) | Personal Software Engineering          |
| COMP 435 | (3) | Basics of Computer Networks            |
| COMP 505 | (3) | Advanced Computer Architecture         |
| COMP 520 | (4) | Compiler Design                        |
| COMP 522 | (4) | Modelling and Simulation               |
| COMP 525 | (3) | Formal Verification                    |
| COMP 526 | (3) | Probabilistic Reasoning and AI         |
| COMP 535 | (3) | Computer Networks 1                    |
| COMP 537 | (3) | Internet Programming                   |
| COMP 547 | (3) | Cryptography and Data Security         |
| COMP 558 | (3) | Fundamentals of Computer Vision        |
| COMP 560 | (3) | Graph Algorithms and Applications      |
| COMP 566 | (3) | Discrete Optimization 1                |
| COMP 575 | (3) | Fundamentals of Distributed Algorithms |
| COMP 577 | (3) | Distributed Database Systems           |
| ECSE 200 | (3) | Fundamentals of Electrical Engineering |
| ECSE 210 | (3) | Circuit Analysis                       |
| ECSE 291 | (2) | Electrical Measurement Laboratory      |
| ECSE 303 | (3) | Signals and Systems 1                  |
| ECSE 304 | (3) | Signals and Systems 2                  |
| ECSE 322 | (3) | Computer Engineering                   |
| ECSE 323 | (5) | Digital Systems Design                 |
| ECSE 404 | (3) | Control Systems                        |
| ECSE 411 | (3) | Communications Systems                 |
| ECSE 420 | (3) | Parallel Computing                     |
| ECSE 421 | (3) | Embedded Systems                       |

|             |     |  |
|-------------|-----|--|
| ECSE 422    | (3) | Fault Tolerant Computing               |
| ECSE 424    | (3) | Human-Computer Interaction             |
| ECSE 425    | (3) | Computer Organization and Architecture |
| ECSE 426    | (3) | Microprocessor Systems                 |
| or COMP 573 | (3) | Microcomputers                         |
| ECSE 504    | (3) | Computer Control                       |
| ECSE 522    | (3) | Asynchronous Circuits and Systems      |
| ECSE 526    | (3) | Artificial Intelligence                |
| ECSE 529    | (3) | Image Processing and Communication     |
| ECSE 530    | (3) | Logic Synthesis                        |
| ECSE 531    | (3) | Real Time Systems                      |
| ECSE 532    | (3) | Computer Graphics                      |
| or COMP 557 | (3) | Computer Graphics                      |
| MATH 261    | (3) | Differential Equations                 |
| MATH 381    | (3) | Complex Variables and Transforms       |

**HONOURS PROGRAM 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)**

|          |     |                                       |
|----------|-----|---------------------------------------|
| COMP 206 | (3) | Introduction to Software Systems      |
| COMP 250 | (3) | Introduction to Computer Science      |
| COMP 252 | (3) | Algorithms and Data Structures        |
| COMP 273 | (3) | Introduction to Computer Systems      |
| COMP 302 | (3) | Programming Languages and Paradigms   |
| COMP 310 | (3) | Computer Systems and Organization     |
| COMP 330 | (3) | Theoretical Aspects: Computer Science |
| COMP 350 | (3) | Numerical Computing                   |
| COMP 362 | (3) | Honours Algorithm Design              |
| COMP 400 | (3) | Technical Project and Report          |
| MATH 222 | (3) | Calculus 3                            |
| MATH 223 | (3) | Linear Algebra                        |
| MATH 240 | (3) | Discrete Structures 1                 |
| MATH 323 | (3) | Probability Theory                    |
| MATH 340 | (3) | Abstract Algebra and Computing        |

**Complementary Courses (27 credits)**

24 credits from Major Program in Computer Science complementary courses in Computer Science, 12 credits of which must be taken at the 500 level.

3 credits above the 300 level from Major Program in Computer Science complementary courses in Mathematics, which must be taken at the 300 level or above.

**JOINT HONOURS PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE**, see page 283 under Mathematics and Statistics. 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

**12.9 Earth and Planetary Sciences (EPSC)**

Frank Dawson Adams Building, Room 238  
 3450 University Street  
 Montreal, QC H3A 2A7

Telephone: (514) 398-6767

Fax: (514) 398-4680

E-mail: carol.matthews@mcgill.ca

Website: [www.eps.mcgill.ca](http://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.)

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.)

Bruce Hart; B.A.(McM.), M.Sc.(U.Q.à Rimouski), Ph.D.(W.Ont.)

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, A.E. Williams-Jones, Room 317, Frank Dawson Adams Building, (514) 398-1676, if they do not have an adviser.

#### MINOR PROGRAM IN EARTH AND PLANETARY SCIENCES (18 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

##### Required Courses (7 credits)

EPSC 210 (3) Introductory Mineralogy  
EPSC 212 (4) Introductory Petrology

##### Complementary Courses (11 credits)

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

8 credits selected from:

EPSC 203 (3) Structural Geology 1  
EPSC 231 (2) Field School 1  
EPSC 243 (3) Environmental Geology  
EPSC 334 (3) Invertebrate Palentology  
EPSC 350 (3) Tectonics  
EPSC 451 (3) Hydrothermal Mineral Deposits  
EPSC 452 (3) Mineral Deposits 2  
EPSC 542 (3) Chemical Oceanography  
BIOL 352 (3) Vertebrate Evolution

Other Earth and Planetary Sciences courses may be substituted with permission.

#### MINOR PROGRAM IN GEOCHEMISTRY (25 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

##### Required Courses (10 credits)

EPSC 201 (3) Understanding Planet Earth  
EPSC 210 (3) Introductory Mineralogy  
EPSC 212 (4) Introductory Petrology

##### Complementary Courses (15 credits)

15 credits selected from:

EPSC 220 (3) Principles of Geochemistry  
EPSC 243 (3) Environmental Geology  
EPSC 501 (3) Crystal Chemistry  
EPSC 519 (3) Isotope Geology  
EPSC 542 (3) Chemical Oceanography  
EPSC 545 (3) Low-Temperature Geochemistry

#### MAJOR PROGRAM IN EARTH AND PLANETARY SCIENCES (66 credits)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

Undergraduate Director: A.E. Williams-Jones, FDA 317,  
(514) 398-1676

##### U1 Required Courses (27 credits)

EPSC 203 (3) Structural Geology 1  
EPSC 210 (3) Introductory Mineralogy  
EPSC 212 (4) Introductory Petrology  
EPSC 220 (3) Principles of Geochemistry  
EPSC 231 (2) Field School 1  
EPSC 233 (3) Earth and Life History  
EPSC 312 (3) Spectroscopy of Minerals  
MATH 222 (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 MATH 133 Vectors, Matrices and Geometry.

##### U2 and/or U3 Required Courses (24 credits)

EPSC 320 (3) Elementary Earth Physics  
EPSC 334 (3) Invertebrate Paleontology  
EPSC 350 (3) Tectonics  
EPSC 423 (3) Igneous Petrology  
EPSC 445 (3) Metamorphic Petrology  
EPSC 452 (3) Mineral Deposits 2  
EPSC 455 (3) Sedimentary Geology  
EPSC 519 (3) Isotope Geology

##### Complementary Courses (15 credits)

3 credits, one of:

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

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

EPSC 330 (3) Earthquakes and Earth Structure  
EPSC 425 (3) Sediments to Sequences  
EPSC 435 (3) Geophysical Applications  
EPSC 451 (3) Hydrothermal Mineral Deposits  
EPSC 501 (3) Crystal Chemistry  
EPSC 530 (3) Volcanology  
EPSC 542 (3) Chemical Oceanography  
EPSC 547 (3) High Temperature Geochemistry  
EPSC 548 (3) Processes of Igneous Petrology  
EPSC 549 (3) Hydrogeology  
EPSC 550 (3) Selected Topics 1  
EPSC 551 (3) Selected Topics 2  
EPSC 552 (3) Selected Topics 3  
EPSC 570 (3) Cosmochemistry  
EPSC 580 (3) Aqueous Geochemistry  
EPSC 590 (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 PROGRAM IN EARTH SCIENCES (75 credits) (CGPA $\geq$ 3.20)

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

##### U1 Required Courses (27 credits)

EPSC 203 (3) Structural Geology 1  
EPSC 210 (3) Introductory Mineralogy  
EPSC 212 (4) Introductory Petrology  
EPSC 220 (3) Principles of Geochemistry  
EPSC 231 (2) Field School 1  
EPSC 233 (3) Earth and Life History  
EPSC 312 (3) Spectroscopy of Minerals  
MATH 222 (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 MATH 133 Vectors, Matrices and Geometry.

##### U2 and/or U3 Required Courses (33 credits)

EPSC 320 (3) Elementary Earth Physics  
EPSC 350 (3) Tectonics  
EPSC 423 (3) Igneous Petrology  
EPSC 445 (3) Metamorphic Petrology  
EPSC 452 (3) Mineral Deposits 2  
EPSC 455 (3) Sedimentary Geology  
EPSC 480D1 (3) Honours Research Project  
EPSC 480D2 (3) Honours Research Project  
EPSC 519 (3) Isotope Geology  
MATH 314 (3) Advanced Calculus  
MATH 315 (3) Ordinary Differential Equations

**Complementary Courses** (15 credits)

3 credits, one of:

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

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

- EPSC 330 (3) Earthquakes and Earth Structure  
 EPSC 334 (3) Invertebrate Paleontology  
 EPSC 425 (3) Sediments to Sequences  
 EPSC 435 (3) Geophysical Applications  
 EPSC 451 (3) Hydrothermal Mineral Deposits  
 EPSC 501 (3) Crystal Chemistry  
 EPSC 530 (3) Volcanology  
 EPSC 542 (3) Chemical Oceanography  
 EPSC 547 (3) High Temperature Geochemistry  
 EPSC 548 (3) Processes of Igneous Petrology  
 EPSC 549 (3) Hydrogeology  
 EPSC 550 (3) Selected Topics 1  
 EPSC 551 (3) Selected Topics 2  
 EPSC 552 (3) Selected Topics 3  
 EPSC 570 (3) Cosmochemistry  
 EPSC 580 (3) Aqueous Geochemistry  
 EPSC 590 (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 PROGRAM IN PLANETARY SCIENCES** (81 credits)CGPA  $\geq$  3.20

[Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

**U1 Required Courses** (27 credits)

- EPSC 203 (3) Structural Geology  
 EPSC 210 (3) Introductory Mineralogy  
 EPSC 212 (4) Introductory Petrology  
 EPSC 220 (3) Principles of Geochemistry  
 EPSC 231 (2) Field School 1  
 EPSC 233 (3) Earth and Life History  
 EPSC 312 (3) Spectroscopy of Minerals  
 MATH 222 (3) Calculus 3  
 MATH 223 (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 MATH 133 Vectors, Matrices and Geometry.

**U2 and/or U3 Required Courses** (42 credits)

- EPSC 320 (3) Elementary Earth Physics  
 EPSC 330 (3) Earthquakes and Earth Structure  
 EPSC 350 (3) Tectonics  
 EPSC 423 (3) Igneous Petrology  
 EPSC 480D1 (3) Honours Research Project  
 EPSC 480D2 (3) Honours Research Project  
 EPSC 510 (3) Geodynamics and Geomagnetism  
 EPSC 519 (3) Isotope Geology  
 EPSC 570 (3) Cosmochemistry  
 MATH 314 (3) Advanced Calculus  
 MATH 315 (3) Ordinary Differential Equations  
 MATH 317 (3) Numerical Analysis  
 MATH 319 (3) Partial Differential Equations  
 PHYS 340 (3) Electricity and Magnetism

**Complementary Courses** (12 credits)

3 credits, one of:

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

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

- EPSC 334 (3) Invertebrate Paleontology  
 EPSC 425 (3) Sediments to Sequences  
 EPSC 435 (3) Geophysical Applications  
 EPSC 451 (3) Hydrothermal Mineral Deposits

- EPSC 501 (3) Crystal Chemistry  
 EPSC 530 (3) Volcanology  
 EPSC 542 (3) Chemical Oceanography  
 EPSC 547 (3) High Temperature Geochemistry  
 EPSC 548 (3) Processes of Igneous Petrology  
 EPSC 549 (3) Hydrogeology  
 EPSC 550 (3) Selected Topics 1  
 EPSC 551 (3) Selected Topics 2  
 EPSC 552 (3) Selected Topics 3  
 EPSC 570 (3) Cosmochemistry  
 EPSC 580 (3) Aqueous Geochemistry  
 EPSC 590 (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 PROGRAM IN PHYSICS AND GEOPHYSICS**, see page 289 under Physics.

**12.10 Environment**

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

**12.11 Experimental Medicine (EXMD)**Website: [www.medcor.mcgill.ca/EXPMED/courses.html](http://www.medcor.mcgill.ca/EXPMED/courses.html)E-mail: [experimental.medicine@mcgill.ca](mailto:experimental.medicine@mcgill.ca)

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 Geography (GEOG)**

Burnside Hall, Room 705  
 805 Sherbrooke Street West  
 Montreal, QC H3A 2K6

Telephone: (514) 398-4951 or 398-4111

Fax: (514) 398-7437

Website: [www.geog.mcgill.ca](http://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.)

N.T. Roulet; B.Sc., M.Sc.(Trent), Ph.D.(McM.)

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.(Wis.)

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

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

J.E. Lewis; M.A.(Ind.), Ph.D.(Ill.)

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

L. Müller-Wille; Dr.phil.(Münster)

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

*Assistant Professors*

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), Ph.D.(S.Illinois)

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)

**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)" on page 78.**

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 analysing 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 and should consult the *Department of Geography Undergraduate Handbook*, which is available from the departmental office.

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.

**MINOR PROGRAM 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)

GEOG 203 (3) Environmental Systems  
GEOG 216 (3) Geography of the World Economy  
GEOG 217 (3) The Canadian City  
GEOG 302 (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)

GEOG 201 (3) Introductory Geo-Information Science  
GEOG 306 (3) Raster Geo-Information Science

GEOG 307 (3) Socioeconomic Applications of GIS  
GEOG 308 (3) Principles of Remote Sensing  
GEOG 506 (3) Perspectives on Geographic Information Analysis

#### Complementary Course (3 credits)

one course to be chosen from:

ATOC 414 (3) Applications of Remote Sensing  
COMP 420 (3) Files and Databases  
COMP 557\* (3) Computer Graphics  
GEOG 535 (3) Remote Sensing and Interpretation  
GEOG 551 (3) Environmental Decisions  
URBP 505 (3) Geographic Information Systems

\*Note prerequisites

#### B.Sc. MAJOR PROGRAM IN GEOGRAPHY (58 credits)

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

#### Required Courses (22 credits)

GEOG 201 (3) Introductory Geo-Information Science  
GEOG 203 (3) Environmental Systems  
GEOG 216 (3) Geography of the World Economy  
GEOG 217 (3) The Canadian City  
GEOG 272 (3) Earth's Changing Surface  
GEOG 302 (3) Environmental Management 1  
GEOG 351 (3) Quantitative Methods  
GEOG 290 (1) Local Geographical Excursion  
(In 2003 reserve Sept. 19-21)

#### Complementary Courses (36 credits)

3 credits of statistics\*, one of:

BIOL 373 (3) Biometry  
GEOG 202 (3) Statistics and Spatial Analysis  
MATH 203 (3) Principles of Statistics 1  
PSYC 204 (3) Introduction to Psychological Statistics  
SOC1 350 (3) Statistics in Social Research

\* Credit given for statistics courses is subject to certain restrictions, see Faculty Degree Requirements, [section 3.6.1 "Course Overlap"](#)

3 credits from GIS techniques:

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

12 credits from systematic physical geography:

GEOG 305 (3) Soils and Environment  
GEOG 321 (3) Climatic Environments  
GEOG 322 (3) Environmental Hydrology  
GEOG 350 (3) Ecological Biogeography  
GEOG 372 (3) Running Water Environments

3 credits from field courses:

GEOG 495 (3) Field Studies - Physical Geography  
GEOG 496 (3) Geographical Excursion  
GEOG 497 (3) Ecology of Coastal Waters  
GEOG 499 (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

GEOG 404 (3) Environmental Management 2  
GEOG 501 (3) Modelling Environmental Systems  
GEOG 505 (3) Global Biogeochemistry  
GEOG 506 (3) Perspectives on Geographic Information Analysis  
GEOG 522 (3) Advanced Environmental Hydrology

- GEOG 523 (3) Advanced Climatology  
 GEOG 535 (3) Remote Sensing and Interpretation  
 GEOG 536 (3) Geocryology  
 GEOG 537 (3) Advanced Fluvial Geomorphology  
 GEOG 550 (3) Quaternary Paleocology

### B.Sc. HONOURS PROGRAM 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.

#### Required Courses (24 credits)

- GEOG 201 (3) Introductory Geo-Information Science  
 GEOG 203 (3) Environmental Systems  
 GEOG 272 (3) Earth's Changing Surface  
 GEOG 302 (3) Environmental Management 1  
 GEOG 351 (3) Quantitative Methods  
 GEOG 381 (3) Geographic Thought and Practice  
 GEOG 491D1 (3) Honours Research  
 GEOG 491D2 (3) Honours Research

#### Complementary Courses (42 credits)

- 6 credits of introductory courses, two of:  
 GEOG 210 (3) Global Places and Peoples  
 GEOG 216 (3) Geography of the World Economy  
 GEOG 217 (3) The Canadian City

3 credits of statistics\*, one of:

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

\* Credit given for statistics courses is subject to certain restrictions, see Faculty Degree Requirements, [section 3.6.1 "Course Overlap"](#)

3 credits from GIS techniques:

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

12 credits from systematic physical geography:

- GEOG 305 (3) Soils and Environment  
 GEOG 321 (3) Climatic Environments  
 GEOG 322 (3) Environmental Hydrology  
 GEOG 350 (3) Ecological Biogeography  
 GEOG 372 (3) Running Water Environments

3 credits from field courses:

- GEOG 495 (3) Field Studies - Physical Geography  
 GEOG 496 (3) Geographical Excursion  
 GEOG 497 (3) Ecology of Coastal Waters  
 GEOG 499 (3) Subarctic Field Studies

15 credits from **approved** courses - in Geography, or elsewhere in the Faculty of Science or the Faculty of Engineering; at least 9 credits of which are to be taken outside Geography. Students may also include any courses that are not already counted towards the GIS techniques or the systematic physical geography requirements. Admission to 500-level courses in Geography requires the instructor's permission. It is not advisable to take more than one in a term.

### AFRICAN FIELD STUDY SEMESTER

**Note: The AFSS will only be offered in 2003-04 pending approval by the Dean of Science.**

The African Field Study Semester (AFSS) is a McGill University activity that has links with the Canadian Field Study in Africa Program (CFSIA). McGill students wishing to participate must apply and register through McGill for participation. Transfer credits for

anyone registering with other CFSIA affiliates will not be accepted at McGill.

The AFSS provides one term of integrated field study in East Africa, with emphasis on environmental conservation. Students investigate challenges of sustaining biological and cultural diversity in African environments subject to social change and development. Cultural and ecological variation is examined in highland, montane, rangeland, desert, riverine, salt and fresh water lake, coastal, and urban settings. Course offerings may vary from year to year, depending on participating staff.

The AFSS is intended for students in their final two years and constitutes a full 15-credit load credited towards McGill degrees. Students will be selected for entry to this program based on the following criteria: academic standing, CGPA of 3.0 or higher, reference letters, and the applicant's academic and career aims.

The semester is not a degree program, but credits can be counted toward other McGill degrees with the permission of program advisors.

The AFSS comprises 15 credits of field study courses. The two required courses (6 credits) in the natural and social sciences provide interdisciplinary academic context for field study. The 9 credits of complementary courses are taken from offerings in two thematic areas and Special Topics.

#### Required Courses (6 credits)

- ANTH 315 (3) Society/Culture: East Africa  
 NRSC 300 (3) Natural History: East Africa

#### Complementary Courses (9 credits)

3 - 9 credits from thematic areas:

- Area A - Biodiversity and conservation in Africa  
 BIOL 328 (3) Biological Diversity in Africa  
 NUTR 403\* (3) Nutrition in Society  
 WILD 420\* (3) Ornithology  
 WILD 421\* (3) Wildlife Conservation

\* Offered on a rotational basis, at least 3 credits annually

Area B - Environment and development in Africa

- ANTH 416 (3) Environment/Development Africa  
 GEOG 404\* (3) Environmental Management  
 GEOG 408\* (3) Geography of Development Policy

\* Offered on a rotational basis, at least 3 credits annually

0 - 6 credits, special topics

- AFRI 480 (3) Special Topics  
 AFRI 481 (3) Special Topics  
 ENVR 380 (3) Topics in Environment 1  
 ENVR 480 (3) Topics in Environment 2  
 INTD 490 (3) Development Field Research

Or other program Special Topics courses, with permission of instructor and an AFSS advisor.

With the permission of course instructors and AFSS advisors, up to 6 additional credits can be taken as Special Topics, allowing students to pursue tailor-made research topics or complementary courses offered by non-McGill university professors. Students may take Special Topics in the MSE, in African Studies, or in Development Studies, or in their home departments, with permission of the program advisor.

Enrolment of McGill students is limited to 25 students. In addition to the regular McGill fees, students will be required to pay the additional costs associated with delivering the courses in the field. These costs include airfare, local travel, all food and accommodation, special admission fees for parks and museums as well as other field costs. Airfares and currency fluctuations determine the amount of this charge. The 2003 trip cost \$14,000. The actual cost for 2004 will be determined by September 2003.

For the 2004 AFSS, students must submit, by April 1, 2003, a letter of intent, a CV, a copy of their transcript and two reference letters to June Connolly in the Geography Department office, Room 705, Burnside Hall. Further details are available on the Geography Department Website.

**BAY OF FUNDY FIELD STUDY SEMESTER**, see page 344 under the McGill School of Environment for details.



**PANAMA FIELD STUDY SEMESTER**, see page 344 under the McGill School of Environment for details.

**Geography courses of most interest to Science students:**

|            |   |
|------------|---|
| GEOG 199   | FYS: Geo-Environments                           |
| GEOG 201   | Introductory Geo-Information Science            |
| GEOG 203   | Environmental Systems                           |
| GEOG 205   | Global Change: Past, Present and Future         |
| GEOG 272   | Earth's Changing Surface                        |
| GEOG 290   | Local Geographical Excursion                    |
| GEOG 302   | Environmental Management 1                      |
| GEOG 305   | Soils and Environment                           |
| GEOG 306   | Raster Geo-Information Science                  |
| GEOG 308   | Principles of Remote Sensing                    |
| GEOG 321   | Climatic Environments                           |
| GEOG 322   | Environmental Hydrology                         |
| GEOG 350   | Ecological Biogeography                         |
| GEOG 351   | Quantitative Methods                            |
| GEOG 370   | Protected Areas                                 |
| GEOG 372   | Running Water Environments                      |
| GEOG 404   | Environmental Management 2                      |
| GEOG 490   | Geography: Independent Studies                  |
| GEOG 491D1 | Honours Research                                |
| GEOG 491D2 | Honours Research                                |
| GEOG 492D1 | Joint Honours Research                          |
| GEOG 492D2 | Joint Honours Research                          |
| GEOG 495   | Field Studies - Physical Geography              |
| GEOG 496   | Geographical Excursion                          |
| GEOG 497   | Ecology of Coastal Waters                       |
| GEOG 499   | Subarctic Field Studies                         |
| GEOG 501   | Modelling Environmental Systems                 |
| GEOG 505   | Global Biogeochemistry                          |
| GEOG 506   | Perspectives on Geographic Information Analysis |
| GEOG 522   | Advanced Environmental Hydrology                |
| GEOG 523   | Advanced Climatology                            |
| GEOG 535   | Remote Sensing and Interpretation               |
| GEOG 536   | Geocryology                                     |
| GEOG 537   | Advanced Fluvial Geomorphology                  |
| GEOG 550   | Quaternary Paleocology                          |

### 12.13 Immunology Interdepartmental Honours

The Honours Program in Immunology is offered by three Departments: Biochemistry, Microbiology and Immunology, and Physiology. The program is a demanding one which will prepare the student for graduate work in immunology.

All admissions to the Honours program will be after completion of the U1 year, and a student must have obtained a U1 GPA of 3.20. Admission to U3 requires a GPA of 3.20 in U2. Students who do not maintain Honours standing must transfer their registration to a program in one of three participating Departments.

For graduation in the Honours program, the student must complete a minimum of 90 credits, and achieve a CGPA of not less than 3.20. In addition, the five Immunology courses (BIOC 503, MIMM 314, MIMM 414, PHGY 419D1/PHGY 419D2, PHGY 513) must be passed with a grade not less than B.

U1 students who are interested in the program are advised to register in either the Faculty or Major program in Biochemistry or Physiology, or the Major program in Microbiology and Immunology. U1 students should inform their advisers of their intent to enter the Honours Immunology Program in U2.

Students wishing to enter the program must apply in writing by April 1 to:

Dr. M. Baines, Department of Microbiology and Immunology, Room 404, Lyman Duff Medical Sciences Building, 3775 University Street, Montreal, QC, H3A 2B4.  
Telephone (514) 398-4443 or (514) 398-3928;  
malcolm.baines@mcgill.ca

or Dr. W.S. Lapp, Department of Physiology, Room 1137, McIntyre Medical Sciences Building, 3655 Promenade Sir-

William-Osler, Montreal, QC, H3G 1Y6.  
Telephone (514) 398-4328 or (514) 398-4327;  
wayne.lapp@mcgill.ca

All candidates will be interviewed for admission if demand exceeds the number of available places. Enrolment is limited.

### INTERDEPARTMENTAL HONOURS PROGRAM IN IMMUNOLOGY (77 credits)

#### U1 Required Courses (20 credits)

|             |     |  |
|-------------|-----|--|
| BIOL 200    | (3) | Molecular Biology                        |
| BIOL 201    | (3) | Cell Biology and Metabolism              |
| or BIOC 212 | (3) | Molecular Mechanisms of Cell Function    |
| CHEM 212    | (4) | Introductory Organic Chemistry 1         |
| CHEM 222    | (4) | Introductory Organic Chemistry 2         |
| CHEM 203    | (3) | Survey of Physical Chemistry             |
| or CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| PHGY 209    | (3) | Mammalian Physiology 1                   |

#### U1, U2 or U3 Required Course (3 credits)

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

#### U1 Complementary Courses (6 credits)

Selected from:

|           |     |                                   |
|-----------|-----|-----------------------------------|
| ANAT 214  | (3) | Systematic Human Anatomy          |
| ANAT 261* | (4) | Introduction to Dynamic Histology |
| BIOL 202  | (3) | Basic Genetics                    |
| BIOL 205  | (3) | Biology of Organisms              |
| BIOL 304  | (3) | Evolution                         |
| MATH 204  | (3) | Principles of Statistics 2        |
| MIMM 211  | (3) | Introductory Microbiology         |
| MIMM 212  | (2) | Laboratory in Microbiology        |

\*students must take this course in U1 or U2

#### U2 Required Courses (15 credits)

|                |     |   |
|----------------|-----|---|
| BIOC 311       | (3) | Metabolic Biochemistry                    |
| BIOC 312       | (3) | Biochemistry of Macromolecules            |
| MIMM 314       | (3) | Immunology                                |
| BIOC 300D1     | (3) | Laboratory in Biochemistry                |
| and BIOC 300D2 | (3) | Laboratory in Biochemistry                |
| or MIMM 386D1  | (3) | Laboratory in Microbiology and Immunology |
| and MIMM 386D2 | (3) | Laboratory in Microbiology and Immunology |

#### U2 Complementary Courses (9 credits)

one of:

|          |     |                                   |
|----------|-----|-----------------------------------|
| ANAT 261 | (4) | Introduction to Dynamic Histology |
| MIMM 211 | (3) | Introductory Microbiology         |
| PHGY 210 | (3) | Mammalian Physiology 2            |

plus 6 credits selected from:

|             |     |                                  |
|-------------|-----|----------------------------------|
| BIOL 300    | (3) | Molecular Biology of the Gene    |
| BIOL 314    | (3) | Molecular Biology of Oncogenes   |
| CHEM 302    | (3) | Introductory Organic Chemistry 3 |
| MATH 222    | (3) | Calculus 3                       |
| MATH 315    | (3) | Ordinary Differential Equations  |
| or BIOL 309 | (3) | Mathematical Models in Biology   |
| MIMM 323    | (3) | Microbial Physiology             |
| MIMM 324    | (3) | Fundamental Virology             |
| PATH 300    | (3) | Human Disease                    |
| PHAR 300    | (3) | Drug Action                      |
| PHAR 301    | (3) | Drugs and Disease                |
| PHAR 303    | (3) | Principles of Toxicology         |
| PHGY 210    | (3) | Mammalian Physiology 2           |
| PHGY 311    | (3) | Intermediate Physiology 1        |
| PHGY 312    | (3) | Intermediate Physiology 2        |
| PHGY 313    | (3) | Intermediate Physiology 3        |

**U3 Required Courses** (18 credits)

|            |       |                                   |
|------------|-------|-----------------------------------|
| BIOC 503   | (3)   | Immunochemistry                   |
| MIMM 414   | (3)   | Advanced Immunology               |
| PHGY 419D1 | (4.5) | Project and Seminar in Immunology |
| PHGY 419D2 | (4.5) | Project and Seminar in Immunology |
| PHGY 513   | (3)   | Cellular Immunology               |

**U3 Complementary Courses** (6 credits)

6 credits selected from:

|             |     |                                   |
|-------------|-----|-----------------------------------|
| BIOL 520    | (3) | Gene Activity in Development      |
| BIOC 404    | (3) | Biophysical Chemistry             |
| BIOC 450    | (3) | Protein Structure and Function    |
| BIOC 454    | (3) | Nucleic Acids                     |
| BIOC 458    | (3) | Membranes and Cellular Signaling  |
| or ANAT 458 | (3) | Membranes and Cellular Signaling  |
| MIMM 413    | (3) | Parasitology                      |
| MIMM 465    | (3) | Bacterial Pathogenesis            |
| MIMM 466    | (3) | Viral Pathogenesis                |
| MIMM 509    | (3) | Inflammatory Processes            |
| PHAR 503    | (3) | Drug Design and Development 1     |
| PHAR 504    | (3) | Drug Design and Development 2     |
| PHGY 531    | (3) | Topics in Applied Immunology      |
| PHGY 552    | (3) | Cellular and Molecular Physiology |

**12.14 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**

(18 credits)

Program revisions are under consideration for September 2003. Go to [www.mcgill.ca](http://www.mcgill.ca) (Course Calendars) in July for details.]

**Required Courses** (9 credits)

|          |     |                                 |
|----------|-----|---------------------------------|
| EDKP 206 | (3) | Biomechanics of Human Movement  |
| EDKP 391 | (3) | Ergo-physiology                 |
| EDKP 492 | (3) | Psychology of Motor Performance |

**Complementary Courses** (9 credits)

three of the following courses:

|          |     |                                     |
|----------|-----|-------------------------------------|
| EDKP 261 | (3) | Motor Development                   |
| EDKP 330 | (3) | Physical Activity and Health        |
| EDKP 485 | (3) | Exercise: Chronic Health Conditions |
| EDKP 495 | (3) | Scientific Principles of Training   |
| EDKP 496 | (3) | Adapted Physical Activity           |
| EDKP 498 | (3) | Sport Psychology                    |
| EDKP 550 | (3) | Analyzing Instructional Behaviors   |
| EDKP 553 | (3) | Physiological Assessment: Sport     |
| EDKP 566 | (3) | Biomechanical Assessment in Sport   |

Note: Some courses have prerequisites, for details please refer to the Faculty of Education course listings.

**12.15 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](#), see page 300.

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 (MGCR 211) 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 176, 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 PROGRAM IN MANAGEMENT** (24 credits)**Required Courses** (9 credits)

|          |     |                                      |
|----------|-----|--------------------------------------|
| MGCR 211 | (3) | Introduction to Financial Accounting |
| MGCR 293 | (3) | Managerial Economics                 |
| MATH 203 | (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 MATH 203 but must take MATH 324 instead. (Note: Credit given for statistics courses is subject to certain restrictions, see Faculty Degree Requirements, [section 3.6.1 "Course Overlap"](#))

**Complementary Courses** (15 credits)

3 credits from:

|          |     |                                       |
|----------|-----|---------------------------------------|
| MGCR 213 | (3) | Introduction to Management Accounting |
| MGCR 341 | (3) | Finance 1                             |
| MGCR 382 | (3) | International Business                |

3 credits from:

|          |     |  |
|----------|-----|--|
| MGCR 222 | (3) | Introduction to Organizational Behaviour |
| MGCR 320 | (3) | Managing Human Resources                 |
| MGCR 352 | (3) | Marketing Management 1                   |

3 credits from:

|          |     |                            |
|----------|-----|----------------------------|
| MGCR 360 | (3) | Social Context of Business |
| MGCR 373 | (3) | Operations Research 1      |
| MGCR 423 | (3) | Organizational Policy      |

6 credits from:

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

**12.16 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](http://www.math.mcgill.ca)*Chair* — Kohur GowriSankaran*Emeritus Professors*

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

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.)

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

Henri Darmon; B.Sc.(McG.), Ph.D.(Harv.) (*Steacie Fellow*)

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

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

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

Niky Kamran; B.Sc., M.Sc.(Brussels), Ph.D.(Wat.) (*James McGill Professor*)

Olga Kharlampovich; M.A.(Ural State), Ph.D.(Leningrad),  
Dr. of Sc.(Steklov Institute)  
Alexei Miasnikov; M.S.c.(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<sup>e</sup> 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)  
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)  
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)  
Ravi Ramakrishna; B.A.(Cornell), Ph.D.(Princ.) (*Canada  
Research Chair*)  
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*)

#### Assistant Professors

Masoud Asgharian; B.Sc.(Shahid Beheshti), M.Sc., Ph.D.(McG.)  
Dave Bryant; B.Sc.Hons, Ph.D.(Canterbury) (*joint appoint. with  
Computer Science*)  
Martin J. Gander; M.S.(ETH), M.S., Ph.D.(Stan.)  
Dmitry Jakobson; B.Sc. (M.I.T.), Ph.D.(Princeton)(*William  
Dawson Scholar*)  
Dietmar Leisen; B.Sc.(Mainz), M.Sc., Ph.D.(Bonn) (*joint appoint.  
with Management*)  
Nilima Nigam; B.Sc.(I.I.T., Bombay), M.S., Ph.D.(Delaware)  
Russell Steele; B.S., M.S.,(Carnegie Mellon), Ph.D.(Wash.)  
Alain Vandal; B.Sc., M.Sc. (McGill), Ph.D.(Auckland)  
Daniel T. Wise; B.A.(Yeshiva), Ph.D.(Princ.)

#### Assistant Professor (Special Category)

Vera Rosta; M.Sc., Ph.D.(Lorand Eotvos, Budapest)

#### 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*)

#### Adjunct Professors

Donald A. Dawson; B.Sc., M.Sc.(McG.), Ph.D.(M.I.T.)  
Victor Havin; M.Sc., Ph.D.(Leningrad)  
M. Ram Murty; B.Sc.(Car.), Ph.D.(M.I.T.) F.R.S.C.  
Brian Rowley; B.Sc.(Wat.), M.Sc., Ph.D.(McG.)  
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 character-  
ized by its method of proof, its concern for a progressive broaden-  
ing 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 mathemat-  
ics and applied mathematics. The pure mathematician is inter-  
ested 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 technol-  
ogy, although many problems in pure mathematics have devel-  
oped from the sciences.

The applied mathematician is more interested in how mathe-  
matics can be used to study some aspects of the world. Mathe-  
maticians are engaged in the creation, study and application of  
advanced mathematical methods relevant to scientific problems.  
Statistical science and methodology today is concerned with phe-  
nomena in which there is a background of uncertainty arising from  
inherent variability and the investigator is obliged to arrive at deci-  
sions from limited data. A key tool in statistics is probability.

Some of the fields in which pure mathematicians work are alge-  
bra, 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 optimiza-  
tion, 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 univer-  
sities and research institutions. Employment is to be found in finan-  
cially 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 stu-  
dents 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 Mathe-  
matics Major, various combinations of courses are suggested to  
meet the needs of different students. These include course sug-  
gestions 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 stu-  
dents 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. Mathe-  
matics 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, manage-  
ment and psychology. Students should consider completing the  
requirements for Minor programs such as those available in Cog-  
nitive 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 Man-  
agement. 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 eli-  
gible students and normally taken between their U2 and U3 years.

For more information, see "IYES: Internship Year for Engineering and Science" on page 165.

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 MATH 222 (Calculus 3) as a required course and who have successfully completed a course equivalent to MATH 222 prior to coming to McGill are given exemption from taking MATH 222, but must replace it with a Complementary Mathematics course in the program of at least 3 credits.

#### MINOR PROGRAM 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 MATH 323. The remaining credits may be freely chosen from the required and complementary courses for Majors and Honours students in Mathematics, with the obvious exception of courses that involve duplication of material. Alternatively up to 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)

- MATH 222 (3) Calculus 3
- MATH 223\* (3) Linear Algebra
- MATH 315 (3) Ordinary Differential Equations

\*MATH 223 may be replaced by MATH 235 and MATH 236. 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 MATH 323 strongly recommended; alternatively up to 6 credits may be allowed for appropriate courses from other departments.

#### MINOR PROGRAM 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)

- MATH 222 (3) Calculus 3
- MATH 223\* (3) Linear Algebra
- MATH 323 (3) Probability Theory

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

\*MATH 223 may be replaced by MATH 235 and MATH 236. In this case the complementary credit requirement is reduced by three.

#### Complementary Courses (9 credits)

selected from:

- CHEM 593 (3) Statistical Mechanics
- GEOG 351 (3) Quantitative Methods
- MATH 447 (3) Stochastic Processes
- MATH 523 (4) Generalized Linear Models
- MATH 525 (4) Sampling Theory and Applications
- MATH 556 (4) Mathematical Statistics 1
- MATH 557 (4) Mathematical Statistics 2
- PHYS 362 (3) Statistical Mechanics
- PHYS 559 (3) Advanced Statistical Mechanics
- SOCI 504 (3) Quantitative Methods 1
- SOCI 505 (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**, see page 262 under Biology.

**FACULTY PROGRAM IN CHEMISTRY AND MATHEMATICS**, see page 268 under Chemistry.

#### FACULTY PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE (54 credits)

##### Required Courses (48 credits)

- COMP 202 (3) Introduction to Computing 1
- COMP 203 (3) Introduction to Computing 2
- COMP 206 (3) Introduction to Software Systems
- COMP 251 (3) Data Structures and Algorithms
- COMP 273 (3) Introduction to Computer Systems
- COMP 302 (3) Programming Languages and Paradigms
- COMP 310 (3) Computer Systems and Organization
- COMP 420 (3) Files and Databases
- COMP 530 (3) Formal Languages
- MATH 222 (3) Calculus 3
- MATH 223 (3) Linear Algebra
- MATH 315 (3) Ordinary Differential Equations
- MATH 317 (3) Numerical Analysis
- MATH 323 (3) Probability Theory
- MATH 324 (3) Statistics
- MATH 343 (3) Discrete Mathematics and Applied Algebra

##### Complementary Courses (6 credits)

selected from:

- MATH 240 (3) Discrete Structures 1
- MATH 314 (3) Advanced Calculus
- MATH 318 (3) Mathematical Logic
- MATH 327 (3) Matrix Numerical Analysis
- MATH 328 (3) Computability and Mathematical Linguistics
- MATH 407 (3) Dynamic Programming
- MATH 417 (3) Mathematical Programming

**FACULTY PROGRAM IN MATHEMATICS, STATISTICS AND COMPUTER SCIENCE** (54 credits)**Required Courses** (30 credits)

|          |     |                                     |
|----------|-----|-------------------------------------|
| COMP 202 | (3) | Introduction to Computing 1         |
| COMP 203 | (3) | Introduction to Computing 2         |
| COMP 206 | (3) | Introduction to Software Systems    |
| COMP 251 | (3) | Data Structures and Algorithms      |
| MATH 222 | (3) | Calculus 3                          |
| MATH 223 | (3) | Linear Algebra                      |
| MATH 315 | (3) | Ordinary Differential Equations     |
| MATH 323 | (3) | Probability Theory                  |
| MATH 324 | (3) | Statistics                          |
| MATH 423 | (3) | Regression and Analysis of Variance |

**Complementary Courses** (24 credits)

at least 6 credits selected from:

|          |     |  |
|----------|-----|--|
| MATH 314 | (3) | Advanced Calculus                          |
| MATH 317 | (3) | Numerical Analysis                         |
| MATH 318 | (3) | Mathematical Logic                         |
| MATH 319 | (3) | Partial Differential Equations             |
| MATH 327 | (3) | Matrix Numerical Analysis                  |
| MATH 328 | (3) | Computability and Mathematical Linguistics |
| MATH 343 | (3) | Discrete Mathematics and Applied Algebra   |
| MATH 407 | (3) | Dynamic Programming                        |
| MATH 417 | (3) | Mathematical Programming                   |

at least 6 credits in Statistics selected from:

|          |     |                                  |
|----------|-----|----------------------------------|
| MATH 329 | (3) | Theory of Interest               |
| MATH 447 | (3) | Stochastic Processes             |
| MATH 523 | (4) | Generalized Linear Models        |
| MATH 525 | (4) | Sampling Theory and Applications |

at least 6 credits in Computer Science selected from:

|          |     |                                     |
|----------|-----|-------------------------------------|
| COMP 273 | (3) | Introduction to Computer Systems    |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 310 | (3) | Computer Systems and Organization   |
| COMP 420 | (3) | Files and Databases                 |

**FACULTY PROGRAM IN MATHEMATICS, CHEMISTRY AND PHYSICS** (56 credits)**Required Courses** (47 credits)

|          |     |   |
|----------|-----|---|
| CHEM 201 | (3) | Modern Inorganic Chemistry 1<br>or CHEM 281 (3) Inorganic Chemistry 1                       |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1<br>or CHEM 213 (3) Introductory Physical Chemistry |
| CHEM 212 | (4) | Introductory Organic Chemistry 1  |
| CHEM 214 | (3) | Physical Chemistry/Biological Sciences 2  |
| CHEM 222 | (4) | Introductory Organic Chemistry 2  |
| MATH 222 | (3) | Calculus 3  |
| MATH 223 | (3) | Linear Algebra  |
| MATH 314 | (3) | Advanced Calculus   |
| MATH 315 | (3) | Ordinary Differential Equations   |
| MATH 319 | (3) | Partial Differential Equations  |
| PHYS 230 | (3) | Dynamics of Simple Systems  |
| PHYS 232 | (3) | Heat and Waves  |
| PHYS 241 | (3) | Signal Processing   |
| PHYS 340 | (3) | Electricity and Magnetism   |
| COMP 202 | (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 PROGRAM IN MATHEMATICS** (54 credits)

Students entering the Major program are normally expected to have completed MATH 133, MATH 140 and MATH 141 or their equivalents. Otherwise they will be required to make up any deficiencies in these courses over and above the 54 credits of required courses.

Major students who have done well in MATH 242 and MATH 235 are urged to consider, in consultation with their adviser

and the instructors concerned, entering the Honours stream by registering for MATH 251 and MATH 255.

**Guidelines for Selection of Courses in the Major Program**

The following informal guidelines should be discussed with the student's adviser. Where appropriate, Honours courses may be substituted for equivalent Major courses. Students planning to pursue graduate studies are encouraged to make such substitutions.

Students interested in computer science are advised to choose courses from the following MATH 317, MATH 318, MATH 327, MATH 328, MATH 343, MATH 407, MATH 417 and to complete the Computer Science Minor.

Students interested in probability and statistics are advised to take MATH 324, MATH 407, MATH 423, MATH 447, MATH 523, MATH 525.

Students interested in applied mathematics should take MATH 317, MATH 319, MATH 324, MATH 326, MATH 327, MATH 407, MATH 417.

Students considering a career in secondary school teaching are advised to take MATH 318, MATH 328, MATH 338, MATH 339, MATH 346, MATH 348.

Students interested in careers in business, industry or government are advised to select courses from the following list: MATH 317, MATH 319, MATH 327, MATH 329, MATH 330, MATH 407, MATH 417, MATH 423, MATH 447, MATH 523, MATH 525.

**Required Courses** (27 credits)

|          |     |   |
|----------|-----|---|
| MATH 222 | (3) | Calculus 3  |
| MATH 235 | (3) | Basic Algebra   |
| MATH 236 | (3) | Linear Algebra  |
| MATH 242 | (3) | Analysis 1  |
| MATH 243 | (3) | Real Analysis   |
| MATH 314 | (3) | Advanced Calculus   |
| MATH 315 | (3) | Ordinary Differential Equations                                       |
| MATH 316 | (3) | Functions of a Complex Variable<br>or MATH 249(3) Advanced Calculus 2 |
| MATH 323 | (3) | Probability Theory  |

**Complementary Courses** (27 credits)

21 credits selected from the following list, with

at least 6 credits selected from:

|          |     |  |
|----------|-----|--|
| MATH 317 | (3) | Numerical Analysis                       |
| MATH 324 | (3) | Statistics                               |
| MATH 343 | (3) | Discrete Mathematics and Applied Algebra |

the remainder of the 21 credits to be selected from:

|          |     |  |
|----------|-----|--|
| MATH 318 | (3) | Mathematical Logic                         |
| MATH 319 | (3) | Partial Differential Equations             |
| MATH 320 | (3) | Differential Geometry                      |
| MATH 326 | (3) | Nonlinear Dynamics and Chaos               |
| MATH 327 | (3) | Matrix Numerical Analysis                  |
| MATH 328 | (3) | Computability and Mathematical Linguistics |
| MATH 329 | (3) | Theory of Interest                         |
| MATH 338 | (3) | History and Philosophy of Mathematics      |
| MATH 339 | (3) | Foundations of Mathematics                 |
| MATH 346 | (3) | Number Theory                              |
| MATH 348 | (3) | Topics in Geometry                         |
| MATH 407 | (3) | Dynamic Programming                        |
| MATH 417 | (3) | Mathematical Programming                   |
| MATH 423 | (3) | Regression and Analysis of Variance        |
| MATH 447 | (3) | Stochastic Processes                       |
| MATH 523 | (4) | Generalized Linear Models                  |
| MATH 525 | (4) | Sampling Theory and Applications           |

6 additional credits in Mathematics or related disciplines selected in consultation with the adviser.

**JOINT MAJOR PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE** (72 credits)**Required courses** (48 credits)

|           |     |                                       |
|-----------|-----|---------------------------------------|
| COMP 206  | (3) | Introduction to Software Systems      |
| COMP 250* | (3) | Introduction to Computer Science      |
| COMP 251  | (3) | Data Structures and Algorithms        |
| COMP 273  | (3) | Introduction to Computer Systems      |
| COMP 302  | (3) | Programming Languages and Paradigms   |
| COMP 310  | (3) | Computer Systems and Organization     |
| COMP 330  | (3) | Theoretical Aspects: Computer Science |
| COMP 360  | (3) | Algorithm Design Techniques           |
| MATH 222  | (3) | Calculus 3                            |
| MATH 235  | (3) | Basic Algebra                         |
| MATH 236  | (3) | Linear Algebra                        |
| MATH 242  | (3) | Analysis 1                            |
| MATH 315  | (3) | Ordinary Differential Equations       |
| MATH 317  | (3) | Numerical Analysis                    |
| MATH 318  | (3) | Mathematical Logic                    |
| MATH 323  | (3) | Probability Theory                    |

\* Students with no basic knowledge of any high level programming language (e.g. Fortran, Basic, Pascal, C, C++, Java) may take COMP 202 and have it count as a complementary course in Computer Science.

**Complementary Courses** (24 credits)

12 credits from the set of courses recommended for a Major or Honours Program in Mathematics, excluding MATH 240 and MATH 340.

12 credits from the set of courses recommended for a Major or Honours Program in Computer Science.

**JOINT MAJOR PROGRAM IN PHYSIOLOGY AND MATHEMATICS**, see page 293 under Physiology.**HONOURS PROGRAMS**

The minimum requirement for entry into the Honours program is that the student has completed with high standing the following courses: MATH 133, MATH 140, MATH 141, or their equivalents. In addition, a student who has not completed the equivalent of MATH 222 must take it in the first term without receiving credits 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 PROGRAM IN MATHEMATICS** (60 credits)**Required Courses** (42 credits)

|          |     |                                 |
|----------|-----|---------------------------------|
| MATH 235 | (3) | Basic Algebra                   |
| MATH 242 | (3) | Analysis 1                      |
| MATH 248 | (3) | Advanced Calculus 1             |
| MATH 251 | (3) | Algebra 2                       |
| MATH 255 | (3) | Analysis 2                      |
| MATH 325 | (3) | Ordinary Differential Equations |
| MATH 354 | (3) | Analysis 3                      |
| MATH 355 | (3) | Analysis 4                      |
| MATH 356 | (3) | Probability                     |
| MATH 357 | (3) | Statistics                      |
| MATH 370 | (3) | Algebra 3                       |
| MATH 371 | (3) | Algebra 4                       |
| MATH 380 | (3) | Differential Geometry           |
| MATH 466 | (3) | Complex Analysis                |

**Complementary Courses** (18 credits)

|             |     |                                 |
|-------------|-----|---------------------------------|
| MATH 375    | (3) | Differential Equations          |
| or MATH 574 | (4) | Ordinary Differential Equations |

and 15 credits to be selected from the following:

COMP 250\* (3) Introduction to Computer Science

COMP 252 (3) Algorithms and Data Structures

\*COMP 250 may be preceded by COMP 202

further Honours Mathematics courses, of which MATH 470 is encouraged;

non-Honours Mathematics courses (other than MATH 242, MATH 235), for which no Honours equivalent exists (these count for half of their credits);

certain Honours level courses in other departments; with credit weight determined by the Department of Mathematics and Statistics.

**HONOURS PROGRAM IN APPLIED MATHEMATICS**

(68 credits)

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 diversity of areas in which applications can be found.

**Required Courses** (39 credits)

|             |     |                                  |
|-------------|-----|----------------------------------|
| COMP 252    | (3) | Algorithms and Data Structures   |
| COMP 250*   | (3) | Introduction to Computer Science |
| MATH 235    | (3) | Basic Algebra                    |
| MATH 242    | (3) | Analysis 1                       |
| MATH 248    | (3) | Advanced Calculus 1              |
| MATH 251    | (3) | Algebra 2                        |
| MATH 255    | (3) | Analysis 2                       |
| MATH 325    | (3) | Ordinary Differential Equations  |
| MATH 356    | (3) | Probability                      |
| MATH 357    | (3) | Statistics                       |
| MATH 375    | (3) | Differential Equations           |
| MATH 387    | (3) | Numerical Analysis               |
| MATH 466    | (3) | Complex Analysis                 |
| or MATH 249 | (3) | Advanced Calculus 2              |

\*COMP 250 may be preceded by COMP 202

**Complementary Courses** (29 credits)

at least 6 credits selected from:

|          |     |                       |
|----------|-----|-----------------------|
| MATH 354 | (3) | Analysis 3            |
| MATH 355 | (3) | Analysis 4            |
| MATH 370 | (3) | Algebra 3             |
| MATH 371 | (3) | Algebra 4             |
| MATH 380 | (3) | Differential Geometry |

at least 9 credits selected from:

|          |     |  |
|----------|-----|--|
| MATH 376 | (3) | Chaos and Nonlinear Dynamics           |
| MATH 397 | (3) | Matrix Numerical Analysis              |
| MATH 470 | (3) | Honours Project                        |
| MATH 487 | (3) | Mathematical Programming               |
| MATH 523 | (4) | Generalized Linear Models              |
| MATH 525 | (4) | Sampling Theory and Applications       |
| MATH 555 | (4) | Fluid Dynamics                         |
| MATH 556 | (4) | Mathematical Statistics 1              |
| MATH 557 | (4) | Mathematical Statistics 2              |
| MATH 560 | (4) | Optimization                           |
| MATH 561 | (4) | Analytical Mechanics                   |
| MATH 574 | (4) | Ordinary Differential Equations        |
| MATH 575 | (4) | Partial Differential Equations         |
| MATH 578 | (4) | Numerical Analysis 1                   |
| MATH 579 | (4) | Numerical Differential Equations       |
| MATH 585 | (4) | Integral Equations and Transforms      |
| MATH 586 | (4) | Applied Partial Differential Equations |

and the following, for which **half credit only** may be counted:

|          |     |                                     |
|----------|-----|-------------------------------------|
| MATH 407 | (3) | Dynamic Programming                 |
| MATH 423 | (3) | Regression and Analysis of Variance |
| MATH 447 | (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 6 credits must be chosen from a single department other than Computer Science.

### HONOURS PROGRAM IN PROBABILITY AND STATISTICS (63 credits)

All Honours students are encouraged to take MATH 325, MATH 387, MATH 423 and MATH 447.

Students primarily interested in probability should include courses MATH 325, MATH 375 and MATH 447 in their program.

Students primarily interested in statistics should include MATH 423, MATH 447, MATH 523, MATH 524 and MATH 525 in their program.

#### Required Courses (46 credits)

|             |     |                                  |
|-------------|-----|----------------------------------|
| COMP 250*   | (3) | Introduction to Computer Science |
| MATH 235    | (3) | Basic Algebra                    |
| MATH 242    | (3) | Analysis 1                       |
| MATH 248    | (3) | Advanced Calculus 1              |
| MATH 249    | (3) | Advanced Calculus 2              |
| or MATH 466 | (3) | Complex Analysis                 |
| MATH 251    | (3) | Algebra 2                        |
| MATH 255    | (3) | Analysis 2                       |
| MATH 354    | (3) | Analysis 3                       |
| MATH 356    | (3) | Probability                      |
| MATH 357    | (3) | Statistics                       |
| MATH 556    | (4) | Mathematical Statistics 1        |
| MATH 557    | (4) | Mathematical Statistics 2        |
| MATH 587    | (4) | Advanced Probability Theory 1    |
| MATH 589    | (4) | Advanced Probability Theory 2    |

\*COMP 250 may be preceded by COMP 202

#### Complementary Courses (17 credits)

selected from:

|          |     |                                  |
|----------|-----|----------------------------------|
| MATH 325 | (3) | Ordinary Differential Equations  |
| MATH 355 | (3) | Analysis 4                       |
| MATH 375 | (3) | Differential Equations           |
| MATH 387 | (3) | Numerical Analysis               |
| MATH 397 | (3) | Matrix Numerical Analysis        |
| MATH 470 | (3) | Honours Project                  |
| MATH 523 | (4) | Generalized Linear Models        |
| MATH 524 | (4) | Nonparametric Statistics         |
| MATH 525 | (4) | Sampling Theory and Applications |

and the following, for which **half credit only** may be counted:

|          |     |                                     |
|----------|-----|-------------------------------------|
| MATH 423 | (3) | Regression and Analysis of Variance |
| MATH 447 | (3) | Stochastic Processes                |

### JOINT HONOURS PROGRAM IN MATHEMATICS AND COMPUTER SCIENCE (72 credits)

Students must consult an Honours adviser in both departments.

#### Required Courses (39 credits)

|           |     |                                       |
|-----------|-----|---------------------------------------|
| COMP 206  | (3) | Introduction to Software Systems      |
| COMP 250* | (3) | Introduction to Computer Science      |
| COMP 252  | (3) | Algorithms and Data Structures        |
| COMP 273  | (3) | Introduction to Computer Systems      |
| COMP 302  | (3) | Programming Languages and Paradigms   |
| COMP 310  | (3) | Computer Systems and Organization     |
| COMP 330  | (3) | Theoretical Aspects: Computer Science |
| COMP 362  | (3) | Honours Algorithm Design              |
| MATH 235  | (3) | Basic Algebra                         |
| MATH 242  | (3) | Analysis 1                            |
| MATH 248  | (3) | Advanced Calculus 1                   |
| MATH 251  | (3) | Algebra 2                             |
| MATH 255  | (3) | Analysis 2                            |

\* Students with no basic knowledge of any high level programming language (e.g. Fortran, Basic, Pascal, C, C++, Java) are advised to take COMP 202 before COMP 250. In this case COMP 202 counts as an elective.

#### Complementary Courses (33 credits)

21 credits in Mathematics,

at least 12 credits selected from:

|           |     |                    |
|-----------|-----|--------------------|
| MATH 354  | (3) | Analysis 3         |
| MATH 355  | (3) | Analysis 4         |
| MATH 356* | (3) | Probability        |
| MATH 370  | (3) | Algebra 3          |
| MATH 371  | (3) | Algebra 4          |
| MATH 387  | (3) | 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 MATH 587 for MATH 356 and must then also register for MATH 355.

12 credits in Computer Science, selected from:

|          |     |                              |
|----------|-----|------------------------------|
| COMP 303 | (4) | Programming Techniques       |
| COMP 304 | (3) | Object-Oriented Design       |
| COMP 335 | (3) | Software Engineering Methods |

400-level and 500-level Computer Science courses with the exception of COMP 431.

**JOINT HONOURS PROGRAM IN MATHEMATICS AND PHYSICS**, see page 290 under Physics.

### 12.17 Microbiology and Immunology (MIMM)

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*Chair* — Greg J. Matlashewski

*Emeritus Professor*

Eddie C.S. Chan; M.A.(Texas), Ph.D.(Maryland)

*Professors*

Nicholas H. Acheson; A.B.(Harv.), Ph.D.(Rockefeller)  
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.)  
Michael S. Dubow, B.Sc.(SUNY), M.A., Ph.D.(Ind.)  
John Hiscott; B.Sc., M.Sc.(W.Ont.), Ph.D.(N.Y.)  
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.)  
Greg J. Matlashewski; B.Sc.(C'dia), Ph.D.(Ott.)

*Assistant Professors*

Benoit Cousineau; B.Sc., M.Sc., Ph.D.(Montr.)  
Sylvie Fournier; Ph.D.(Montr.)  
Anne Gatignol; M.Sc., Ph.D.(Toulouse)  
Hervé Le Moual; Ph.D.(Montr.)  
Gregory T. Marczynski; B.Sc., Ph.D.(Illinois)  
Andrew Moulard; Ph.D.(McG.)  
Martin Olivier; B.Sc.(Montr.), Ph.D.(McG.)

*Associate Members*

Institute of Parasitology: Gaeton Faubert, Armando Jardim,  
Paula Ribeiro, Terence Spithill  
Division of Experimental Medicine: Clement Couture  
Microbiology & Immunology: Lawrence Kleiman  
Medicine: Marcel Behr, Andre Dascal, Sabah Hussain,  
Vivian Loo, J. Dick Maclean, Jack Mendelson, Mark A. Miller,

Marianna Newkirk, Roger G.E. Palfree, Kostas Pantopoulos,  
 Joyce E. Rauch, Bernard Turcotte, Brian J. Ward  
 Neuroimmunology: Amit Bar-Or  
 Neurology & Neurosurgery: Jack Antel  
 Pathology: Gerard Prud'homme  
 Oncology: Matthias Gotte, Antonis E. Koromilas,  
 Stephane Richard  
 Surgery: Nicholas V. Christou, A. Robin Poole

#### Adjunct Professors

Vibhuti Dave; M.Sc., Ph.D.(Bombay)  
 Albert Descoteaux; B.Sc., M.Sc.(Montr.), Ph.D.(McG.)  
 Patrick Hugo; B.Sc., M.Sc., Ph.D.(McG.)  
 George Kukolj; B.Sc., Ph.D.(McG.)  
 Peter Lau; Ph.D.(Ottawa)  
 Clement Rioux; B.Sc., M.Sc.(Laval), Ph.D.(Guelph)  
 Rafick-P. Sekaly; B.A.(Stanislas), B.Sc., M.Sc.(Montr.),  
 Ph.D.(Lausanne)

#### Affiliated Centre:

Centre for Host Resistance, Montreal General Hospital,  
 1650 Cedar Avenue, Montreal, QC H3G 1A4  
 Telephone: (514) 398-8038. Director: E. Skamane

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 transplants, allergies, cancer, autoimmune diseases and immune-deficiency diseases such as AIDS. Antibodies may soon be used in conjunction with antibiotics or chemical agents as specific "magic bullets" to diagnose disease and attack microbes and cancers.

The disciplines of microbiology and immunology are natural partners in research, and both fields use the modern methods of cell biology, molecular biology and genetics to study basic life processes. The members of the Department of Microbiology and Immunology perform research on microbial physiology and genetics, microbial pathogenesis, molecular virology, cellular and molecular immunology, and parasitology. Students registered in the Department therefore are exposed to these related areas and receive an excellent background in basic biology and chemistry as well as in the more applied areas of biotechnology and medicine.

Many opportunities exist for careers in basic or applied microbiology and immunology, medical microbiology, environmental microbiology, and biotechnology. They include positions in industry (pharmaceutical and biotechnology), hospitals, universities, and government (environment, public health, and energy). A degree in microbiology also provides an excellent basis for entering professional and postgraduate programs in medicine, dentistry, the veterinary sciences, research, and education.

#### Notes on admission to Microbiology and Immunology

**programs.** Please note that enrolment to 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 BIOL 111, BIOL 112, CHEM 110 or CHEM 111, CHEM 120 or CHEM 121, MATH 112, MATH 139 or MATH 140, MATH 141, PHYS 101 and PHYS 102 or their equivalent with an overall average of at least of 65% (B-). 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 MIMM 211 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](http://www.mcgill.ca/microimm).

All students (U1, U2, U3) must attend an advising session. Please check [www.mcgill.ca/microimm](http://www.mcgill.ca/microimm) for dates.

### 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)

|             |     |                                       |
|-------------|-----|---------------------------------------|
| BIOL 200    | (3) | Molecular Biology                     |
| BIOL 201    | (3) | Cell Biology and Metabolism           |
| or BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 202    | (3) | Basic Genetics                        |
| CHEM 212    | (4) | Introductory Organic Chemistry 1      |
| MIMM 211    | (3) | Introductory Microbiology             |
| MIMM 212    | (2) | Laboratory in Microbiology            |

#### U1, U2 or U3 Required Course (3 credits)

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

#### U2 Required Courses (15 credits)

|            |     |   |
|------------|-----|---|
| MIMM 314   | (3) | Immunology                                |
| MIMM 323   | (3) | Microbial Physiology                      |
| MIMM 324   | (3) | Fundamental Virology                      |
| MIMM 386D1 | (3) | Laboratory in Microbiology and Immunology |
| MIMM 386D2 | (3) | Laboratory in Microbiology and Immunology |

#### U3 Complementary Courses (6 credits)

6 credits selected from:

|          |     |                                     |
|----------|-----|-------------------------------------|
| MIMM 387 | (3) | Applied Microbiology and Immunology |
| MIMM 413 | (3) | Parasitology                        |
| MIMM 414 | (3) | Advanced Immunology                 |
| MIMM 465 | (3) | Bacterial Pathogenesis              |
| MIMM 466 | (3) | Viral Pathogenesis                  |
| MIMM 509 | (3) | Inflammatory Processes              |

#### U1, U2 or U3 Complementary Courses (15 credits)

15 credits selected from:

|             |     |  |
|-------------|-----|--|
| ANAT 261    | (4) | Introduction to Dynamic Histology        |
| ANAT 262    | (3) | Introductory Molecular and Cell Biology  |
| ANAT 365    | (3) | Cell Biology: Secretory Process          |
| ANAT 458    | (3) | Membranes and Cellular Signalling        |
| or BIOC 458 | (3) | Membranes and Cellular Signalling        |
| BIOC 311    | (3) | Metabolic Biochemistry                   |
| BIOC 312    | (3) | Biochemistry of Macromolecules           |
| BIOC 450    | (3) | Protein Structure and Function           |
| BIOC 454    | (3) | Nucleic Acids                            |
| BIOL 300    | (3) | Molecular Biology of the Gene            |
| BIOL 314    | (3) | Molecular Biology of Oncogenes           |
| BIOT 505    | (3) | Selected Topics in Biotechnology         |
| CHEM 203    | (3) | Survey of Physical Chemistry             |
| or CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 222    | (4) | Introductory Organic Chemistry 2         |
| CHEM 302    | (3) | Introductory Organic Chemistry 3         |
| EXMD 504    | (3) | Biology of Cancer                        |
| MIMM 387    | (3) | Applied Microbiology and Immunology      |
| MIMM 413    | (3) | Parasitology                             |



|          |     |   |
|----------|-----|---|
| MIMM 414 | (3) | Advanced Immunology   |
| MIMM 465 | (3) | Bacterial Pathogenesis  |
| MIMM 466 | (3) | Viral Pathogenesis  |
| MIMM 509 | (3) | Inflammatory Processes  |
| PATH 300 | (3) | Human Disease   |
| PHAR 300 | (3) | Drug Action   |
| PHAR 301 | (3) | Drugs and Diseases  |
| PHGY 209 | (3) | Mammalian Physiology 1<br>(Class Schedule conflict with MIMM 324, if taken should be in U1 or U3) |
| PHGY 210 | (3) | Mammalian Physiology 2  |

### MAJOR PROGRAM 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:

|             |     |  |
|-------------|-----|--|
| CHEM 222    | (4) | Introductory Organic Chemistry 2         |
| CHEM 203    | (3) | Survey of Physical Chemistry             |
| or CHEM 204 | (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

|          |     |                                |
|----------|-----|--------------------------------|
| BIOC 311 | (3) | Metabolic Biochemistry         |
| BIOC 312 | (3) | Biochemistry of Macromolecules |

#### U3 Required Courses (9 credits)

|          |     |                        |
|----------|-----|------------------------|
| MIMM 413 | (3) | Parasitology           |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis     |

#### Complementary Courses (9 credits)

9 credits selected from:

|             |     |   |
|-------------|-----|---|
| ANAT 261    | (4) | Introduction to Dynamic Histology   |
| ANAT 262    | (3) | Introductory Molecular and Cell Biology   |
| ANAT 458    | (3) | Membranes and Cellular Signaling  |
| or BIOC 458 | (3) | Membranes and Cellular Signaling  |
| ANAT 365    | (3) | Cell Biology: Secretory Process   |
| BIOC 450    | (3) | Protein Structure and Function  |
| BIOC 454    | (3) | Nucleic Acids   |
| BIOL 300    | (3) | Molecular Biology of the Gene   |
| BIOL 314    | (3) | Molecular Biology of Oncogenes  |
| BIOT 505    | (3) | Selected Topics in Biotechnology  |
| CHEM 302    | (3) | Introductory Organic Chemistry 3  |
| EXMD 504    | (3) | Biology of Cancer   |
| MIMM 387    | (3) | Applied Microbiology and Immunology   |
| MIMM 414    | (3) | Advanced Immunology   |
| MIMM 509    | (3) | Inflammatory Processes  |
| PATH 300    | (3) | Human Disease   |
| PHAR 300    | (3) | Drug Action   |
| PHAR 301    | (3) | Drugs and Diseases  |
| PHGY 209    | (3) | Mammalian Physiology 1<br>(Class Schedule conflict with MIMM 324, if taken should be in U1 or U3) |
| PHGY 210    | (3) | Mammalian Physiology 2  |

### HONOURS PROGRAM 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 3.10 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:

|            |     |                          |
|------------|-----|--------------------------|
| MIMM 502D1 | (6) | Honours Research Project |
| MIMM 502D2 | (6) | Honours Research Project |

#### Complementary Courses (3 credits)

3 credits selected from:

|             |     |                                   |
|-------------|-----|-----------------------------------|
| BIOL 520    | (3) | Gene Activity in Development      |
| BIOT 505    | (3) | Selected Topics in Biotechnology  |
| ANAT 458    | (3) | Membranes and Cellular Signalling |
| or BIOC 458 | (3) | Membranes and Cellular Signalling |
| BIOC 404    | (3) | Biophysical Chemistry             |
| BIOC 450    | (3) | Protein Structure and Function    |
| BIOC 454    | (3) | Nucleic Acids                     |
| BIOC 455    | (3) | Neurochemistry                    |
| MIMM 414    | (3) | Advanced Immunology               |
| MIMM 509    | (3) | Inflammatory Processes            |
| PHAR 562    | (3) | General Pharmacology 1            |
| PHAR 563    | (3) | General Pharmacology 2            |

### INTERDEPARTMENTAL HONOURS PROGRAM IN IMMUNOLOGY, see page 277. This program 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, malcolm.baines@mcgill.ca

### 12.18 Music

Strathcona Music Building  
555 Sherbrooke Street West  
Montreal, QC H3A 1E3

Telephone: (514) 398-4535

Fax: (514) 398-8061

Website: [www.music.mcgill.ca](http://www.music.mcgill.ca)

*Department of Theory* — Brian Cherny (Chair)

*Department of Performance* — TBA (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, 2003 and must be completed and returned to that office by May 15, 2003. 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, 2003.

#### Required Courses (24 credits)

|          |     |                                    |
|----------|-----|------------------------------------|
| MUHL 342 | (3) | History of Electroacoustic Music   |
| MUMT 202 | (3) | Fundamentals of New Media          |
| MUMT 203 | (3) | Introduction to Digital Audio      |
| MUMT 301 | (3) | Music and the Internet             |
| MUMT 302 | (3) | New Media Production 1             |
| MUMT 303 | (3) | New Media Production 2             |
| PHYS 224 | (3) | Physics and Psychophysics of Music |
| PHYS 225 | (3) | Musical Acoustics                  |

Science students are eligible to take the Arts **Minor Concentration in Music**, see page 105.

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 3.6.3 "Courses outside the Faculties of Arts and Science" for the relevant regulations).

### 12.19 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 Program in Neuroscience, is considered as a course taught by the Faculty of Science.

### 12.20 Neuroscience

Minor Program in Neuroscience – Program Coordinator:

Professor Ellis Cooper, Department of Physiology  
McIntyre Medical Sciences Building, Room 1127  
E-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 PROGRAM IN NEUROSCIENCE (24 credits)

The Minor Program 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 Program in Neuroscience, where appropriate.

**All course selections for the Minor Program in Neuroscience must be approved by the Program Coordinator.**

**Students should very carefully check the Calendar Supplement for restrictions for the following four courses: ANAT 321, BIOL 306, PHGY 311, PSYC 308.**

#### Complementary Courses (24 credits)

6 credits selected from:

|          |     |   |
|----------|-----|---|
| ANAT 321 | (3) | Circuitry of the Human Brain  |
| NEUR 310 | (3) | Cellular Neurobiology   |
| PSYC 308 | (3) | Behavioural Neuroscience 1<br>or BIOL 306 (3) Neurobiology and Behaviour<br>or PHGY 311 (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

|          |     |  |
|----------|-----|--|
| BIOL 306 | (3) | Neurobiology and Behaviour                 |
| BIOL 389 | (3) | Laboratory in Neurobiology                 |
| BIOL 530 | (3) | Neural Basis of Behaviour                  |
| BIOL 531 | (3) | Neurobiology Learning Memory               |
| PHGY 311 | (3) | Intermediate Physiology 1                  |
| PHGY 556 | (3) | Topics in Systems Neuroscience             |
| PSYC 318 | (3) | Behavioural Neuroscience 2                 |
| PSYC 427 | (3) | Sensorimotor Behaviour                     |
| PSYC 505 | (3) | The Psychology of Pain                     |
| PSYC 522 | (3) | Neurochemistry and Behaviour               |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

#### Molecular and Developmental Neurobiology

|          |     |                                    |
|----------|-----|------------------------------------|
| ANAT 321 | (3) | Circuitry of the Human Brain       |
| BIOC 455 | (3) | Neurochemistry                     |
| BIOL 532 | (3) | Developmental Neurobiology Seminar |
| BIOL 588 | (3) | Molecular/Cellular Neurobiology    |
| NEUR 310 | (3) | Cellular Neurobiology              |
| PHGY 311 | (3) | Intermediate Physiology 1          |
| PHGY 451 | (3) | Advanced Neurophysiology           |

#### Neurophysiology

|          |     |                                 |
|----------|-----|---------------------------------|
| ANAT 322 | (3) | Neuroendocrinology              |
| BIOL 389 | (3) | Laboratory in Neurobiology      |
| BIOL 531 | (3) | Neurobiology Learning Memory    |
| BIOL 588 | (3) | Molecular/Cellular Neurobiology |
| PHGY 311 | (3) | Intermediate Physiology 1       |
| PHGY 451 | (3) | Advanced Neurophysiology        |
| PHGY 520 | (3) | Ion Channels                    |
| PHGY 556 | (3) | Topics in Systems Neuroscience  |
| PSYC 427 | (3) | Sensorimotor Behaviour          |

#### Neuropsychology

|          |     |                                   |
|----------|-----|-----------------------------------|
| ANAT 321 | (3) | Circuitry of the Human Brain      |
| ANAT 322 | (3) | Neuroendocrinology                |
| BIOL 306 | (3) | Neurobiology and Behaviour        |
| PSYC 311 | (3) | Human Cognition and the Brain     |
| PSYC 318 | (3) | Behavioural Neuroscience 2        |
| PSYC 410 | (3) | Special Topics in Neuropsychology |
| PSYC 470 | (3) | Memory and Brain                  |
| PSYC 505 | (3) | The Psychology of Pain            |
| PSYC 522 | (3) | Neurochemistry and Behaviour      |
| PSYC 526 | (3) | Advances in Visual Perception     |

#### Neuropharmacology

|          |     |  |
|----------|-----|--|
| ANAT 321 | (3) | Circuitry of the Human Brain               |
| BIOC 455 | (3) | Neurochemistry                             |
| BIOL 588 | (3) | Molecular/Cellular Neurobiology            |
| PHAR 300 | (3) | Drug Action                                |
| PHAR 301 | (3) | Drug and Disease                           |
| PHAR 562 | (3) | General Pharmacology 1                     |
| PHGY 311 | (3) | Intermediate Physiology 1                  |
| PHGY 451 | (3) | Advanced Neurophysiology                   |
| PHGY 520 | (3) | Ion Channels                               |
| PSYT 301 | (3) | Issues in Drug Dependence                  |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

**12.21 Nutrition (NUTR)**

The School of Dietetics and Human Nutrition offers a **Minor in Human Nutrition**, see page 313, which can be taken by Science students.

NUTR 307 is considered as a course taught by the Faculty of Science and is offered on the Downtown Campus.

**12.22 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.

**12.23 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](http://www.pharma.mcgill.ca)

*Chair* — Hans Zingg

*Emeritus Professor*

Theodore Sourkes; Ph.D.(Cornell)

*Professors*

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.)

Barbara Hales; M.Sc.(Phil. Coll. of Pharmacy and Science), Ph.D.(McG.)

Peter J. McLeod; M.D.(Manit.), F.R.C.P.(C.)

John B. Richardson; B.Sc., M.D.C.M., L.M.C.C., F.R.C.P., Ph.D.(McG.)

Bernard Robaire; B.A.(Calif.), Ph.D.(McG.)(*James McGill Professor*)

Moshe Szyf; M.Sc., Ph.D.(Hebrew U.)

Daya R. Varma; M.D.(Lucknow), Ph.D.(McG.)

Hans H. Zingg; M.D., Ph.D.(McG.)

*Associate Professors*

Guillermina Almazan; Ph.D.(McG.)

Barbara Esplin; M.D.(Warsaw)

Dusica Maysinger; Ph.D.(Los Angeles)

Stanley Nattel; B.Sc., M.D.,C.M.(McG.)

Ante L. Padjen; M.D., M.Sc., D.Sc.(Zagreb);

Alfredo Ribeiro-da-Silva; M.D., Ph.D.(Oporto)

H. Uri Saragovi; Ph.D.(Miami)

Betty I. Sasyniuk; B.S.P., Ph.D.(Man.)

Jacquetta Trasler; M.D.C.M., Ph.D.(McG.)

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.)

Claude De Montigny; M.D., Ph.D.(Montr.), F.R.C.P.(C)

Giovanni Di Battista; B.Sc., Ph.D.(Montr.)

Pierre Fiset; M.D.(Laval), F.R.C.P.S.(C).

Serge Gauthier, M.D.(Montr.)

Yogesh C. Patel; M.D.(Otago), Ph.D.(Monash)

Roger Prichard; B.Sc., Ph.D.(N.S.W.)

Remi Quirion; M.Sc., Ph.D.(Sher.)

Allan Tenenhouse; B.Sc., M.D.,C.M., Ph.D.(McG.)

*Adjunct Professors*

Sylvain Chemtob; M.D.(Montr.), Ph.D.(McG.)

Yves De Koninck; Ph.D.(McG.)

Lorella Garofalo; Ph.D.(McG.)

Joseph Mancini; M.Sc., Ph.D.(McG.)

Kathleen Metters; Ph.D.(London)

George S. Robertson; Ph.D.(Dal.)

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 multi-disciplinary 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 can be subdivided into a number of different areas such as neuropharmacology, molecular biology, 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 should provide students with knowledge concerning the actions of drugs on living systems and insight into approaches to basic pharmacological research.

**MINOR PROGRAM IN PHARMACOLOGY (24 credits)**

The Minor Program 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 Program 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)**

|          |     |                        |
|----------|-----|------------------------|
| PHAR 300 | (3) | Drug Action            |
| PHAR 562 | (3) | General Pharmacology 1 |
| PHAR 563 | (3) | General Pharmacology 2 |

**Complementary Courses (15 credits)**

3 credits, one of:

|          |     |                                       |
|----------|-----|---------------------------------------|
| BIOL 200 | (3) | Molecular Biology                     |
| BIOL 201 | (3) | Cell Biology and Metabolism           |
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |

3 credits, one of:

|          |     |                        |
|----------|-----|------------------------|
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

9 credits, chosen from

|           |     |                                   |
|-----------|-----|-----------------------------------|
| PHAR 301  | (3) | Drugs and Diseases                |
| PHAR 303  | (3) | Principles of Toxicology          |
| PHAR 503  | (3) | Drug Design and Development 1     |
| PHAR 504* | (3) | Drug Design and Development 2     |
| PHAR 599  | (6) | Research Projects in Pharmacology |

\* can be taken with PHAR 503 only.

**12.24 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](mailto:secretariat@physics.mcgill.ca)

Website: [www.physics.mcgill.ca](http://www.physics.mcgill.ca)

*Chair* — M. Grant

*Emeritus Professors*

M.P. Langleben; B.Sc., M.Sc., Ph.D.(McG.), F.R.S.C.

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.(Oxon.), 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.)

Jonathan K.P. Lee; B.Eng., M.Sc., Ph.D.(McG.)

David G. Ryan; B.Sc., M.Sc.(Queen's), Ph.D.(Birm.)

John M. Trischuk; B.Eng.(McG.), Ph.D.(Cal. Tech.)

*Professors*

Jean Barrette; B.Sc., M.Sc., Ph.D.(Montr.)

Clifford P. Burgess; B.Sc.(Waterloo), Ph.D.(Texas) (*James McGill*

*Professor*)

Subal Das Gupta; B.A., M.Sc.(Calc.), Ph.D.(McM.) (*William C.*

*Macdonald Professor of Physics*)

Nicholas DeTakacsy; B.Sc., M.Sc.(Montr.), Ph.D.(McG.)

Charles Gale; B.Sc.(Ott.), M.Sc., Ph.D.(McG.)

Martin Grant; B.Sc.(P.E.I.), M.Sc., Ph.D.(Tor.) (*James McGill*

*Professor*)

Hong Guo; B.Sc.(Sichuan), M.Sc., Ph.D.(Pitt.)

David Hanna; B.Sc.(McG.), M.A., Ph.D.(Harv.)

Richard Harris; B.A.(Oxon.), 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.)

Tommy S.K. Mark; B.Sc., M.Sc., Ph.D.(McG.) (*William C.*

*Macdonald Professor of Physics*)

Robert B. Moore; B.Eng., M.Sc., Ph.D.(McG.)

Robert Myers; B.Sc.(Wat.), M.A., Ph.D.(Prin.)

Popat M. Patel; B.Sc., M.Sc.(Manc.), Ph.D.(Harv.)

Dominic H. Ryan; B.A., Ph.D.(Trin.Coll.)

John O. Strom-Olsen; B.A., M.S., Ph.D.(Cantab.)

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

Luc Vinet; B.Sc., M.Sc., Ph.D.(Montr.), Doctorat 3<sup>e</sup> cycle (Paris VI)

(*joint appoint. with Mathematics & Statistics*)

*Associate Professors*

James M. Cline; B.Sc.(Calif.), M.Sc., Ph.D.(Cal Tech.)

François Corriveau; B.Sc.(Laval), M.Sc.(U.B.C.),

Docteur Sc.Nat.(Zurich)

Peter Grutter; Dipl., Ph.D.(Basel) (*William Dawson Scholar*)

Victoria Kaspi; B.Sc.(McG.), M.A., Ph.D.(Princ.)(*C.anada*

*Research Chair*)

Kenneth J. Ragan; B.Sc.(Alta.), Ph.D.(Geneva)

*Assistant Professors*

Michael Hilke; B.Sc., M.Sc., Ph.D.(Geneva)

Sangyong Jeon; B.Sc.(Seoul), M.Sc., Ph.D.(Wash.)

Guy Moore; B.Sc.(Calif.), Ph.D.(Prin.)

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*)

*Lecturers*

Z. Altounian; B.Sc., M.Sc.(Cairo), Ph.D.(McM.)

F. Buchinger; M.Sc., Dr.(Mainz)

*Associate Members*

R. Davies (*Atmospheric & Oceanic Sciences*),

B.C. Eu (*Chemistry*), G. Fallone (*Radiation Oncology*),

M. Mackey (*Physiology*), E. Podgorsak (*Radiation Oncology*),

D. Ronis (*Chemistry*)

*Curator (Rutherford Museum and McPherson Collection)*

Tommy S.K. Mark; B.Sc., M.Sc., Ph.D.(McG.)

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 Joint Honours in Mathematics and Physics is an even more 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. 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 two Physics options. Both of these combine physics courses from the Major program with Education courses. They are, respectively, the Major program in Chemistry and Physics for Teachers, and the Major program in Mathematics and Physics for Teachers. (For details, see the Science for Teachers section.)

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 co-requisites 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.

\**CEGEP objectives 00UR, 00US, 00UT or equivalent.*

**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” on page 165](#).

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 PHYS 131 and PHYS 142 if they have previously taken physics at the high school level and will be taking differential calculus concurrently with PHYS 131 and integral calculus concurrently with PHYS 142. 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 PHYS 101 and PHYS 102. 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 MATH 112 should be taken concurrently with PHYS 101. Those for whom this is not necessary are advised to take MATH 139 concurrently with PHYS 101.

**MINOR PROGRAM 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 co-requisites. 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)**

PHYS 257 (3) Experimental Methods 1

**Complementary Courses (15 credits)**

15 credits to be selected as follows:

- PHYS 230 (3) Dynamics of Simple Systems  
or PHYS 251(3) Classical Mechanics 1
- PHYS 232 (3) Heat and Waves  
or PHYS 253(3) Thermal Physics
- PHYS 258 (3) Experimental Methods 2  
or PHYS 241(3) Signal Processing
- PHYS 271 (3) Quantum Physics  
or PHYS 260(3) Modern Physics and Relativity  
or PHYS 214(3) Introductory Astrophysics  
or PHYS 225(3) Musical Acoustics
- PHYS 340 (3) Electricity and Magnetism  
or PHYS 350(3) Electromagnetism

**FACULTY PROGRAM IN PHYSICS (54 credits)****Required Courses (36 credits)**

- MATH 222 (3) Calculus 3
- MATH 223 (3) Linear Algebra
- MATH 314 (3) Advanced Calculus
- MATH 315 (3) Ordinary Differential Equations

- PHYS 230 (3) Dynamics of Simple Systems
- PHYS 232 (3) Heat and Waves
- PHYS 257 (3) Experimental Methods 1
- PHYS 258 (3) Experimental Methods 2
- PHYS 333 (3) Thermal and Statistical Physics
- PHYS 340 (3) Electricity and Magnetism
- PHYS 436 (3) Modern Physics
- PHYS 446 (3) Quantum Physics

**Complementary Courses (18 credits)**

at least 3 credits selected from:

- PHYS 241 (3) Signal Processing
- PHYS 434 (3) Optics
- PHYS 439 (3) Laboratory in Modern Physics

the remainder selected from:

- COMP 202 (3) Introduction to Computing 1
- EPSC 320 (3) Elementary Earth Physics
- MATH 316 (3) Functions of a Complex Variable
- MATH 317 (3) Numerical Analysis
- MATH 319 (3) Partial Differential Equations
- PHYS 328 (3) Electronics
- PHYS 331 (3) Topics in Classical Mechanics
- PHYS 339 (3) Measurements Laboratory in General Physics
- PHYS 342 (3) Electromagnetic Waves

**FACULTY PROGRAM IN MATHEMATICS, CHEMISTRY AND PHYSICS**, see page 281 under Mathematics and Statistics.

**MAJOR PROGRAM IN PHYSICS (60 credits)****U1 Required Courses (21 credits)**

- MATH 222 (3) Calculus 3
- MATH 223 (3) Linear Algebra
- PHYS 230 (3) Dynamics of Simple Systems
- PHYS 232 (3) Heat and Waves
- PHYS 241 (3) Signal Processing
- PHYS 257 (3) Experimental Methods 1
- PHYS 258 (3) Experimental Methods 2

**U2 Required courses (24 credits)**

- MATH 314 (3) Advanced Calculus
- MATH 315 (3) Ordinary Differential Equations
- PHYS 328 (3) Electronics
- PHYS 331 (3) Topics in Classical Mechanics
- PHYS 333 (3) Thermal and Statistical Physics
- PHYS 339 (3) Measurements Laboratory in General Physics
- PHYS 340 (3) Electricity and Magnetism
- PHYS 342 (3) Electromagnetic Waves

**U3 Required Courses (15 credits)**

- PHYS 434 (3) Optics
- PHYS 436 (3) Modern Physics
- PHYS 439 (3) Laboratory in Modern Physics
- PHYS 446 (3) Quantum Physics
- PHYS 449 (3) Project Laboratory

**JOINT MAJOR PROGRAM 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)**

- EPSC 203 (3) Structural Geology 1
- EPSC 210 (3) Introductory Mineralogy
- EPSC 231 (2) Field School 1
- MATH 222 (3) Calculus 3
- MATH 223 (3) Linear Algebra
- MATH 314 (3) Advanced Calculus

- PHYS 230 (3) Dynamics of Simple Systems  
 PHYS 232 (3) Heat and Waves  
 PHYS 257 (3) Experimental Methods 1  
 PHYS 258 (3) Experimental Methods 2

**U2 Required Courses** (18 credits)

- EPSC 320 (3) Elementary Earth Physics  
 EPSC 350 (3) Tectonics  
 MATH 315 (3) Ordinary Differential Equations  
 MATH 319 (3) Partial Differential Equations  
 PHYS 339 (3) Measurements Laboratory in General Physics  
 PHYS 340 (3) Electricity and Magnetism

**U2 or U3 Required Courses** (6 credits)

- EPSC 330 (3) Earthquakes and Earth Structure  
 EPSC 510 (3) Geodynamics and Geomagnetism

**U3 Required Courses** (15 credits)

- PHYS 331 (3) Topics in Classical Mechanics  
 PHYS 332 (3) Physics of Fluids  
 PHYS 333 (3) Thermal and Statistical Physics  
 PHYS 342 (3) Electromagnetic Waves  
 PHYS 446 (3) Quantum Physics

**JOINT MAJOR PROGRAM IN ATMOSPHERIC SCIENCE AND PHYSICS**, see page 257 under Atmospheric and Oceanic Sciences. 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.

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 PROGRAM IN PHYSICS AND COMPUTER SCIENCE** (66 credits)

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 centerpiece of the final year of the program.

**U1 Required Courses** (21 credits)

- COMP 250 (3) Introduction to Computer Science  
 MATH 222 (3) Calculus 3  
 MATH 223 (3) Linear Algebra  
 MATH 240 (3) Discrete Structures 1  
 PHYS 230 (3) Dynamics of Simple Systems  
 PHYS 257 (3) Experimental Methods 1  
 PHYS 258 (3) Experimental Methods 2

**U2 Required Courses** (24 credits)

- COMP 251 (3) Data Structures and Algorithms  
 COMP 302 (3) Programming Languages and Paradigms  
 COMP 350 (3) Numerical Computing  
 COMP 360 (3) Algorithm Design Techniques  
 MATH 314 (3) Advanced Calculus  
 MATH 315 (3) Ordinary Differential Equations  
 PHYS 232 (3) Heat and Waves  
 PHYS 241 (3) Signal Processing

**U3 Required Courses** (21 credits)

- COMP 557 (3) Computer Graphics  
 MATH 323 (3) Probability Theory  
 PHYS 331 (3) Topics in Classical Mechanics  
 PHYS 339 (3) Measurements Laboratory in General Physics  
 PHYS 340 (3) Electricity and Magnetism  
 PHYS 446 (3) Quantum Physics  
 PHYS 489 (3) Special Project

**JOINT MAJOR PROGRAM IN PHYSIOLOGY AND PHYSICS**, see page 293 under Physiology. This program provides a firm basis for graduate work in bio-physics and other interdisciplinary fields involving the physical and biological sciences.

**HONOURS PROGRAM 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 MATH 222 must take it in the first term without receiving credits toward the 78 credits required in the Honours program.

A student whose average in the required and complementary courses in any year falls below a GPA of 3.00, or whose grade in any individual required or complementary course falls below a C, 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)

- MATH 247 (3) Linear Algebra  
 MATH 248 (3) Advanced Calculus 1  
 MATH 249 (3) Advanced Calculus 2  
 MATH 325 (3) Ordinary Differential Equations  
 PHYS 241 (3) Signal Processing  
 PHYS 251 (3) Classical Mechanics 1  
 PHYS 257 (3) Experimental Methods 1  
 PHYS 258 (3) Experimental Methods 2  
 PHYS 260 (3) Modern Physics and Relativity

**U2 Required Courses** (24 credits)

- MATH 375 (3) Differential Equations  
 PHYS 253 (3) Thermal Physics  
 PHYS 350 (3) Electromagnetism  
 PHYS 357 (3) Quantum Physics  
 PHYS 359 (3) Laboratory in Modern Physics  
 PHYS 362 (3) Statistical Mechanics  
 PHYS 451 (3) Classical Mechanics  
 PHYS 457 (3) Quantum Physics

**U3 Required Courses** (6 credits)

- PHYS 551 (3) Quantum Theory  
 PHYS 352 (3) Electromagnetic Waves

**U3 Complementary Courses** (21 credits)

6 credits selected from:

- PHYS 459D1 (3) Honours Research Project  
 and PHYS 459D2 (3) Honours Research Project  
 PHYS 469 (3) Laboratory in Modern Physics 2  
 PHYS 479 (3) Honours Project Laboratory

15 credits selected from:

- PHYS 332 (3) Physics of Fluids  
 PHYS 434 (3) Optics  
 PHYS 514 (3) General Relativity  
 PHYS 521 (3) Astrophysics  
 PHYS 557 (3) Nuclear Physics  
 PHYS 558 (3) Solid State Physics  
 PHYS 559 (3) Advanced Statistical Mechanics  
 PHYS 562 (3) Electromagnetic Theory  
 PHYS 567 (3) Particle Physics

or other 3-credit course approved by the Department of Physics

**JOINT HONOURS PROGRAM 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 in 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 MATH 222 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)

|          |     |                                 |
|----------|-----|---------------------------------|
| MATH 235 | (3) | Basic Algebra                   |
| MATH 248 | (3) | Advanced Calculus 1             |
| MATH 249 | (3) | Advanced Calculus 2             |
| MATH 325 | (3) | Ordinary Differential Equations |
| PHYS 241 | (3) | Signal Processing               |
| PHYS 251 | (3) | Classical Mechanics 1           |
| PHYS 257 | (3) | Experimental Methods 1          |
| PHYS 258 | (3) | Experimental Methods 2          |
| PHYS 260 | (3) | Modern Physics and Relativity   |

#### U1 Complementary Course (3 credits)

3 credits selected from:

|          |     |                |
|----------|-----|----------------|
| MATH 251 | (3) | Algebra 2      |
| MATH 247 | (3) | Linear Algebra |

#### U2 Required Courses (27 credits)

|          |     |                        |
|----------|-----|------------------------|
| MATH 242 | (3) | Analysis 1             |
| MATH 255 | (3) | Analysis 2             |
| MATH 375 | (3) | Differential Equations |
| PHYS 253 | (3) | Thermal Physics        |
| PHYS 350 | (3) | Electromagnetism       |
| PHYS 357 | (3) | Quantum Physics        |
| PHYS 362 | (3) | Statistical Mechanics  |
| PHYS 451 | (3) | Classical Mechanics    |
| PHYS 457 | (3) | Quantum Physics        |

#### U3 Required Courses (12 credits)

|          |     |                              |
|----------|-----|------------------------------|
| MATH 354 | (3) | Analysis 3                   |
| MATH 380 | (3) | Differential Geometry        |
| PHYS 352 | (3) | Electromagnetic Waves        |
| PHYS 359 | (3) | Laboratory in Modern Physics |

#### U3 Complementary Courses (12 credits)

3 credits selected from:

|          |     |            |
|----------|-----|------------|
| MATH 370 | (3) | Algebra 3  |
| MATH 355 | (3) | Analysis 4 |

6 credits selected from:

|          |     |                                |
|----------|-----|--------------------------------|
| PHYS 514 | (3) | General Relativity             |
| PHYS 551 | (3) | Quantum Theory                 |
| PHYS 521 | (3) | Astrophysics                   |
| PHYS 557 | (3) | Nuclear Physics                |
| PHYS 558 | (3) | Solid State Physics            |
| PHYS 559 | (3) | Advanced Statistical Mechanics |
| PHYS 562 | (3) | Electromagnetic Theory         |
| PHYS 567 | (3) | Particle Physics               |

3 credits in Honours Mathematics

### JOINT HONOURS PROGRAM IN PHYSICS AND CHEMISTRY (80 credits)

This is a specialized and demanding program intended primarily, although not exclusively, for students with a theoretical bias who are interested in working in fields of study at the crossroads of physical chemistry and physics. The program will prepare students for either theoretical or experimental graduate work in departments where there is an emphasis on such cross-disciplinary areas as condensed matter physics, chemical physics, or material science.

A student whose average in the required and complementary courses in any year falls below a GPA of 3.00, or whose grade in any individual required or complementary course falls below a C (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)

|          |     |                                 |
|----------|-----|---------------------------------|
| CHEM 213 | (3) | Introductory Physical Chemistry |
| CHEM 273 | (1) | Chemical Kinetics               |
| MATH 247 | (3) | Linear Algebra                  |
| MATH 248 | (3) | Advanced Calculus 1             |
| MATH 249 | (3) | Advanced Calculus 2             |
| MATH 325 | (3) | Ordinary Differential Equations |
| PHYS 241 | (3) | Signal Processing               |
| PHYS 251 | (3) | Classical Mechanics 1           |
| PHYS 257 | (3) | Experimental Methods 1          |
| PHYS 258 | (3) | Experimental Methods 2          |

#### U2 Required Courses (26 credits)

|          |     |                                      |
|----------|-----|--------------------------------------|
| CHEM 212 | (4) | Introductory Organic Chemistry 1     |
| CHEM 281 | (3) | Inorganic Chemistry 1                |
| CHEM 355 | (3) | Molecular Properties and Structure 2 |
| CHEM 363 | (2) | Physical Chemistry Laboratory 1      |
| CHEM 365 | (2) | Statistical Thermodynamics           |
| COMP 208 | (3) | Computers in Engineering             |
| PHYS 253 | (3) | Thermal Physics                      |
| PHYS 350 | (3) | Electromagnetism                     |
| PHYS 357 | (3) | Quantum Physics                      |
| PHYS 457 | (3) | Quantum Physics                      |

#### U3 Required Courses (14 credits)

|          |     |                                 |
|----------|-----|---------------------------------|
| CHEM 393 | (2) | Physical Chemistry Laboratory 2 |
| CHEM 455 | (3) | Introductory Polymer Chemistry  |
| CHEM 556 | (3) | Advanced Quantum Mechanics      |
| PHYS 352 | (3) | Electromagnetic Waves           |
| PHYS 558 | (3) | Solid State Physics             |

#### U3 Complementary Courses (12 credits)

(with at least 3 credits in Chemistry and 3 credits in Physics)

3 credits selected from:

|          |     |                                |
|----------|-----|--------------------------------|
| CHEM 593 | (3) | Statistical Mechanics          |
| PHYS 559 | (3) | Advanced Statistical Mechanics |

9 credits selected from:

|              |     |                                  |
|--------------|-----|----------------------------------|
| CHEM 480     | (3) | Research Project                 |
| and CHEM 490 | (3) | Research Project                 |
| CHEM 531     | (3) | Chemistry of Inorganic Materials |
| CHEM 575     | (3) | Chemical Kinetics                |
| CHEM 585     | (3) | Colloid Chemistry                |
| MATH 375     | (3) | Differential Equations           |
| PHYS 434     | (3) | Optics                           |
| PHYS 451     | (3) | Classical Mechanics              |
| PHYS 469     | (3) | Laboratory in Modern Physics 2   |
| PHYS 479     | (3) | Honours Project Laboratory       |
| PHYS 562     | (3) | Electromagnetic Theory           |

### MINOR PROGRAM 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 PHYS 241 towards the requirements of the Major in Physics, and should replace this course by another Physics or Mathematics course. Students who select ECSE 334 in the Minor cannot count PHYS 328 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)

|             |     |  |
|-------------|-----|--|
| ECSE 200    | (3) | Fundamentals of Electrical Engineering |
| ECSE 210    | (5) | Circuit Analysis                       |
| ECSE 303    | (3) | Signals and Systems 1                  |
| ECSE 305    | (3) | Probability and Random Sigs. 1         |
| or ECSE 334 | (5) | Introduction to Microelectronics       |
| ECSE 330    | (3) | Introduction to Electronics            |

#### Complementary Courses (6 credits)

**12.25 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.physio.mcgill.ca](http://www.physio.mcgill.ca)

*Chair* — Alvin Shrier

*Emeritus Professors*

G. Melvill Jones; B.A., M.A., M.B., B.Ch., M.D.(Cantab.)  
Kresmir Krnjacic; 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.)

Wayne S. Lapp; M.S.A.(Tor.), Ph.D.(McG.)

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 Orlowski; 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.)

*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.) (*joint  
appoint. with Anaesthesia Research*)

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 Members*

Anaesthesia: Steven Backman

Biomedical Engineering: Robert E. Kearney, Satya Prakash,  
Tomoko Takano

Dentistry: James Lund

Medicine: Albert Aguayo, Angel Alonso, Andrey Cybulsky,  
Samuel O. Freedman, Abraham Fuks, Claude Gagnon,  
Raymonde Gagnon, Harry Goldsmith, Geoffrey Hendy,  
Peter Macklem, James Martin, Shree Mulay, Mariana Newkirk,  
Barry Posner, Shafaat Rabbani, Ian Shrier, J. Enrique Silva,  
Alan Sniderman, Mary Stevenson, Simon Wing, Hans Zingg

Neurology & Neurosurgery: Massimo Avoli, Charles Bourque,  
Sal T. Carbonetto, Pierre Drapeau, Daniel Guitton,  
Michael Rasminsky

Ophthalmology: Curtis Baker

Otolaryngology: Bernard Segal

Pediatrics: Immanuela Moss

Psychiatry: Bernardo Dubrovsky, Christina Gianoulakis

*Adjunct Professors*

Roy Caplan, Montreal

Terence Hebert, Montreal

James Henry, London ON

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, chemistry and clinical departments (medicine, surgery, pediatrics, neurology, obstetrics, psychiatry, anaesthesia), 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 Terminology**" on page 354.

**FACULTY PROGRAM IN PHYSIOLOGY (55 credits)**

If not previously taken CHEM 212 Introductory Organic Chemistry 1 must be completed in addition to the 55 program credits.

**Required Courses (34 credits)**

|          |     |                                  |
|----------|-----|----------------------------------|
| BIOL 200 | (3) | Molecular Biology                |
| BIOL 202 | (3) | Basic Genetics                   |
| BIOL 301 | (4) | Cell and Molecular Laboratory    |
| CHEM 222 | (4) | Introductory Organic Chemistry 2 |
| PHGY 209 | (3) | Mammalian Physiology 1           |
| PHGY 210 | (3) | Mammalian Physiology 2           |



|            |     |                                    |
|------------|-----|------------------------------------|
| PHGY 212D1 | (1) | Introductory Physiology Laboratory |
| PHGY 212D2 | (1) | Introductory Physiology Laboratory |
| PHGY 311   | (3) | Intermediate Physiology 1          |
| PHGY 312   | (3) | Intermediate Physiology 2          |
| PHGY 313   | (3) | Intermediate Physiology 3          |
| PHGY 314   | (3) | Integrative Neuroscience           |

**Complementary Courses** (21 credits)

6 credits selected from:

|             |     |                                       |
|-------------|-----|---------------------------------------|
| BIOL 201    | (3) | Cell Biology and Metabolism           |
| or BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 373    | (3) | Biometry                              |
| or BIOL 309 | (3) | Mathematical Models in Biology        |

6 credits selected from upper level physiology courses – see approved list in Department.

9 credits selected from upper level science courses – see approved list in Department.

**MAJOR PROGRAM IN PHYSIOLOGY** (64-65 credits)

The Major Program includes, in addition to some intensive studies in Physiology, a strong core content of related biomedical sciences. Admission to the Major Program will be in U2, upon completion of the U1 required courses, and in consultation with the student's adviser.

If not previously taken CHEM 212 Introductory Organic Chemistry 1 must be completed in addition to the 64-65 program credits.

**U1 Required Courses** (18 credits)

|            |     |                                    |
|------------|-----|------------------------------------|
| BIOL 200   | (3) | Molecular Biology                  |
| BIOL 202   | (3) | Basic Genetics                     |
| CHEM 222   | (4) | Introductory Organic Chemistry 2   |
| PHGY 209   | (3) | Mammalian Physiology 1             |
| PHGY 210   | (3) | Mammalian Physiology 2             |
| PHGY 212D1 | (1) | Introductory Physiology Laboratory |
| PHGY 212D2 | (1) | Introductory Physiology Laboratory |

**U2 and U3 Required Courses** (19 credits)

|          |     |                               |
|----------|-----|-------------------------------|
| PHGY 311 | (3) | Intermediate Physiology 1     |
| PHGY 312 | (3) | Intermediate Physiology 2     |
| PHGY 313 | (3) | Intermediate Physiology 3     |
| PHGY 314 | (3) | Integrative Neuroscience      |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOC 311 | (3) | Metabolic Biochemistry        |

**Complementary Courses** (27-28 credits)

12-13 credits selected from:

|             |     |  |
|-------------|-----|--|
| BIOL 201    | (3) | Cell Biology and Metabolism              |
| or BIOC 212 | (3) | Molecular Mechanisms of Cell Function    |
| BIOL 373    | (3) | Biometry                                 |
| or BIOL 309 | (3) | Mathematical Models in Biology           |
| CHEM 203    | (3) | Survey of Physical Chemistry             |
| or CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |

|             |     |                                   |
|-------------|-----|-----------------------------------|
| ANAT 214    | (3) | Systemic Human Anatomy            |
| or ANAT 261 | (4) | Introduction to Dynamic Histology |

9 credits selected from upper level physiology courses – see approved list in Department

6 credits selected from upper level science courses – see approved list in Department

**JOINT MAJOR PROGRAM IN PHYSIOLOGY AND MATHEMATICS** (77 credits)**U1 Required Courses** (14 credits)

|             |     |                                    |
|-------------|-----|------------------------------------|
| PHGY 212D1  | (1) | Introductory Physiology Laboratory |
| PHGY 212D2  | (1) | Introductory Physiology Laboratory |
| MATH 222    | (3) | Calculus 3                         |
| MATH 247    | (3) | Linear Algebra                     |
| or MATH 223 | (3) | Linear Algebra                     |
| BIOL 200    | (3) | Molecular Biology                  |
| BIOL 309    | (3) | Mathematical Models in Biology     |

**U1 Complementary Courses** (15 credits)

9 credits selected from:

|              |     |                                       |
|--------------|-----|---------------------------------------|
| BIOL 201     | (3) | Cell Biology and Metabolism           |
| or BIOC 212  | (3) | Molecular Mechanisms of Cell Function |
| PHGY 209     | (3) | Mammalian Physiology 1                |
| and PHGY 210 | (3) | Mammalian Physiology 2                |
| or PHGY 201  | (3) | Human Physiology: Control Systems     |
| and PHGY 202 | (3) | Human Physiology: Body Functions      |

6 credits selected from:

|             |     |                                 |
|-------------|-----|---------------------------------|
| MATH 248    | (3) | Advanced Calculus 1             |
| or MATH 314 | (3) | Advanced Calculus               |
| MATH 325    | (3) | Ordinary Differential Equations |
| or MATH 315 | (3) | Ordinary Differential Equations |

**U2 Required Courses** (24 credits)

|          |     |                              |
|----------|-----|------------------------------|
| MATH 242 | (3) | Analysis 1                   |
| MATH 243 | (3) | Real Analysis                |
| MATH 323 | (3) | Probability Theory           |
| MATH 326 | (3) | Nonlinear Dynamics and Chaos |
| PHGY 311 | (3) | Intermediate Physiology 1    |
| PHGY 312 | (3) | Intermediate Physiology 2    |
| PHGY 313 | (3) | Intermediate Physiology 3    |
| PHGY 314 | (3) | Integrative Neuroscience     |

**U2 or U3 Required Courses** (6 credits)

|          |     |                                 |
|----------|-----|---------------------------------|
| MATH 437 | (3) | Mathematical Methods in Biology |
| PHYS 413 | (3) | Physical Basis of Physiology    |

**U3 Required Courses** (18 credits)

|            |       |  |
|------------|-------|--|
| BMDE 519   | (3)   | Analysis of Biomedical Systems & Signals |
| MATH 319   | (3)   | Partial Differential Equations           |
| MATH 324   | (3)   | Statistics                               |
| PHGY 461D1 | (4.5) | Experimental Physiology                  |
| PHGY 461D2 | (4.5) | Experimental Physiology                  |

**JOINT MAJOR PROGRAM IN PHYSIOLOGY AND PHYSICS** (80 credits)

This program provides a firm foundation in physics, mathematics and physiology. It is appropriate for students interested in applying methods of the physical sciences to problems in physiology and allied biological sciences.

**U1 Required Courses** (17 credits)

|             |     |                                    |
|-------------|-----|------------------------------------|
| MATH 222    | (3) | Calculus 3                         |
| PHGY 212D1* | (1) | Introductory Physiology Laboratory |
| PHGY 212D2* | (1) | Introductory Physiology Laboratory |
| PHYS 230    | (3) | Dynamics of Simple Systems         |
| PHYS 232    | (3) | Heat and Waves                     |
| PHYS 257    | (3) | Experimental Methods 1             |
| PHYS 258    | (3) | Experimental Methods 2             |

**U1 Complementary Courses** (9 credits)

|               |     |                                   |
|---------------|-----|-----------------------------------|
| MATH 223      | (3) | Linear Algebra                    |
| or MATH 247   | (3) | Linear Algebra                    |
| PHGY 209      | (3) | Mammalian Physiology 1            |
| and PHGY 210* | (3) | Mammalian Physiology 2            |
| or PHGY 201   | (3) | Human Physiology: Control Systems |
| and PHGY 202  | (3) | Human Physiology: Body Functions  |

\* The corequisite BIOL 200, BIOL 201 is waived for this program.

**U2 Required Courses** (21 credits)

|          |     |  |
|----------|-----|--|
| MATH 326 | (3) | Nonlinear Dynamics and Chaos               |
| PHGY 311 | (3) | Intermediate Physiology 1                  |
| PHGY 312 | (3) | Intermediate Physiology 2                  |
| PHGY 313 | (3) | Intermediate Physiology 3                  |
| PHGY 314 | (3) | Integrative Neuroscience                   |
| PHYS 328 | (3) | Electronics                                |
| PHYS 339 | (3) | Measurements Laboratory in General Physics |

**U2 Complementary Course** (6 credits)

|             |     |                                 |
|-------------|-----|---------------------------------|
| MATH 315    | (3) | Ordinary Differential Equations |
| or MATH 325 | (3) | Ordinary Differential Equations |

MATH 314 (3) Advanced Calculus  
or MATH 248 (3) Advanced Calculus 1

**U2 or U3 Required Courses** (6 credits)

MATH 437 (3) Mathematical Methods in Biology  
PHYS 413 (3) Physical Basis of Physiology

**U3 Required Courses** (21 credits)

BMDE 519 (3) Analysis of Biomedical Systems and Signals  
PHGY 461D1 (4.5) Experimental Physiology  
PHGY 461D2 (4.5) Experimental Physiology  
PHYS 333 (3) Thermal and Statistical Physics  
PHYS 340 (3) Electricity and Magnetism  
PHYS 446 (3) Quantum Physics

**HONOURS PROGRAM IN PHYSIOLOGY** (75 credits)

All admissions to the Honours program will be in U2, and the student must have a U1 GPA of 3.30, with no less than a B in PHGY 209 and PHGY 210. Admission to U3 requires a U2 CGPA of 3.20 with no less than a B in U2 Physiology courses. Decisions for admission to U3 will be heavily influenced by student standing in U2 courses.

The Department reserves the right to restrict the number of entering students in the Honours program. Students who do not maintain Honours standing may transfer their registration to the Major Program in Physiology.

The deadline to apply to the Honours Program is 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 CHEM 212 Introductory Organic Chemistry 1 must be completed in addition to the 75 program credits.

**Required Courses** (60 credits)

ANAT 261 (4) Introduction to Dynamic Histology  
BIOC 311 (3) Metabolic Biochemistry  
BIOL 200 (3) Molecular Biology  
BIOL 202 (3) Basic Genetics  
BIOL 301 (4) Cell and Molecular Laboratory  
CHEM 222 (4) Introductory Organic Chemistry 2  
PHGY 209 (3) Mammalian Physiology 1  
PHGY 210 (3) Mammalian Physiology 2  
PHGY 212D1 (1) Introductory Physiology Laboratory  
PHGY 212D2 (1) Introductory Physiology Laboratory  
PHGY 311 (3) Intermediate Physiology 1  
PHGY 312 (3) Intermediate Physiology 2  
PHGY 313 (3) Intermediate Physiology 3  
PHGY 314 (3) Integrative Neuroscience  
PHGY 351 (3) Research Techniques: Physiology  
PHGY 359D1 (.5) Tutorial in Physiology  
PHGY 359D2 (.5) Tutorial in Physiology  
PHGY 459D1 (3) Physiology Seminar  
PHGY 459D2 (3) Physiology Seminar  
PHGY 461D1 (4.5) Experimental Physiology  
PHGY 461D2 (4.5) Experimental Physiology

**Complementary Courses** (15 credits)

9 credits selected from:

BIOL 201 (3) Cell Biology and Metabolism  
or BIOC 212 (3) Molecular Mechanisms of Cell Function  
BIOL 373 (3) Biometry  
or BIOL 309 (3) Mathematical Models in Biology  
CHEM 203 (3) Survey of Physical Chemistry  
or CHEM 204 (3) Physical Chemistry/Biological Sciences 1

6 credits selected from upper level physiology courses – see approved list in Department.

**INTERDEPARTMENTAL HONOURS PROGRAM IN IMMUNOLOGY**, see page 277. This program offered by the Departments of Biochemistry, Microbiology and Immunology, and Physiology. Physiology students interested in the program should contact Dr. W.S. Lapp.

**12.26 Psychiatry (PSYT)**

There are no B.Sc. programs in Psychiatry, but the PSYT courses listed in the Courses section of this Calendar are considered as courses taught by the Faculty of Science.

**12.27 Psychology (PSYC)**

Stewart Biological Sciences Building, Room W8/1  
1205 Avenue Docteur Penfield  
Montreal, QC, H3A 1B1

Telephone: (514) 398-6100  
Fax: (514) 398-4896  
E-mail: [info@psych.mcgill.ca](mailto:info@psych.mcgill.ca)  
Website: [www.psych.mcgill.ca](http://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.)  
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*)  
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.)  
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*

A.G. Baker; B.A.(U.B.C.), M.A., Ph.D.(Dal.)  
Mark Baldwin; B.A.(Tor.), M.A., Ph.D.(Waterloo)  
Avi Chaudhuri; B.Sc., M.Sc.(Tor.), Ph.D.(Berk.) (*James McGill Professor*)  
Don C. Donderi; B.A., B.Sc.(Chic.), Ph.D.(C'neil)  
Richard F. Koestner; B.A., Ph.D.(Roch.)  
John Lydon; B.A.(Notre Dame), M.A., Ph.D.(Wat.)  
James C. Maccougall; 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*

John R.Z. Abela; B.A.(Brown), M.A., Ph.D.(Penn.)  
Ian F. Bradley; B.Sc., M.Sc.(Tor.), Ph.D.(Wat.) (part-time)  
Baerbel Knaeuper; Diploma, Dr. phil. (U. of Mannheim), Dr. phil. habil. (Free University of Berlin)

Daniel J. Levitin; A.B.(Stan.), M.S., Ph.D.(Oregon) (*Bell Professor of Psychology and E-Commerce*)  
 Karim Nader; B.Sc., Ph.D.(Tor.)  
 Zeev Rosberger; B.Sc.(McG.), M.A., Ph.D.(C' dia) (part-time)  
 Debra Titone; B.A.(NY), M.A., Ph.D.(SUNY, Binghamton)

#### 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  
 Family Medicine: Vilma Patel  
 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

M. Bruck; B.A.(Wheaton), M.A., 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.)  
 L.A. Petitto; B.Sc.(New Jersey), M.A. (New York), Ph.D.(Harv.)  
 M. Shapiro; B.A.(Colly), M.A., Ph.D.(Johns H.)  
 D. Sookman; B.A. McG.), M.A.(Guelph), Ph.D.(C' dia)  
 M. Spevack; B.Sc.(McG.), M.A.(Dal.), Ph.D.(McG.)  
 A. Surkis; Ph.D.(Montr.)  
 P. Zelazo; B.A.(American), M.S.(N. Carolina), Ph.D.(Wat.)

#### Part-time Appointments

J. Armony; B.Sc.(Buenos Aires), M.Sc., Ph.D.(NYU)  
 Veronique Bohbot; B.A.(McG.), M.A., Ph.D.(Ariz.)  
 Judith LeGallais; B.A., M.A., Ph.D.(McG.)  
 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)  
 Camilo Zacchia; B.A.(McG.), M.S.(Florida State), 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 "Psychology (PSYC)" on page 114.**

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 25, 2003 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.

(For students entering the Psychology program in the winter term 2004, there will be an Information Meeting on December 17th at 11:30 in Room N2/2D of the Stewart Biology Building).

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](http://www.psych.mcgill.ca/ugrad/ugradm.htm)

**MINOR PROGRAM 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 consult the Psychology listing in the 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 PSYC 204 or equivalent, see [section 3.6.1 "Course Overlap"](#).

**Complementary Courses (24 credits)**

at least 3, but no more than 6, credits selected from:

- PSYC 211 (3) Introductory Behavioural Neuroscience
- PSYC 212 (3) Perception
- PSYC 213 (3) Cognition
- PSYC 215 (3) Social Psychology

18-21 credits selected from 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 PSYC 204. Those who have not taken the recommended collegial level biology must take BIOL 111 or BIOL 112, and those who have not taken Introductory Psychology in college must take PSYC 100.

**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)**

- PSYC 301 (3) Learning
- PSYC 308 (3) Behavioural Neuroscience 1
- PSYC 310 (3) Human Intelligence
- PSYC 311 (3) Human Cognition and the Brain
- PSYC 317 (3) Genes and Behaviour
- PSYC 318 (3) Behavioural Neuroscience 2
- PSYC 334 (3) Computer Simulation - Psychological Processes
- PSYC 335 (3) Formal Models: Psychological Processes
- PSYC 336 (3) Measurement of Psychological Processes
- PSYC 340 (3) Psychology of Language
- PSYC 341 (3) The Psychology of Bilingualism
- PSYC 342 (3) Hormones and Behaviour
- PSYC 352 (3) Laboratory in Cognitive Psychology
- PSYC 353 (3) Laboratory in Human Perception
- PSYC 403 (3) Modern Psychology in Historical Perspective
- PSYC 406 (3) Psychological Tests and Measurements
- PSYC 410 (3) Special Topics in Neuropsychology
- PSYC 413 (3) Cognitive Development
- PSYC 427 (3) Sensorimotor Behaviour
- PSYC 451 (3) Human Factors Research and Techniques

- PSYC 470 (3) Memory and Brain
- PSYC 472 (3) Scientific Thinking and Reasoning
- PSYC 503 (3) Computational Psychology
- PSYC 505 (3) The Psychology of Pain
- PSYC 510 (3) Statistical Analysis of Tests
- PSYC 522 (3) Neurochemistry and Behaviour
- PSYC 526 (3) Advances in Visual Perception
- PSYC 529 (3) Music Cognition
- PSYC 531 (3) Structural Equation Models
- PSYC 532 (3) Cognitive Science
- PSYC 536 (3) Correlational Techniques

**List B (Social, Health and Developmental Psychology)**

- PSYC 304 (3) Child Development
- PSYC 316 (3) Psychology of Deafness
- PSYC 331 (3) Inter-Group Relations
- PSYC 332 (3) Introduction to Personality
- PSYC 333 (3) Personality and Social Psychology
- PSYC 337 (3) Introduction: Abnormal Psychology 1
- PSYC 338 (3) Introduction: Abnormal Psychology 2
- PSYC 343 (3) Language Acquisition in Children
- PSYC 351 (3) Research Methods in Social Psychology
- PSYC 408 (3) Principles of Cognitive Behaviour Therapy
- PSYC 412 (3) Deviations: Child Development
- PSYC 414 (3) Social Development
- PSYC 416 (3) Advanced Topics in Child Development
- PSYC 429 (3) Health Psychology
- PSYC 436 (3) Human Sexuality and its Problems
- PSYC 471 (3) Human Motivation
- PSYC 473 (3) Social Cognition and the Self
- PSYC 474 (3) Interpersonal Relationships
- PSYC 491D1 (3) Advanced Study: Behavioural Disorders and
- PSYC 491D2 (3) Advanced Study: Behavioural Disorders
- PSYC 511 (3) Infant Competence
- PSYC 530 (3) Applied Topics in Deafness
- PSYC 533 (3) International Health Psychology
- PSYC 534 (3) Community Psychology
- PSYC 535 (3) Advanced Topics in Social Psychology

**Unclassified Courses**

- PSYC 450D1 (3) Research Project and Seminar and
- PSYC 450D2 (3) Research Project and Seminar
- PSYC 492 (3) Special Topics Seminar 1
- PSYC 493 (3) Special Topics Seminar 2
- PSYC 495 (3) Psychology Research Project

**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 Advisor of the Psychology Department.

**U1 Required Courses (12 credits)**

- PSYC 211 (3) Introductory Behavioural Neuroscience
- PSYC 212 (3) Perception
- PSYC 213 (3) Cognition
- PSYC 215 (3) Social Psychology

Note: PSYC 100 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 PROGRAM IN PSYCHOLOGY (54 credits)**

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)**

PSYC 211 (3) Introductory Behavioural Neuroscience  
 PSYC 212 (3) Perception  
 PSYC 213 (3) Cognition  
 PSYC 215 (3) Social Psychology

Note: PSYC 100 may be taken as a corequisite with these basic courses.

**U1 or U2 Required Course (3 credits)**

PSYC 305 (3) Statistics for Experimental Design

**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 PROGRAM IN PSYCHOLOGY (54 credits)**

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: PSYC 204, PSYC 211, PSYC 212, PSYC 213 and PSYC 215. Students who have been exempted from PSYC 204 due to previous courses completed in CEGEP are advised to complete PSYC 305 in their U1 year. Once in the Honours Program, the student must obtain a GPA of 3.00 in the U2 year in order to continue in the program for U3. 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 the relevant term.

Students should note that awarding of the Honours degree will depend on both cumulative grade point average and a minimum grade of B on PSYC 380D1/PSYC 380D2, PSYC 482, PSYC 483. "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)**

PSYC 211 (3) Introductory Behavioural Neuroscience  
 PSYC 212 (3) Perception  
 PSYC 213 (3) Cognition  
 PSYC 215 (3) Social Psychology

Note: PSYC 100 may be taken as a corequisite with these basic courses.

**U1 or U2 Required Course (3 credits)**

PSYC 305 (3) Statistics for Experimental Design

**U2 Required Courses (6 credits)**

PSYC 380D1 (3) Honours Research Project and Seminar  
 PSYC 380D2 (3) Honours Research Project and Seminar

**U3 Required Courses (6 credits)**

PSYC 482 (3) Advanced Honours Seminar 1  
 PSYC 483 (3) Advanced Honours Seminar 2

**Complementary Courses (27 credits)**

6 credits to be selected from\*:  
 PSYC 481D1 (3) Honours Thesis Research  
 PSYC 481D2 (3) Honours Thesis Research  
 PSYC 492 (3) Special Topics Seminar 1  
 PSYC 493 (3) Special Topics Seminar 2  
 PSYC 495 (3) Psychology Research Project  
 PSYC 496 (3) Seniors Honours Research 1  
 PSYC 497 (3) Seniors Honours Research 2  
 PSYC 498D1 (3) Senior Honours Research  
 PSYC 498D2 (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 3.6.2](#).

**12.28 Science for Teachers**

Rutherford Physics Building  
 3600 University Street  
 Montreal, QC, H3A 2T8

Fax: (514) 398-8434

E-mail: [bscbcd@physics.mcgill.ca](mailto:bscbcd@physics.mcgill.ca)

*Coordinator - Science* — R. Harris

*Coordinator - Education* — B. Alters

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. Those who complete a B.Sc. which includes the Minor in Education (see below) will have completed a significant part of the requirements for the McGill B.Ed. degree, and should be able to complete the B.Ed. within one year after graduation from Science. Students without the Minor face a heavier load, but, in principle, can also complete their B.Ed. in a year. Students who decide to apply for admission to Education after obtaining a B.Sc. should be eligible for Advanced Standing credit; for details, see the Faculty of Education section "[Advanced Standing/Transfer Credits](#)" on [page 139](#).

**MINOR IN EDUCATION FOR SCIENCE STUDENTS (18 credits)***Program Adviser —*

Mrs. Cheryl Savage, Department of Integrated Studies,  
Faculty of Education

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 the Minor in Education will have completed a substantial number of the necessary credits and might be able to complete a B.Ed. in less than two additional years.

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)**

EDEC 402 (3) Media, Technology and Education  
EDEM 405 (3) Policy issues in Quebec Education  
EDPE 300\* (3) Educational Psychology  
EDPI 309 (3) Exceptional Students

\* Students should consult the Program Adviser for clarification on the prerequisite for EDPE 300.

**Complementary Courses (6 credits)**

3 credits from:

EDER 400 (3) Philosophical Foundations of Education  
EDER 398 (3) Philosophy of Catholic Education

3 credits from:

EDEC 410 (3) Multi-cultural/Multi-racial Class  
EDER 464 (3) Intercultural Education  
EDEE 441 (3) First Nations and Inuit Education

**CONCURRENT B.SC./B.ED. PROGRAM (135 credits)**

The Concurrent B.Sc./B.Ed. Program described below applies only to students who were already registered in it as of September 2002.

**Admission into the Concurrent B.Sc./B.Ed. program is closed for September 2003, because the program is under review and revision. A new program may be offered in September 2004, subject to University and Ministry of Education (MEQ) approval.**

Science students who might want to enter the program in 2004-05 should seek advice about appropriate course choices for 2003-04 by visiting the B.Sc./B.Ed. Web site at [www.physics.mcgill.ca/~bscbcd](http://www.physics.mcgill.ca/~bscbcd) or by contacting Professor Dik Harris, e-mail: [dik.harris@mcgill.ca](mailto:dik.harris@mcgill.ca).

The Concurrent B.Sc./B.Ed. is another option for Science students which 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.

The two components of the Concurrent Program are the B.Ed. General Secondary Two-Subject Option Program and one of the B.Sc. Major Programs in Two Subjects 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 two-subject combinations have been approved for the Concurrent Program:

- biology and chemistry
- biology and geography
- biology and mathematics
- chemistry and physics
- mathematics and chemistry
- mathematics and physics.

**Bachelor of Education General Secondary Two-Subject Option Program (120 credits)**

The aim of the B.Ed. in Secondary Education is to prepare teachers for the secondary school level through a program of academic studies in two subject areas 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 two academic subjects must correspond to one of the six combinations listed above.

A full description of the B.Ed. Secondary Program can be found in the Faculty of Education under "**Concurrent Bachelor of Science (Major in Two Subjects for Teachers) and Bachelor of Education (General Secondary Two-Subject Option) Program**" on page 149. In summary, it consists of the following:

**Academic components (57 credits):** in the present case these courses will be selected from the lists of required and complementary courses in the B.Sc. component of the Concurrent Program, and will count towards both degrees.

**Professional components (57 credits):** these include professional seminars, field experiences, foundation courses, pedagogy courses, and pedagogical support courses. The following 18 credits can be included as electives in the B.Sc. component of the Concurrent program, and will count towards both degrees: EDEM 405, EDPI 309, EDPE 300, EDER 400, EDEC 402, and EDEC 410.

**Electives (6 credits).****Bachelor of Science, Major Program in Two Subjects for Teachers (90 credits)**

These B.Sc. programs are designed specifically as the Science component of the Concurrent B.Sc./B.Ed. Program. Six combinations of two science subjects are approved for the Concurrent Program. These combinations are chosen to reflect compulsory subjects taught in secondary schools and common pairings of subjects taught by secondary school teachers. They also honour the requirement of the Ministère de l'éducation to train teachers in two subjects, with the possibility of a third subject which supports or is related to the other two, since mathematics is a necessary support for physics and chemistry.

The general structure of these B.Sc. programs is as follows:

**Required and complementary courses (64-67 credits).**

The details of these major programs are given below. Note that 57 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 (23-26 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.

- EDEC 402 (3) Media, Technology and Education  
 EDEC 410 (3) Multi-cultural/Multi-racial Class  
 or EDER 464(3) Intercultural Education  
 or EDEE 441(3) First Nations and Inuit Education  
 EDEM 405 (3) Policy issues in Quebec Education  
 EDPE 300 (3) Educational Psychology  
 EDPI 309 (3) Exceptional Students  
 EDER 400 (3) Philosophical Foundations of Education  
 or EDER 398(3) Philosophy of Catholic Education

#### MAJOR PROGRAM IN BIOLOGY AND CHEMISTRY FOR TEACHERS (66 credits)

##### Required Science courses (54 credits)

- BIOL 210 (3) Perspectives of Science  
 MATH 222 (3) Calculus 3  
 MATH 203 (3) Principles of Statistics 1  
 Biology List A  
 Chemistry List A

##### Complementary Science courses (12 credits)

- Biology List B  
 Geoscience List

#### MAJOR PROGRAM IN BIOLOGY AND GEOGRAPHY FOR TEACHERS (68 credits)

##### Required Science courses (44 credits)

- BIOL 210 (3) Perspectives of Science  
 CHEM 212\* (4) Introductory Organic Chemistry 1  
 MATH 203 (3) Principles of Statistics 1  
 Biology List A  
 Geography List A

\*Students who have the CEGEP equivalent of this course must replace it with an additional course chosen from Biology List B.

##### Complementary Science courses (24 credits)

- Biology List C  
 Geography List B  
 Geoscience List

#### MAJOR PROGRAM IN BIOLOGY AND MATHEMATICS FOR TEACHERS (68 credits)

##### Required Science courses (50 credits)

- BIOL 210 (3) Perspectives of Science  
 CHEM 212\* (4) Introductory Organic Chemistry 1  
 Biology List A  
 Mathematics List A

\*Students who have the CEGEP equivalent of this course must replace it with an additional course chosen from Biology List B.

##### Complementary Science courses (18 credits)

6 additional credits in Biology or related disciplines, at 300-level or above, approved by the Biology Department.

Mathematics List C

3 additional credits in either Mathematics or related disciplines, approved by the Mathematics Department, or in Biology or related disciplines, approved by the Biology Department.

#### MAJOR PROGRAM IN CHEMISTRY AND PHYSICS FOR TEACHERS (65 credits)

##### Required Science courses (62 credits)

- BIOL 210 (3) Perspectives of Science  
 Mathematics List B  
 Chemistry List A  
 Physics List A

##### Complementary Science courses (3 credits)

- Geoscience List

#### MAJOR PROGRAM IN MATHEMATICS AND CHEMISTRY FOR TEACHERS (64-65 credits)

##### Required Science courses (47 credits)

- BIOL 210 (3) Perspectives of Science  
 Mathematics List A  
 Chemistry List A

##### Complementary Science courses (17-18 credits)

- Mathematics List C  
 Chemistry List B

#### MAJOR PROGRAM IN MATHEMATICS AND PHYSICS FOR TEACHERS (66 credits)

##### Required Science courses (57 credits)

- BIOL 210 (3) Perspectives of Science  
 Mathematics List A  
 Physics List A and List B

##### Complementary Science courses (9 credits)

- Mathematics List C

#### COURSE LISTS USED IN THE VARIOUS OPTIONS

##### Biology List A: (22 credits)

- BIOL 200 (3) Molecular Biology  
 BIOL 201 (3) Cell Biology and Metabolism  
 BIOL 202 (3) Basic Genetics  
 BIOL 205 (3) Biology of Organisms  
 BIOL 206 (3) Methods in Biology of Organisms  
 BIOL 208 (3) Introduction to Ecology  
 BIOL 301 (4) Cell and Molecular Laboratory

##### Biology List B: (9 credits)

to be selected from the following:

- BIOL 304 (3) Evolution  
 BIOL 370 (3) Human Genetics Applied  
 PHGY 201 (3) Human Physiology: Control Systems  
 or PHGY 209 (3) Mammalian Physiology 1

##### Biology List C: (6 credits)

to be selected from the following:

- BIOL 465 (3) Conservation Biology  
 BIOL 331 (3) Ecology/Behaviour Field Course  
 or BIOL 334 (3) Applied Tropical Ecology  
 or BIOL 335 (3) Marine Mammals  
 or BIOL 336 (3) Marine Aquaculture  
 or BIOL 337 (3) Ecology and Behaviour of Fishes

##### Chemistry List A: (23 credits)

- CHEM 150 (3) World of Chemistry: Food  
 or CHEM 160 (3) World of Chemistry: Technology  
 or CHEM 170 (3) World of Chemistry: Drugs  
 or CHEM 180 (3) World of Chemistry: Environment  
 CHEM 203\* (3) Survey of Physical Chemistry  
 or CHEM 213\* (3) Introductory Physical Chemistry  
 CHEM 212\* (4) Introductory Organic Chemistry 1  
 or CHEM 212\* (4) Introductory Organic Chemistry 2  
 CHEM 257D1 (2) Introductory Analytical Chemistry  
 and CHEM 257D2(2) Introductory Analytical Chemistry  
 CHEM 281 (3) Inorganic Chemistry 1  
 CHEM 381 (3) Chemistry of Transition Elements  
 CHEM 350 (3) Earth, Air, Fire, Water  
 or CHEM 307 (3) Analytical Chemistry of Pollutants

\*students who have the CEGEP equivalent of any one of these courses must replace it with one course chosen from the block CHEM 273 through BIOC 404 in List B (for CHEM 203/ CHEM 213) or from the block CHEM 302 through CHEM 402 (for CHEM 212/CHEM 222).

##### Chemistry List B: (8 or 9 credits)

to be selected from the following, subject to the requirement that at least one course must include a laboratory.

- BIOC 404 (3) Biophysical Chemistry  
 CHEM 273 (1) Chemical Kinetics  
 CHEM 302 (3) Introductory Organic Chemistry 3

|             |     |   |
|-------------|-----|---|
| CHEM 345    | (3) | Molecular Properties and Structure 1    |
| CHEM 355    | (3) | Molecular Properties and Structure 2    |
| CHEM 362    | (2) | Advanced Organic Chemistry Laboratory   |
| CHEM 363    | (2) | Physical Chemistry Laboratory 1         |
| CHEM 365    | (2) | Statistical Thermodynamics              |
| CHEM 367    | (3) | Instrumental Analysis 1                 |
| CHEM 377    | (3) | Instrumental Analysis 2                 |
| CHEM 392    | (3) | Integrated Inorganic/Organic laboratory |
| CHEM 393    | (2) | Physical Chemistry Laboratory 2         |
| CHEM 402    | (3) | Advanced Bio-organic Chemistry          |
| CHEM 455    | (3) | Introductory Polymer Chemistry          |
| CHEM 531    | (3) | Chemistry of Inorganic Materials        |
| CHEM 543    | (3) | Chemistry of Pulp and Paper             |
| CHEM 556    | (3) | Advanced Quantum Mechanics              |
| CHEM 567    | (3) | Chemometrics: Analysis of Chemical Data |
| CHEM 591    | (3) | Advanced Coordination Chemistry         |
| EPSC 210    | (3) | Introductory Mineralogy                 |
| or EPSC 220 | (3) | Principles of Geochemistry              |
| or EPSC 580 | (3) | Aqueous Geochemistry                    |
| or EPSC 542 | (3) | Chemical Oceanography                   |

**Geography List A:** (12 credits)

|          |     |                                      |
|----------|-----|--------------------------------------|
| GEOG 201 | (3) | Introductory Geo-Information Science |
| GEOG 203 | (3) | Environmental Systems                |
| GEOG 216 | (3) | Geography of the World Economy       |
| GEOG 272 | (3) | Earth's Changing Surface             |

**Geography List B:** (15 credits)

to be selected from the following:

|             |     |   |
|-------------|-----|---|
| GEOG 200    | (3) | Geographical Perspectives: World Environmental Problems |
| GEOG 302    | (3) | Environmental Management 1                              |
| GEOG 305    | (3) | Soils and Environment                                   |
| GEOG 306    | (3) | Raster Geo-Information Science                          |
| or GEOG 308 | (3) | Principles of Remote Sensing                            |
| GEOG 321    | (3) | Climatic Environments                                   |
| GEOG 322    | (3) | Environmental Hydrology                                 |
| GEOG 350    | (3) | Ecological Biogeography                                 |
| GEOG 372    | (3) | Running Water Environments                              |
| GEOG 408    | (3) | Geography of Development                                |
| GEOG 410    | (3) | Geography of Underdevelopment: Current Problems         |
| GEOG 495    | (3) | Field studies - Physical Geography                      |
| or GEOG 398 | (3) | Field studies in Human Geography                        |
| or GEOG 494 | (3) | Urban Field Studies                                     |
| or GEOG 496 | (3) | Geographical Excursion                                  |
| or GEOG 497 | (3) | Ecology of Coastal Waters                               |
| or GEOG 499 | (3) | Subarctic Field Studies                                 |

**Geoscience List:** (3 credits)

to be selected from the following:

|          |     |                                     |
|----------|-----|-------------------------------------|
| ATOC 210 | (3) | Introduction to Atmospheric Science |
| ATOC 220 | (3) | Introduction to Oceanic Sciences    |
| ATOC 315 | (3) | Water in the Atmosphere             |
| EPSC 200 | (3) | The Terrestrial Planets             |
| EPSC 201 | (3) | Understanding Planet Earth          |
| EPSC 320 | (3) | Elementary Earth Physics            |

**Mathematics List A:** (21 credits)

|          |     |                                 |
|----------|-----|---------------------------------|
| MATH 222 | (3) | Calculus 3                      |
| MATH 235 | (3) | Basic Algebra                   |
| MATH 236 | (3) | Linear Algebra                  |
| MATH 314 | (3) | Advanced Calculus               |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 323 | (3) | Probability Theory              |
| MATH 324 | (3) | Statistics                      |

**Mathematics List B:** (15 credits)

|          |     |                            |
|----------|-----|----------------------------|
| MATH 203 | (3) | Principles of Statistics 1 |
| MATH 222 | (3) | Calculus 3                 |
| MATH 223 | (3) | Linear Algebra             |
| MATH 314 | (3) | Advanced Calculus          |

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

**Mathematics List C:** (9 credits)

to be selected from the following

|          |     |                                       |
|----------|-----|---------------------------------------|
| COMP 202 | (3) | Introduction to Computing 1           |
| COMP 203 | (3) | Introduction to Computing 2           |
| MATH 242 | (3) | Analysis 1                            |
| MATH 243 | (3) | Real Analysis                         |
| MATH 317 | (3) | Numerical Analysis                    |
| MATH 318 | (3) | Mathematical Logic                    |
| MATH 338 | (3) | History and Philosophy of Mathematics |
| MATH 348 | (3) | Topics in Geometry                    |

**Physics List A:** (21 credits)

|             |     |                            |
|-------------|-----|----------------------------|
| PHYS 230    | (3) | Dynamics of Simple Systems |
| PHYS 232    | (3) | Heat and Waves             |
| PHYS 241    | (3) | Signal Processing          |
| PHYS 257    | (3) | Experimental Methods 1     |
| PHYS 340    | (3) | Electricity and Magnetism  |
| PHYS 342    | (3) | Electromagnetic Waves      |
| or PHYS 434 | (3) | Optics                     |
| PHYS 446    | (3) | Quantum Physics            |

**Physics List B:** (12 credits)

|              |     |                              |
|--------------|-----|------------------------------|
| PHYS 258     | (3) | Experimental Methods 2       |
| PHYS 342*    | (3) | Electromagnetic Waves        |
| or PHYS 434* | (3) | Optics                       |
| PHYS 436     | (3) | Modern Physics               |
| PHYS 439     | (3) | Laboratory in Modern Physics |

\* Both of PHYS 342 and PHYS 434 are required for the Mathematics and Physics option.

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## 12.29 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 Program in Management, see page 278](#).

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 176, 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: ACCT 210, MARKT 360 and either MGCR 320 or ORGB 321, BUSA 465, MGPO 562, BUSA 466.

**MINOR IN TECHNOLOGICAL ENTREPRENEURSHIP FOR SCIENCE STUDENTS** (18 credits)**Required Courses** (15 credits)

|          |     |  |
|----------|-----|--|
| ACCT 210 | (3) | Accounting for Managers                |
| MRKT 360 | (3) | Marketing of Technology                |
| BUSA 465 | (3) | Technological Entrepreneurship         |
| MGPO 562 | (3) | Seminar in Organizational Strategy     |
| BUSA 466 | (3) | Technological Entrepreneurship Project |

**Complementary Courses** (3 credits)

one of the following courses:

|          |     |                          |
|----------|-----|--------------------------|
| MGCR 320 | (3) | Managing Human Resources |
| ORGB 321 | (3) | Leadership               |