
1 The Faculty

1.1 Location

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

Telephone: (514) 398-4210

Faculty Website:

Student Affairs Office Website:

The Student Affairs Office and thSharon Bezeau; B.A.(Tor.), M.A.(C'dia)

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

Records
Chief Investigator
Senior Advisor

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.). Admi

3.3 Cumulative Grade Point Average (CGPA)

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.

3.6.4 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 labo-

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.

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 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.

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;

- 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 subm

- 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

11.5 Joint Honours Programs

11.6 Minor Programs

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.

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 (Course Calendars) in July for details.]

Required Courses (39 credits)

* 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 biologically oriented courses (BOC) in the following list:

BIOL 300, BIOL 301, BIOL 303,

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*

Students should consult undergraduate advisers in both departments.

Required Courses (67 credits)

Complementary Courses (12 credits)

Complementary Course (3 credits)

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)

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 w

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
Website: www.medicine.mcgill.ca/biochem

Chair — David Y. Thomas

Emeritus Professors

Angus F. Graham; M.Sc.(Tor.), Ph.D., D.Sc.(Edin.), F.R.S.C.
Rose M. Johnstone; B.Sc., Ph.D.(McG.), F.R.S.C.
Samuel Solomon; M.Sc., Ph.D.(McG.), F.R.S.C.
Theodore L. Sourkes; M.Sc.(McG.), Ph.D.(Corn.), F.R.S.C.

Professors

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*);

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)

U1 Complementary Courses (9 credits)

U2 Required Courses (23 credits)

U2 Complementary Courses (3 credits)

U3 Required Courses (15 credits)

U3 Complementary Courses (6 credits)

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

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 fo

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

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 307L 350aquatic
BIOL 441 or BIOL 442, BIOL 560; COMP 202 or COMP 273

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	

12.6 Chemistry (CHEM)

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

Website: www.mcgill.ca/chemistry

Departmental Office: Room 322. Telephone: (514) 398-6999
Student Advisory Office: Room 304. Telephone: (514) 398-3653
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.)

Richard S. Farber; B.Sc.(McG.)

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

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

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.A.(W.Ont.), 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 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 suit-

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.

MINOR PROGRAM IN COMPUTER SCIENCE (24 credits)

[Program revisions are under consideration for September 2003. Go to 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

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 (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

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

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.)

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)

Complementary Courses (27 credits)

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

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 (Course Calendars) in July for details.]

Required Courses (7 credits)

Complementary Courses (11 credits)

MINOR PROGRAM IN GEOCHEMISTRY (25 credits)

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

Required Courses (10 credits)

Complementary Courses (15 credits)

MAJOR PROGRAM IN EARTH AND PLANETARY SCIENCES

(66 credits)

[Program revisions are under consideration for September 2003. Go to 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)

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)

HONOURS PROGRAM IN EARTH SCIENCES

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 (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.htmlE-mail: 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

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.-1.1259 TD-0.0012 Tc-0ic-01.-1.125, we0.00i89.la wide .1259ere a05ents may purter9 -1.

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)**Complementary Courses (42 credits)**

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) .**Complementary Courses (9 credits)**

Enrolment of McGill students is limited to 25 students. In addition to on environm

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

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

Geography courses of most interest to Science students:

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

U3 Required Courses (18 credits)

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 a(4tembeb-c-0.0o[lieae300])T5-0.0012 TuNf64(com Tc-0.0028 Tw

U3 Complementary Courses (6 credits)

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 (Course Calendars) in July for details.]

Required Courses (9 credits)

Complementary Courses (9 credits)

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.

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^e cycle (Paris VI)
 (*joint appoint. with Physics*)
 David Wolfson; M.Sc.(Natal), Ph.D.(Purdue)
 Keith J. Worsley; B.Sc., M.Sc., Ph.D.(Auckland)
 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*),

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

FACULTY PROGRAM IN MATHEM

JOINT MAJOR PROGRAM IN MATHEMATICS AND

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)

Lyman Duff Medical Sciences Building, Room 511
3775 University Street
Montreal, QC H3A 2B4

Telephone: (514) 398-3915

Facsimile: (514) 398-7052

E-mail: office.microimm@mcgill.ca

Website: www.mcgill.ca/microimm

Chair — Greg J. Matlashewski

Emeritus Professor

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

Professors

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: Gerarld 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. Microbiol6 Tc-0asiiifoetoS -1. gmW

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)

U1, U2 or U3 Required Statistics Courses (3 credits)

U2 Required Courses (21 credits)

U3 Required Courses (21 credits)

Complementary Courses (3 credits)

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)

U1, U2 or U3 Required Statistics Courses (3 credits)

U2 Required Courses (21 credits)

U3 Required Courses (9 credits)

Complementary Courses (9 credits)

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

Students interested in immunol

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

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.

12.24 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
Website: 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'nell)
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*)

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

U2 Required Courses (18 credits)

U2 or U3 Required Courses (6 credits)

U3 Required Courses (15 credits)

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.

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)

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)

U2 Required Courses (24 credits)

U3 Required Courses (6 credits)

U3 Complementary Courses (21 credits)

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 students

O d e n e a d e m i c c a r e e a t t h o u g h t h e p r o g r a m i s o p t i m i z e d f o r s t u d e n t s

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)

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.

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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

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

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 Orłowski; B.Sc.(McG.), M.Sc., Ph.D.(Queen's) (*James*

McGill Professor)

Premysl Ponka; M.D., Ph.D.(Prague)

Alvin Shrier; B.Sc.(C'dia), Ph.D.(Dal.)

- 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

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U2 Required Courses (24 credits)**U2 or U3 Required Courses (6 credits)****U3 Required Courses (18 credits)****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)**U1 Complementary Courses (9 credits)****U2 Required Courses (21 credits)****U2 Complementary Course (6 credits)**

U2 or U3 Required Courses (6 credits)

U3 Required Courses (21 credits)

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. Appli-

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)

FACULTY, MAJOR, HONOURS PROGRAMS IN PSYCHOLOGY

Recommended Background

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

towards both the B.Sc. and the B.Ed. components of the Concurrent Program.

**MAJOR PROGRAM IN BIOLOGY AND CHEMISTRY
FOR TEACHERS** (66 credits)
Required Science courses (54 credits)

Complementary Science courses (12 credits)

- 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

Geoscience List: (3 credits)

Mathematics List A: (21 credits)

Mathematics List B: (15 credits)

Mathematics List C: (9 credits)

Physics List A: (21 credits)

Physics List B: (12 credits)

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)

Complementary Courses (3 credits)