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All courses in this Calendar will be offered in 2001-02 unless a ● appears to the left of the course number. No description will appear after the title if the course is not given in the current year, descriptions can usually be found in preceding Calendars.

The letters which form part of course numbers have the following significance:

A – fall term
B – winter term
D – fall term and winter term

C – summer session courses starting in May
L – summer session courses starting in June
T – summer session courses starting in July

E – winter term and summer session
G – summer session and fall term
H – fall term, winter term and summer session
J – winter term, summer session and fall term
K – summer session, fall term and winter term
N – winter term and fall term

# 1 Agricultural and Biosystems Engineering

Department of Agricultural and Biosystems Engineering
Macdonald Campus
21,111 Lakeshore Road
Sainte-Anne de Bellevue, Q CH9X 3V9
Canada

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Fax: (514) 398-8387
Email: raghavan@macdonald.mcgill.ca
Website: http://www.agrenv.mcgill.ca/agreng

*Chair* — G.S.V. Raghavan

## 1.1 Staff

*Emeritus Professor*
R.S. Broughton; B.S.A., B.A.Sc.(Tor.), S.M.(M.I.T.), Ph.D.(McG.), LL.D.(Dal.)

*Professors*
S. Barrington; B.Sc.(Agr. Eng.), Ph.D.(McG.)
R. Kok; B.E.Sc., Ph.D.(W.Ont.)
C.A. Madramootoo; B.Sc.(Agr. Eng.), M.Sc., Ph.D.(McG.) *(James McGill Professor)*
E. McKyes; B.Eng., M.Eng., Ph.D.(McG.)
S.O. Prasher; B.Tech, M.Tech.(Punj.), Ph.D.(Br.Col.)
G.S.V. Raghavan; B.Eng.(B'lore), M.Sc.(Guelph), Ph.D.(Colo.St.)

*Associate Professors*
E.R. Norris; B.S.A.(Tor.), M.Sc.(Guelph), Ph.D.(Mich. St.)
J. Sheppard; B.Sc.(Eng.)(Guelph), M.E.Sc.(W.Ont.), Ph.D.(McG.)

*Brace Centre for Water Resources Management*
*Associate Professor*
R.B. Bonnell; B.Sc.(Geo.), B.Sc.(Agr.Eng.), M.Sc., Ph.D.(McG.)

*Assistant Professors*
S. Babarutsi; B.Sc.(Agr.Eng.), M.Eng., Ph.D.(McG.)
(Special Category, Part-time)
J.A. Landry; B.Sc.(Agr.Eng.), Ph.D.(McG.)
M.O. Ngadi; B.Eng.(Agr.Eng.), M.A.Sc., Ph.D.(Dal.Tech.)

*Auxiliary Professors*
N.B. McLaughlin, B. Paterson, A. Shady, G. Sunahara, C. Vigneault

*Research Associates*
P. Enright, V. Orsat

## 1.2 Programs Offered

The Department offers facilities for research in the areas of biosystems engineering, agricultural structures, plant and animal environment, hydrology, irrigation, drainage, farm water supply for people and livestock, water quality, waste management, environmental pollution from agrochemicals, bio-remediation of industrial contaminated sites, agricultural machinery, soil-machine mechanics, computers in agriculture, artificial intelligence, machine vision, control systems, expert systems, precision agriculture, post-harvest technology, food processing and fermentation engineering leading to the degrees of Master of Science and Doctor of Philosophy.

The interdisciplinary nature of agricultural and biosystems engineering often requires candidates for higher degrees to work in association with, or attend courses given by a number of other departments at both the McGill University Macdonald Campus and Downtown Campus.

## 1.3 Admission Requirements

Candidates for M.Sc. and Ph.D. degrees should indicate in some detail their fields of special interest when making application for admission. An equivalent cumulative grade point average of 3.0/4.0 is required at the Bachelor's level. Experience after the undergraduate degree is an additional asset.

## 1.4 Application Procedures

Applications for admission and all supporting documents must be sent directly to:

Student Affairs Office (Graduate Studies)
Macdonald Campus of McGill University
21,111 Lakeshore
Sainte-Anne de Bellevue, Q CH9X 3V9
Canada

Telephone: (514) 398-7925
Fax: (514) 398-7968
Email: grad@macdonald.mcgill.ca

Applications will be considered upon receipt of a signed and completed application form, $60 application fee, all official transcripts, two signed original letters of reference on official letterhead of originating institution, and (if required) proof of competency in oral and written English by appropriate exams.

**Deadlines** – For **international students**, complete applications with supporting documents must reach the Student Affairs Office (Graduate Studies) at Macdonald Campus at least **eight months** prior to the intended start of program. May 1 for January (winter); September 1 for May (summer); January 1 for September (fall). For **domestic students**, it is recommended that complete applications with supporting documents reach the Office at least **six months** (but definitely no later than **three full months)** in advance of the intended start of program – July 1 for January (winter), November 1 for summer, March 1 for September (fall).

**Application Fee (non-refundable)** – *A fee of $60 Canadian* must accompany each application (including McGill students), *otherwise it cannot be considered.* This sum must be remitted using one of the following methods:

1. **Certified** personal cheque in Cdn.$ drawn on a Canadian bank;
2. **Certified** personal cheque in U.S.$ drawn on a U.S. bank;
3. Canadian Money order in Cdn.$;
4. U.S. Money Order in U.S.$;
5. Bank draft in Cdn.$ drawn on a Canadian bank;
6. Bank draft in U.S.$ drawn on a U.S. bank; negotiable in Canada
7. Credit card (by completing the appropriate section of the application form).

**Transcripts** – Two official copies of all transcripts are required for admission. Transcripts written in a language other than English or French must be accompanied by a certified translation. An explanation of the grading system used by the applicant's university is essential. It is the applicant's responsibility to arrange for transcripts to be sent. DOCUMENTS SUBMITTED WILL NOT BE RETURNED.

It is desirable to submit a list of the titles of courses taken in the major subject, since transcripts often give code numbers only. Applicants must be graduates of a university of recognized reputation and hold a Bachelor's degree equivalent to a McGill Honours degree in a subject closely related to the one selected for graduate work. This implies that about one-third of all undergraduate courses should have been devoted to the subject itself and another third to cognate subjects.

The minimum cumulative grade point average (CGPA) is 3.0/4.0 (second-class upper) or 3.2/4.0 during the last two full-time years of university study. High grades are expected in courses considered by the academic unit to be preparatory to the graduate program.

**Letters of Recommendation** – Two letters of recommendation on letterhead or bearing the university seal and with original signatures from two instructors familiar with the applicant's work, preferably in the applicant's area of specialization, are required. It is the applicant's responsibility to arrange for these letters to be sent.

**Competency in English** – Non-Canadian applicants whose mother tongue is not English and who have not completed an undergraduate degree using the English language are required to submit documented proof of competency in oral and written

English, by appropriate exams, e.g. TOEFL (minimum score 550 on the paper-based test or 213 on the computer-based test) or IELTS (minimum 6.5). The MCHE is not considered equivalent. Results must be submitted as part of the application. The University code is 0935 (McGill University, Montreal); department code is 31 (graduate schools), Biological Sciences - Agriculture.

**Graduate Record Exam (GRE)** – The GRE is not required, but it is highly recommended.

**Financial aid is very limited and highly competitive. It is suggested that students give serious consideration to their financial planning before submitting an application.**

Acceptance to all programs depends on a staff member agreeing to serve as the student's supervisor and the student obtaining financial support. Normally, a student will not be accepted unless adequate financial support can be provided by the student and/or the student's supervisor. Academic units cannot guarantee financial support via teaching assistantships or other funds.

**Qualifying Students** – Some applicants whose academic degrees and standing entitle them to serious consideration for admission to graduate studies, but who are considered inadequately prepared in the subject selected may be admitted to a *Qualifying Program* if they have met the Faculty of Graduate Studies and Research minimum CGPA of 3.0 /4.0. The course(s) to be taken in a *Qualifying Program* will be prescribed by the academic unit concerned. *Qualifying students* are registered in the Faculty of Graduate Studies and Research, **but not as candidates for a degree.** Only one qualifying year is permitted. **Successful completion of a qualifying program does not guarantee admission to a degree program.**

## 1.5 Program Requirements

### M.Sc.

At least 12 months of full-time study are required for this degree. A student may complete the requirements by obtaining 46 credits under the conditions of the thesis or non-thesis options.

### M.Sc. Thesis Option

This option for the M.Sc. degree is oriented towards individuals who intend to develop a career in agricultural and biosystems engineering research. The requirements for this option are:

1. completion and final acceptance of a supervised research thesis in one of the areas described above, according to the regulations of the faculty of graduate studies and research. This work is represented by courses M.Sc. Thesis I through VIII, described below and equivalent to four credits each, for a total of 32 credits allotted to thesis work (336-691 to 698).
2. 12 credits of postgraduate course work in agricultural and biosystems engineering and other fields to be determined in consultation with the research director. It is required that the candidate include the scientific publication course in this category of credits.
3. Participation in graduate seminar during two semesters.

### M.Sc. Applied – Non-thesis Option

The non-thesis option is aimed towards individuals already employed in industry or seeking to improve their skills in specific areas (soil and water/structures and environment/waste management/and environment protection/post harvest technology/food process engineering/environmental engineering) in order to enter the engineering profession at a higher level. The requirements for a candidate registering for this option are:

1. a minimum of 2 project courses of 6 credits each (336-671 and 672).
2. 31 additional credits in graduate courses from the Agricultural and Biosystems Engineering Department or courses from other departments relevant to project topics which must be approved by the academic advisor. Selection of courses in each area can follow the format of the example shown below for the Food Process Engineering area: this option is offered under the regulations of the non-thesis degree in cooperation with the Department of Food Science and Agricultural Chemistry and the Department of Chemical Engineering. The candidate is expected to obtain 12 of the 31 non-project credits in the cooperating departments. The division of these 12 credits between the two departments should be decided between the candidate and the supervisors of the projects undertaken. In some cases, necessary senior undergraduate courses in the collaborative departments can be taken for credit towards the M.Sc., Applied.
3. participation in graduate seminar during two semesters.

Candidates must meet the qualifications of a professional engineer either before or during their M.Sc., Applied program.

Each candidate for this option is expected to establish and maintain contact with his/her academic advisor in the Department of Agricultural and Biosystems Engineering some time before registration in order to clarify objectives, investigate project possibilities and plan a program of study.

### M.Sc. Applied in Environmental Engineering

The program consists of a minimum of 45 credits, of which, depending on the student's home department, a minimum of 5 and a maximum of 15 may be allotted to the project. The balance is earned by coursework, of which one to three approved undergraduate (below 500-level) courses are allowed. Candidates must possess a Bachelor's degree in engineering with superior academic achievement (a minimum cumulative grade point average of 3.0 out of a possible 4.0).

To complete the program, students must:

1. complete four required core courses;
2. complete a minimum of two engineering courses;
3. complete a minimum of two non-engineering courses (each course should be chosen from a different department);
4. complete a design or research project of 5 to 15 credits;
5. complete all the remaining courses (to a total of at least 45 credits) as required in the student's departmental program (these courses must be approved by the student's Academic Advisor); and
6. obtain a grade of 65% (or B-) or better in all required and approved courses.

### Ph.D.

Candidates for the Ph.D. degree will normally register for the M.Sc. degree in the first instance. In cases where the research work is proceeding very satisfactorily, or where the equivalent of the M.Sc. degree has been completed, candidates may be permitted to proceed directly to the Ph.D. degree.

Courses of study selected for a Ph.D. program will depend on the existing academic qualifications of the candidate and on those needed for effective pursuit of research in the chosen field. Candidates are encouraged to take an additional course of study of their own choice in some field of the humanities, sciences or engineering not directly related to their research. The program will be established by consultation of the candidate with a committee that will include the Research Director and at least one other professor.

A comprehensive examination, Agricultural and Biosystems Engineering 336-701A,B,C, will be taken either late in the first, or early in the second, registration year to qualify to proceed to the completion of the Ph.D. degree.

Participation in graduate seminar during four semesters.

## 1.6 Courses

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

- Denotes courses not offered in 2001-02.

**336-500B ARTIFICIAL INTELLIGENCE FOR BIOSYSTEMS** (3) (3 hour lecture, 2 hour lab) Utilization of artificially intelligent constructs in

biosystem engineering (design, construction, maintenance, operation, expansion), especially in agroecosystems. Topics include: neural networks rule-based expert systems, databases, control networks, artificial life.

● **336-504B INSTRUMENTATION AND CONTROL.** (3) (3 hours lectures and 2 hours lab)

● **336-506A,B,C ADVANCES IN DRAINAGE AND WATER MANAGEMENT.** (3) (Three weeks intensive course.)

● **336-509A,B HYDROLOGIC SYSTEMS AND MODELLING.** (3) (3 hours lectures)

● **336-512B SOIL CUTTING, TILLAGE AND TRENCHING.** (3) (2 hours lectures and 2 hours lab)

**336-514B DRAIN PIPE AND ENVELOPE MATERIALS.** (3) Plastic, concrete, ceramic and geotextile drainage materials. Production, processing and management sciences. Quality control, testing, inventory management, handling, uses. Granular media for drainage.

**336-515B COMPUTER MODELS IN DRAINAGE ENGINEERING.** (3) A review of computer simulation models of designing subsurface drainage systems. Use of CAD systems in design and drafting drainage plans. In depth discussion and applications of DRAINMOD and SWATRE, two microcomputer based models for designing and evaluating drainage water management systems for soils with high water tables, analysis of climatic and parametric uncertainties in the design.

● **336-516A PREPARATION AND APPRAISAL OF DRAINAGE PROJECTS.** (3)

● **336-517A DRAINAGE PROJECT CONTRACTS, INSTALLATION AND MANAGEMENT.** (3)

**336-518A POLLUTION CONTROL FOR AGRICULTURE.** (3) (3 hours lectures) Special topics concerning control of pollution agents from the agri-food industry; odour control, waste treatment including biological and chemical treatments, land disposal and wet lands.

**336-519A ADVANCED FOOD ENGINEERING.** (3) Advanced topics in food engineering concepts of mathematical modelling and research methodologies in food engineering. Topics include heat and mass transfer in food systems, packaging and distribution of food products, thermal and non-thermal processing, rheology and kinetics of food transformations.

**336-525B VENTILATION OF AGRICULTURAL STRUCTURES.** (3) The analyses of heat and water vapour transfer through the structure of buildings are used to design heating, ventilation and refrigeration systems. Heat conduction, convection and radiation are included in the analysis of heat transfer. Ventilation systems are designed for livestock shelters, produce storages and greenhouses.

**336-530B FERMENTATION ENGINEERING.** (3) (3 lectures and one 3-hour lab) (Prerequisite 336-325 or equivalent) Advanced topics in food and fermentation engineering are covered, emphasizing bioreactor engineering and bioprocess control in the development and optimization of new food and fermentation processes.

● **336-605A FUNCTIONAL ANALYSIS OF AGRICULTURAL MACHINES.** (3) (3 hours lectures)

● **336-607B ENGINEERING ASPECTS OF PLANT ENVIRONMENT.** (3) (3 hours lectures)

**336-608A,B,C SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING.** (3) (2 conferences, either term) Laboratory, field and library studies and reports on special problems related to agricultural and biosystems engineering that are not covered in regular course work.

● **336-611A ADVANCES IN IRRIGATION ENGINEERING.** (3) ( 3hours lectures)

**336-612A SIMULATION AND MODELLING.** (3) (3 hours lectures) Modelling: physical and virtual models of linear, chaotic and stochastic systems. Simulation: techniques and methods for static and dynamic models (steady and unsteady state). Examples from various areas such as machine design, population dynamics, food processing, biological control, farm management, ecological system design. Mathematics and computer oriented – students must be familiar with microcomputer operation.

● **336-614B ENGINEERING DECISION ANALYSIS.** (3) (3 hours lectures)

**336-616B ADVANCED SOIL AND WATER ENGINEERING.** (3) (3 hours lectures) Derivation of the governing partial differential equations for both steady and unsteady 3-D flow of groundwater through a variably saturated, heterogeneous, anisotropic and deformable medium, finite difference techniques, numerical method of lines (NMOL), computer programs, stochastic methods in soil and water engineering.

● **336-617B SPECIAL DRAINAGE APPLICATIONS.** (3)

**336-619B,C DRAINAGE AND RECLAMATION OF IRRIGATED LANDS.** (3) Design of drainage systems for control of salinity and water-logging in irrigated arid and semi-arid lands. Field investigations of soil and water salinity components, movement of water and salts. Canal leakage control, interceptor drains and field drains. Groundwater geology considerations. Disposal or reuse of drainage water.

● **336-621A,B ADVANCES IN POST-HARVEST TECHNOLOGY – DRYING.** (3) (3 hours lectures)

**336-622A,B ADVANCES IN POST-HARVEST TECHNOLOGY – STORAGE.** (3) (3 hours lectures) Active, semi-passive and passive storage systems; environmental control systems; post-harvest physiology and pathogenicity; quality assessment and control methodology; economic aspects of long-term storage.

**336-623A,B,C PROPOSAL PREPARATION.** (3) (3 hours conferences) Critiques of proposals prepared by others. Preparation and defense of draft proposals for funding agencies.

**336-651A,B,C DEPARTMENTAL SEMINAR M.SC. I.** (1) To give seminars and participate in discussions.

**336-652A,B,C DEPARTMENTAL SEMINAR M.SC. II.** (1) To give seminars and participate in discussions.

**336-653A,B,C DEPARTMENTAL SEMINAR M.SC. III.** (1) To give seminars and participate in discussions

**336-671A,B,C PROJECT I.** (6) Prepare project outline, execute and report. This project relates to the M.Sc. (Applied) degree.

**336-672A,B,C PROJECT II.** (6) Prepare project outline, execute and report. This project relates to the M.Sc. (Applied) degree.

**336-691 through 336-698 must be taken in sequence.**

**336-691A,B,C M.SC. THESIS I.** (4) Problem definition and literature Review.

**336-692A,B,C M.SC. THESIS II.** (4) Project proposal and presentation.

**336-693A,B,C M.SC. THESIS III.** (4) Methodology development.

**336-694A,B,C M.SC. THESIS IV.** (4) Experimentation I.

**336-695A,B,C M.SC. THESIS V.** (4) Experimentation II.

**336-696A,B,C M.SC. THESIS VI.** (4) Data analysis.

**336-697A,B,C M.SC. THESIS VII.** (4) Draft thesis preparation.

**336-698A,B,C M.SC. THESIS VIII.** (4) Thesis completion and acceptance.

**336-699A,B,C SCIENTIFIC PUBLICATION.** (3) (Periodic conferences) Review and critique papers that are published in field of the candidate. Prepare draft paper(s) following the format of leading journals in field of study undertaken.

**336-701A,B,C PH.D. COMPREHENSIVE EXAMINATION.**

**336-702A,B SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING II.** (3) (2 conferences, either term) Advanced level laboratory, field and library studies and reports on special problems related to agricultural and biosystems engineering which are not covered in regular course work. Designed for doctoral level students with experience in postgraduate studies.

**336-751A,B,C DEPARTMENTAL SEMINAR PH.D. I.** To give seminars and participate in discussions.

**336-752A,B,C DEPARTMENTAL SEMINAR PH.D. II.** To give seminars and participate in discussions.

**336-753A,B,C. DEPARTMENTAL SEMINAR PH.D. III.** To give seminars and participate in discussions

**336-754A,B,C DEPARTMENTAL SEMINAR PH.D. IV.** To give seminars and participate in discussions

**336-755A,B,C DEPARTMENTAL SEMINAR PH.D. V.** To give seminars and participate in discussions

- **360-612B MATHEMATICAL METHODS.** (3) (3 hours lectures)

# 2 Agricultural Economics

Department of Agricultural Economics
Macdonald Campus
21,111 Lakeshore Road
Sainte-Anne de Bellevue, Q CH9X 3V9
Canada

Telephone: (514) 398-7820
Fax: (514) 398-8130
Email: atkinson@macdonald.mcgill.ca
Website: http://www.agrenv.mcgill.ca/agrecon

*Chair* — J.C. Henning

## 2.1 Staff

*Associate Professors*
K.R. Gunjal; B.Sc.(Poona), M.Sc.(New Delhi), Ph.D.(Iowa St.)
J.C. Henning; B.Sc., Ph.D.(Guelph)
P.J. Thomassin; B.Sc.(McG.), M.S., Ph.D.(Hawaii)

*Assistant Professors*
L.B.B. Baker; S.D.A., D.C.P.(Edin.), D.F.B.O.M.(Aberd.), M.Sc.(Man.), Ph.D.(McG.)
M. Brown; B.A.(St-Mary's), M.A., Ph.D.(McM.)

*Adjunct Professors*
Joan Marshall, Peter Goldsmith

## 2.2 Programs Offered

The Department of Agricultural Economics offers programs leading to the M.Sc. and, with the Faculty of Management, a joint M.Sc./M.B.A. in Agricultural Economics. Students who complete all the degree requirements of the joint program will be awarded two degrees, an M.Sc. and an M.B.A.

It is possible for students to pursue doctoral studies through the Department of Economics which offers Agricultural Economics as an area of specialization. For specific requirements of that graduate program see the Department of Economics.

## 2.3 Admission Requirements

**M.Sc.**

Direct admission to the M.Sc. requires the completion of a B.Sc. in Agricultural Economics or a closely related area, with the equivalent cumulative grade point average of 3.0/4.0 (Second Class-Upper).

The ideal preparation includes courses in agricultural economics, economic theory (intermediate micro and macro), calculus, linear algebra, and statistics. Students with deficiencies in these areas will be required to take additional courses as part of their degree program.

**M.Sc./M.B.A.**

Students must fulfill the admission requirements for both the M.Sc. degree in Agricultural Economics and the M.B.A. degree in the Faculty of Management.

## 2.4 Application Procedures

Applications for admission and all supporting documents must be sent directly to:

Student Affairs Office (Graduate Studies)
Macdonald Campus of McGill University
21,111 Lakeshore
Sainte-Anne de Bellevue, Q CH9X 3V9
Canada

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Applications will be considered upon receipt of a signed and completed application form, $60 application fee, all official transcripts, two signed original letters of reference on official letterhead of originating institution, and (if required) proof of competency in oral and written English by appropriate exams.

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**Application Fee (non-refundable)** – *A fee of $60 ($100 M.Sc./M.B.A.) Canadian* must accompany each application (including McGill students), *otherwise it cannot be considered.* This sum must be remitted using one of the following methods:

1. **Certified** personal cheque in Cdn.$ drawn on a Canadian bank;
2. **Certified** personal cheque in U.S.$ drawn on a U.S. bank;
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**Transcripts** – Two official copies of all transcripts are required for admission. Transcripts written in a language other than English or French must be accompanied by a certified translation. An explanation of the grading system used by the applicant's university is essential. It is the applicant's responsibility to arrange for transcripts to be sent. DOCUMENTS SUBMITTED WILL NOT BE RETURNED.

It is desirable to submit a list of the titles of courses taken in the major subject, since transcripts often give code numbers only. Applicants must be graduates of a university of recognized reputation and hold a Bachelor's degree equivalent to a McGill Honours degree in a subject closely related to the one selected for graduate work. This implies that about one-third of all undergraduate courses should have been devoted to the subject itself and another third to cognate subjects.

The minimum cumulative grade point average (CGPA) is 3.0/4.0 (second-class upper) or 3.2/4.0 during the last two full-time years of university study. High grades are expected in courses considered by the academic unit to be preparatory to the graduate program.

**Letters of Recommendation** – Two letters of recommendation on letterhead or bearing the university seal and with original signatures from two instructors familiar with the applicant's work, preferably in the applicant's area of specialization, are required. It is the applicant's responsibility to arrange for these letters to be sent.

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English, by appropriate exams, e.g. TOEFL (minimum score 570 on the paper-based test or 230 on the computer-based test) or IELTS (minimum 7 overall band). The MCHE is not considered equivalent. Results must be submitted as part of the application. The University code is 0935 (McGill University, Montreal); department code is 31 (graduate schools), Biological Sciences - Agriculture.

**Graduate Record Exam (GRE)** – The GRE is not required, but it is highly recommended.

**Financial aid is very limited and highly competitive. It is suggested that students give serious consideration to their financial planning before submitting an application.**

**Qualifying Students** – Some applicants whose academic degrees and standing entitle them to serious consideration for admission to graduate studies, but who are considered inadequately prepared in the subject selected may be admitted to a *Qualifying Program* if they have met the Faculty of Graduate Studies and Research minimum CGPA of 3.0 /4.0. The course(s) to be taken in a *Qualifying Program* will be prescribed by the academic unit concerned. *Qualifying students* are registered in the Faculty of Graduate Studies and Research, **but not as candidates for a degree.** Only one qualifying year is permitted. **Successful completion of a qualifying program does not guarantee admission to a degree program.**

## 2.5 Program Requirements

**M.Sc.**

A minimum of 19 graduate course credits and the completion of a research thesis (27 credits) are required for the M.Sc. Students may specialize, by way of their research program, in agribusiness, development, finance, marketing and trade, policy, and resource and ecological economics.

Specific requirements are as follows:

1. Economic Theory
   (Micro and/or Macro) – 2 courses (6 credits)
2. Quantitative Methods – 1 course (3 credits)
3. Three other courses chosen in consultation with the Agricultural Economics Advisor with a minimum of one course in the Department of Agricultural Economics (9 credits).
4. Seminar (334-690) (1 credit)
5. M.Sc. Thesis I, II, III, IV, V (27 credits)

**M.Sc./M.B.A.**

A minimum of 19 graduate course credits and the completion of a research thesis (26 credits) are required for the M.Sc. degree which includes 5 credits of internship. The M.B.A. component of this joint program requires 45 credits.

The specific course requirements for the M.Sc. degree are:

1. Economic Theory – 1 course (3 credits)
2. Quantitative Methods – 1 course (3 credits)
3. Four other courses chosen in consultation with the Agricultural Economics Advisor with a minimum of one course in the Department of Agricultural Economics (12 credits).
4. Seminar (334-690) (1 credit)
5. Thesis requirement (26 credits).

The course requirements for the M.B.A degree are:

1. First year of the M.B.A. program (three trimesters - 30 credits).
2. 15 additional credits of M.B.A. courses.

(See the Faculty of Management M.B.A. program for additional details).

## 2.6 Graduate Courses

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

- Denotes courses not offered in 2001-02.

**334-611B PRICE ANALYSIS.** (3) Topics in advanced microeconomic theory with applications in agricultural economics.

- **334-633A ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS.** (3)

- **334-640A AGRICULTURE AND FOOD MARKETING.** (3)

**334-642B ECONOMICS OF AGRICULTURAL DEVELOPMENT.** (3) This course focuses on the role of agriculture in economic development. Topics covered will be – development theories, economic efficiency, employment, technology adoption and structural change in developing countries. Also, agriculture, food and development policies and implications for long term planning will be discussed.

**334-679A FINANCING: ALTERNATIVE STRATEGIES.** (3) An in-depth study of the relationship between financing, asset acquisition, tenure, and property rights and obligations for farm businesses. Emphasis will be placed on the potential for the use of non-debt financial instruments such as Community Based Land Trusts (CBLT) and Community Supported Agriculture (CSA).

**334-685A,B,C SELECTED TOPICS IN AGRICULTURAL ECONOMICS.** (3) This course is designed to permit students to explore agricultural economics topics that are not covered in other courses. Students may be asked to prepare a presentation or lead discussion on the selected topic for the benefit of other students and staff. (Pass/Fail grading)

**334-690 A,B,C SEMINAR.** (1) This course will focus on current research on economic problems of agriculture through presentations by staff, students and special guests. All graduate students are required to register for this course, and make at least one major presentation.

**334-691A,B,C M.SC. THESIS I.** (6)

**334-692A,B,C M.SC. THESIS II.** (3)

**334-693A,B,C M.SC. THESIS III.** (6)

**334-694A,B,C M.SC. THESIS IV.** (6)

**334-695A,B,C M.SC. THESIS IV.** (6)

# 3 Anatomy and Cell Biology

Department of Anatomy and Cell Biology
Strathcona Anatomy and Dentistry Building
3640 University Street
Montreal, QC  H3A 2B2
Canada

Telephone: (514) 398-6335
Fax: (514) 398-5047

Website: http://mercury.medserv.mcgill.ca/anatomy

*Chair* — J.J.M. Bergeron

## 3.1 Staff

*Emeritus Professor*
Y. Clermont; B.Sc.(Montr.), M.Sc., Ph.D.(McG.)

*Professors*
A. Beaudet*; M.Sc., Ph.D., M.D.(Montr.)
G.C. Bennett; B.A., B.Sc.(Sir. G.Wms.), M.Sc., Ph.D.(McG.)
J.J.M. Bergeron; B.Sc.(McG.), D.Phil.(Oxon.)
J.R. Brawer; B.S.(Tufts), Ph.D.(Harv.)
M. Burnier*; M.D.,M.Sc.,Ph.D.(Brazil)
L. Hermo; B.A.(Montr.), M.Sc., Ph.D.(McG.)
D. Lawrence*; B.Sc.(Bishop's), M.D., C.M.(McG.)
C.P. Leblond; M.D.(Paris), Ph.D.(Montr.), D.Sc.(Sorbonne)
S.C. Miller; B.Sc.(Sir G.Wms.), M.Sc., Ph.D.(McG.)
C.R. Morales; D.V.M.(Argentina), Ph.D.(McG.)
R. Murphy*; M.S.(Northeastern), Ph.D.(Rutgers)
D.G. Osmond; B.Sc., M.B., Ch.B., D.Sc.(Brist.), F.R.S.C.
B. Posner*; M.D.(Man.), Ph.D.(Iowa)

C.E. Smith*; D.D.S., Ph.D.(McG.)
E. Wang*; M.A.(N. Mich.), Ph.D.(C.W.R., Clev.)
H. Warshawsky; B.Sc.(Sir G.Wms), M.Sc., Ph.D.(McG.)

*Associate Professors*
O.W. Blaschuk*; B.Sc.(Winn.), M.Sc.(Man.), Ph.D.(Tor.)
E. Daniels; M.Sc., Ph.D.(Man.)
S. David*; Ph.D.(Man.)
M.F. Lalli; B.S., M.A.(Bowling Green), Ph.D.(McG.)
P. Lasko*; A.B.(Harv.), Ph.D.(M.I.T.)
M. McKee*; B.Sc.,M.Sc.,Ph.D.(McG.)
M. Miller*; B.Sc.(Marquette), M.Sc., Ph.D.(Loyola)
H. Vali*; B.Sc., M.Sc., Ph.D.(Munich)

*Assistant Professors*
C. Autexier; B.Sc.(C'dia) Ph.D.(McG.)
P. Barker*; B.Sc.(S.Fraser), Ph.D.(Alta.)
M. Greenwood*; B.Sc.,M.Sc.(C'dia), Ph.D.(McG.)
T. Kennedy*; B.Sc.(McM.), M.Phil., Ph.D.(Col.)
A. Koromilas*; B.Sc., Ph.D.(Aristotelian U., Greece)
N. Lamarche-Vane; B.Sc.,Ph.D.(U.Mtl.)
P. McPherson*; M.Sc.(Man.), Ph.D.(Iowa)
J.F. Presley; B.A., Ph.D.(Texas)
A. Ribeiro-da-Silva*; M.D., Ph.D.(Oporto)
W. Sossin*; S.B.(M.I.T.), Ph.D.(Stan.)
J. Snipes*; Ph.D., M.D.(Vanderbilt)
S. Stifani*; Ph.D.(Rome), Ph.D.(Alta.)
D. Walker*; B.Sc.(Geneva), Ph.D.(Salk), Ph.D.(Geneva)
G. Wild*; B.Sc., Ph.D., M.D., C.M.(McG.)

*Adjunct Professors*
D. Cyr; B.Sc., M.Sc.(C'dia), Ph.D.(Man.)
J. Drouin; B.Sc., D.Sc.(Laval)
S. Inoue; M.Sc., Ph.D.(Hok. U.)
A. Nantel, B.Sc., M.Sc.(Laval), Ph.D.(Chapel Hill)
D. Thomas*; B.Sc.(Brist.), M.Sc., Ph.D.(Lond.)

* Denotes cross or joint appointees.

## 3.2 Programs Offered

Graduate research activities leading to the presentation of the M.Sc. and Ph.D. thesis involve original experimental work in one of the areas being actively investigated by the Department's Research Supervisors. Current research projects include: cell biology of secretion; cell biology of endocytosis; signal transduction of cell receptors for growth factors and hormones; synthesis and migration of glycoproteins; subcomponents of the Golgi apparatus and their function; biogenesis and function of lysosomes; cell turnover in various tissues; control of cell growth and proliferation; molecular biology of extracellular matrix; structure, composition and function of basement membranes and connective tissue microfibrils; cell and mocrofibrils; cell and molecular biology of spermatogenesis; genetic expression of proteins in the formation of cytoskeletal components of spermatozoa; role of endocytosis and secretion by epididymal cells in sperm maturation; molecular biology of Sertoli cell secretions and their interaction with germ cells; synchronization of sperm production; transferrin, transferrin receptors and iron in germinal cells; differentiation of B lymphocytes in bone marrow in relation to mechanisms of humoral immunity, immunodeficiency states and B cell neoplasias; control mechanisms and cytokines in B lymphopoiesis; in situ organization and stromal cell-interactions of B lineage precursor cells in bone marrow; microenvironmental regulation of hemopoiesis; differentiation and regulation of cells mediating natural tumor immunosurveillance; tumor-cell biology; cell and molecular biology of the formation of dental enamel, dentin and bone; structure of organic matrices and inorganic crystals of dental enamel; role of hormones and their binding sites with calcified tissues; secretion and degradation of the proteins of enamel matrix, hypothalamo-pituitary function and gonadotropin patterns in ovarian follicular development; polycystic ovarian disease; computer assisted modeling of morphometric and kinetic data; cell biology and molecular genetics of ageing; senescence and cell cycle-specific genes and their products.

**Research in the Department** investigates the dynamics and organization of molecules, organelles, cells and tissues in several major systems of the body. The work makes fundamental contributions to a number of established and emerging multidisciplinary fields: cell and molecular biology, cellular immunology and hematology, reproductive biology, calcified tissue biology, tumor cell biology, developmental biology, neurobiology and ageing.

The Department offers contemporary facilities for the wide range of techniques currently employed in research. Modern methods of cell and molecular biology, immunology and biochemistry are used in conjunction with specialized microscopy in a variety of experimental systems. Techniques used by Department members include labeling with radioisotopes and other tracers, radioautography, immunocytochemistry, histochemistry, cryo immune microscopy, fluorescence microscopy, high resolution electron microscopy, scanning electron microscopy, backscattered electron imaging, confocal microscopy, microinjection, video-microscopy in living cells, X-ray microanalysis, electron diffraction, freeze-fracture replication, computer reconstruction and quantitation, chromatography, subcellular fractionation, recombinant DNA technology, in situ hybridization, tissue grafting, cell and tissue culture, mutant and transgenic mice, hybridomas, and monoclonal antibodies.

The Department has one of the largest electron microscope facilities in Canada. Currently in use are three modern electron microscopes, including a high voltage instrument, the JEOL 2000FX. Combined with some of these microscopes are computer-aided analytical equipment capable of elemental microanalysis, histomorphometry, reconstruction and quantitation. The high voltage microscope is particularly useful for certain analytical electron optical procedures such as electron diffraction, lattice imaging and stereo electron microscoy.

## 3.3 Admission Requirements

### M.Sc. and Ph.D. Programs

1. A B.Sc. degree in life sciences or any of M.D., D.D.S. or D.V.M. degrees from a university of recognized reputation.
2. Evidence of a high academic achievement with a minimum Cumulative Grade Point Average (CGPA) of 3.3 on 4.0.

### Admission to a Qualifying Program

Applicants whose academic degree and standing entitle them to serious consideration for admission to graduate studies, but who are considered inadequately prepared in the area chosen may, upon recommendation of the Graduate Student Affairs Committee, and with the permission of the Director of Graduate Studies of the Faculty of Graduate Studies and Research, be admitted to Qualifying Programs. The courses to be taken in qualifying programs will be stipulated by the Graduate Student Affairs Committee. (Note: Only one qualifying program of a maximum of one year is permitted.)

## 3.4 Application Procedures

Application for admission to the Faculty of Graduate Studies and Research for the degrees of M.Sc. or Ph.D. in Anatomy should be made to the Chair of Graduate Studies, Department of Anatomy and Cell Biology.

Application forms and a brochure giving full details of the Graduate Program are available upon request.

### Documents Required

1. Two official copies of complete university-level academic records to date (this also applies to McGill University transcripts). It may be desirable to submit a list of the titles of the courses taken, if transcripts give code numbers only.
   It is the applicant's responsibility to contact the institution(s) which he/she has attended and request that the transcripts be forwarded directly to the Department of Anatomy.

2. Two letters of recommendation.
   It is the applicant's responsibility to arrange that these letters are originals, sent directly to the Department of Anatomy from the persons specified by the applicant.
3. Fee of $60.00 in Canadian funds for processing the application.
4. TOEFL score (where applicable).

### 3.5 Program Requirements

The M.Sc. program is a 48-credit program. Students must complete 15 credits in course work and 33 credits of thesis research (504-698 and 504-699).

For the Ph.D. degree, the student must complete a series of courses selected to suit individual requirements. In addition, Ph.D. candidates will write a comprehensive examination after the end of the first year.

For both degrees, the major emphasis is placed on the conduct of original research and the preparation of a thesis.

### 3.6 Courses

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

**504-663D HISTOLOGY.** (9) The study of the cytology and structure of tissues and organs.

**504-690D CELL BIOLOGY.** (6) Current developments in molecular cell biology and developmental biology will be presented by course coordinators and staff from primary papers in the scientific literature. These will be researched and critiqued by students through oral and written presentations. Two term papers are required for students taking the course.

**504-698D M.SC. THESIS RESEARCH.** (24)

**504-699D M.SC. THESIS SEMINAR.** (9)

**504-701D PH.D. COMPREHENSIVE EXAMINATION.**

## 4 Animal Science

Department of Animal Science
Macdonald Campus
21,111 Lakeshore Road
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Canada

Telephone: (514) 398-7794
Fax: (514) 398-7964
Email: Info@AnimSci.AgrEnv.McGill.CA
Website: http://www.agrenv.mcgill.ca/animal/animal.htm

*Chair* — X. Zhao

### 4.1 Staff

*Emeritus Professor*
J.E. Moxley; B.Sc.(Agr.), M.Sc.(McG.), Ph.D.(C'nell)

*Professors*
R.B. Buckland; B.Sc(Agr.), M.Sc.(McG.), Ph.D.(Maryland)
E.R. Chavez; Agr.Eng.(Chile), M.Sc. Ph.D.(Calif.)
B.R. Downey; D.V.M.(Tor.), Ph.D.(McG.)
J.F. Hayes; B.Agr.Sc., M.Agr.Sc.(Dub.), Ph.D.(N.C.St.)
U. Kuhnlein; B.Sc.(Fed. Inst. of Tech., Zurich), Ph.D.(Geneva)
K.F. Ng-Kwai-Hang; B.Sc.(Agr.), M.Sc., Ph.D.(McG.)

*Associate Professors*
R.I. Cue; B.Sc.(Newcastle-upon-Tyne), Ph.D.(Edin.)
P.C. Laguë; B.A.(Montr.), B.S.A.(Laval), M.S., Ph.D.(C'nell)
H. Monardes; Ing. Agr.(Concepcion, Chile), M.Sc., Ph.D.(McG.)
L.E. Phillip; B.Sc.(Agr.), M.Sc.(Agr.)(McG.), Ph.D.(Guelph)
K.M. Wade; B.Sc.(Agr.), M.Sc.(Agr.)(Dublin), Ph.D.(C'nell)
D. Zadworny; B.Sc., Ph.D.(Guelph)
X. Zhao; B.Sc., M.Sc.(Nanjing), Ph.D.(C'nell)

*Assistant Professors*
R.C. Chian; B.Sc.(Northeast Agric.U., PR China), M.Sc.(Nanjing Agric.U, PR China), Ph.D.(Okayama U., Japan) (PT)
R. Lacroix; B.Sc., M.Sc.(Que.), Ph.D.(McG.) (PT)
A.F. Mustafa; B.Sc., M.Sc.(Khartoum), Ph.D.(Sask.)

*Associate Members*
Faculty in the School of Dietetics and Human Nutrition

*Adjunct Professors*
C. Keefer, P. Lacasse, B. Murphy, D. Petitclerc

### 4.2 Programs Offered

The Department provides laboratory facilities for research work leading to the degrees of Master of Science and Doctor of Philosophy in the disciplines of animal breeding (genetics), nutrition, and reproductive physiology, molecular biology, milk biochemistry and information systems. Within these areas advantage may be taken of strong research programs and expertise in molecular biology and milk biochemistry. Students registered in the Department of Animal Science may develop programs in conjunction with other units at McGill, for example the Nutrition and Food Science Centre or the School of Dietetics and Human Nutrition. Each student has an advisory committee composed of the thesis supervisor and at least two other faculty members.

### 4.3 Admission Requirements

**M.Sc. (Thesis)**

Candidates are required to have either a Bachelor's degree in Agriculture or a B.Sc. degree in an appropriate, related discipline with an equivalent cumulative grade point average of 3.2/4.0 over the past four full-time semesters of study.

**M.Sc. Applied**

All candidates are required to have a B.Sc. degree or equivalent.

**Ph.D.**

Candidates are normally required to have an M.Sc. degree in an area related to the chosen field of specialization for the Ph.D. program.

### 4.4 Application Procedures

Applications for admission and all supporting documents must be sent directly to:

Student Affairs Office (Graduate Studies)
Macdonald Campus of McGill University
21,111 Lakeshore
Sainte-Anne de Bellevue, Q  CH9X 3V9
Canada

Telephone: (514) 398-7925
Fax: (514) 398-7968
Email: grad@macdonald.mcgill.ca

Applications will be considered upon receipt of a signed and completed application form, $60 application fee, all official transcripts, two signed original letters of reference on official letterhead of originating institution, and (if required) proof of competency in oral and written English by appropriate exams.

**Deadlines** – For **international students**, complete applications with supporting documents must reach the Student Affairs Office (Graduate Studies) at Macdonald Campus at least **eight months** prior to the intended start of program. May 1 for January (winter); September 1 for May (summer); January 1 for September (fall). For **domestic students**, it is recommended that complete applications with supporting documents reach the Office at least **six months** (but definitely no later than **three full months)** in advance of the intended start of program – July 1 for January (winter), November 1 for summer, March 1 for September (fall).

**Application Fee (non-refundable)** – *A fee of $60 Canadian* must accompany each application (including McGill students), *otherwise it cannot be considered.* This sum must be remitted using one of the following methods:

1. **Certified** personal cheque in Cdn.$ drawn on a Canadian bank;
2. **Certified** personal cheque in U.S.$ drawn on a U.S. bank;
3. Canadian Money order in Cdn.$;
4. U.S. Money Order in U.S.$;
5. Bank draft in Cdn.$ drawn on a Canadian bank;
6. Bank draft in U.S.$ drawn on a U.S. bank, negotiable in Canada;
7. Credit card (by completing the appropriate section of the application form).

**Transcripts** – Two official copies of all transcripts are required for admission. Transcripts written in a language other than English or French must be accompanied by a certified translation. An explanation of the grading system used by the applicant's university is essential. It is the applicant's responsibility to arrange for transcripts to be sent. DOCUMENTS SUBMITTED WILL NOT BE RETURNED.

It is desirable to submit a list of the titles of courses taken in the major subject, since transcripts often give code numbers only. Applicants must be graduates of a university of recognized reputation and hold a Bachelor's degree equivalent to a McGill Honours degree in a subject closely related to the one selected for graduate work. This implies that about one-third of all undergraduate courses should have been devoted to the subject itself and another third to cognate subjects.

The minimum cumulative grade point average (CGPA) is 3.0/4.0 (second-class upper) or 3.2/4.0 during the last two full-time years of university study. High grades are expected in courses considered by the academic unit to be preparatory to the graduate program.

**Letters of Recommendation** – Two letters of recommendation on letterhead or bearing the university seal and with original signatures from two instructors familiar with the applicant's work, preferably in the applicant's area of specialization, are required. It is the applicant's responsibility to arrange for these letters to be sent.

**Competency in English** – Non-Canadian applicants whose mother tongue is not English and who have not completed an undergraduate degree using the English language are required to submit documented proof of competency in oral and written English, by appropriate exams, e.g. TOEFL (minimum score 550 or 213 on computerized test) or IELTS (minimum 6.5 overall band). The MCHE is not considered equivalent. Results must be submitted as part of the application. The University code is 0935 (McGill University, Montreal); department code is 31 (graduate schools), Biological Sciences - Agriculture.

**Graduate Record Exam (GRE)** – The GRE is not required, but it is highly recommended.

**Financial aid is very limited and highly competitive. It is suggested that students give serious consideration to their financial planning before submitting an application.**

Acceptance to all programs depends on a staff member agreeing to serve as the student's supervisor and the student obtaining financial support. Normally, a student will not be accepted unless adequate financial support can be provided by the student and/or the student's supervisor. Academic units cannot guarantee financial support via teaching assistantships or other funds.

**Qualifying Students** – Some applicants whose academic degrees and standing entitle them to serious consideration for admission to graduate studies, but who are considered inadequately prepared in the subject selected may be admitted to a *Qualifying Program* if they have met the Faculty of Graduate Studies and Research minimum CGPA of 3.0 /4.0. The course(s) to be taken in a *Qualifying Program* will be prescribed by the academic unit concerned. *Qualifying students* are registered in the Faculty of Graduate Studies and Research, **but not as candidates for a degree.** Only one qualifying year is permitted. **Successful completion of a qualifying program does not guarantee admission to a degree program.**

## 4.5 Program Requirements

**M.Sc. (Thesis)**

Four one-semester courses or the equivalent and two seminar courses at the post-graduate level are required, as a minimum, although a student may be advised to take additional courses as specified by his/her advisory committee. Advanced undergraduate courses may be considered for graduate credit if approved by the student's committee and graduate faculty and passed at the graduate level; generally, this will not constitute more than one of the four required courses.

A minimum of 45 credits and completion of an acceptable thesis is required for the M.Sc. degree; 14 credits are for course work and 31 credits for the thesis (342-680, 681, 682, and 683). Exceptional M.Sc. students may be considered for Ph.D. status after one full year in the Department.

**M.Sc. Applied** (45 credits)

The M.Sc. Applied (non-thesis) degree is oriented to animal scientists already working in industry or government, to undergraduate students inspired by concepts in sustainable and integrated animal agriculture, to project leaders interested in animal resource management and to veterinarians. The program aims to provide graduate training in applied areas of animal production with a view towards integrating technology and management in animal production with allied areas of agricultural resource utilisation.

**Required Course** (3 credits)
342-501B (3) Advanced Animal Production Systems.

**Complementary Courses** (27 credits)
9 credits must be in Animal Science at the graduate level

18 credits can be selected from a recommended list where no more than 6 credits can be chosen from undergraduate level courses.

**Project Component – Required** (15 credits)
342-643 (3) Project I
342-644 (3) Project II
342-645 (3) Project III
342-646 (3) Project IV
342-647 (3) Project V

**Ph.D.**

Since the Ph.D. is primarily a research degree, the amount of course work required may comprise a smaller portion of the total than is the case for the M.Sc., this will depend on the background of the individual student, and must be approved by the student's advisory committee. This course work must include two seminar courses at the graduate level and the Ph.D. Comprehensive Examination 342-701D.

The thesis must clearly show originality and be a contribution to knowledge.

## 4.6 Courses

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered in 2001-02.

In addition to the courses listed below, students may be required to take one or more courses offered by other departments or faculties.

**342-501B ADVANCED ANIMAL PRODUCTION SYSTEMS.** (3)
(3 lectures) An advanced course dealing with current world animal production systems (ruminant and monogastric) emphasizing their practices, constraints and relative efficiencies with a view to developing methods of improving productivity.

**342-504A POPULATION GENETICS.** (3) (3 lectures) A consideration of the problems involved in the improvement of animals and the application of genetics in their solution.

**342-551B CARBOHYDRATE AND LIPID METABOLISM.** (3) (3 lectures) Comparative aspects of nutrition and metabolism of carbohydrate and lipid from the cellular level through the multi-organ of the whole organism. Main topics will include biothermodynamics, calorimetry, cellular metabolism and functions of carbohydrate and lipid, digestion, absorption and utilization of dietary carbohydrate and lipid.

**342-552A PROTEIN METABOLISM AND NUTRITION.** (3) (3 lectures) Comparative aspects of nutrition and metabolism of amino acids and proteins from the cellular level on through the multisystem operation of the whole organism. Main topics include cellular metabolism and functions of amino acids and proteins, digestion, absorption and utilization of dietary protein. Comparison between farm animals and humans.

**342-605B ESTIMATION OF GENETIC PARAMETERS.** (3) (3 lectures) (Given in alternate years.) General methods for the estimation of components of variance and co-variance are considered, with specific emphasis given to their application to heritability, repeatability and genetic correlation estimation.

**342-606B SELECTION INDEX AND ANIMAL IMPROVEMENT.** (3) (3 lectures) Selection index principles and their application to livestock improvement are considered, with emphasis on the estimation of genetic breeding values for single and multi-trait selection.

**342-607A LINEAR MODELS IN AGRICULTURAL RESEARCH.** (3) (3 lectures) The theory and application of linear models to agricultural research is considered. Special emphasis is given to the analysis of experimental and survey data with unequal subclass numbers.

**342-611B ADVANCE REPRODUCTIVE PHYSIOLOGY.** (3) ( 2lectures, 1 seminar) (Given in alternate years.) Discussion of current concepts relating to male and female reproduction, primarily of domestic animals and avian species. Topics include: the regulation of gonadal function and sexual behavior, pregnancy and parturition, and methods of assessing and/or improving reproductive efficiency.

**342-622B SELECTED TOPICS IN MOLECULAR BIOLOGY.** (3) (1 lecture and 2 seminars) (Prerequisite: 362-500B or permission of instructor) Key examples of applications of molecular biology to the study of animal physiology and animal genetics will be drawn from the current literature and discussed in depth. The course has a dual purpose. It will familiarize students with current events at the forefront of molecular biology and will teach them how to read and critically evaluate research publications.

**342-623B TECHNIQUES IN MOLECULAR GENETICS: DNA SEQUENCING.** (3) Growth of bacterial cells and isolation of plasmids containing DNA; dideoxysequencing of double-strand DNA; separation using urea-polyacrylamide gels; autoradiography and sequence analysis including use of DNAsis and genbank/EMBL databases.

**342-624B TECHNIQUES IN MOLECULAR GENETICS: DNA FINGERPRINTING.** (3) (Requires previous laboratory experience.) Isolation of DNA from blood, tissue samples or plant material (students can choose their preferred source of DNA and problem). Digestion of the DNA with restriction enzymes. Agarose gel electrophoresis; Southern blotting; hybridisation with a DNA fingerprinting probe; autoradiography; interpretation (i.e. genetic variability, genetic relationship or paternity).

**342-625B TECHNIQUES IN MOLECULAR GENETICS: POLYMERASE CHAIN REACTION.** (3) Isolation of genomic DNA; amplification of target sequences using the polymerase chain reaction; analysis of the product using restriction enzymes and electrophoresis (polyacrylamide or agarose gel electrophoresis).

**342-630A EXPERIMENTAL TECHNIQUES IN ANIMAL SCIENCE: NUTRITION.** (3) (1 lecture, 1 lab) Lectures and laboratories dealing with animal experimentation. Emphasis on the design and conduction of animal studies, selection of experimental animals, chemical and biological assays, statistical analysis, interpretation of data and preparation of technical reports.

**342-635B VITAMIN AND MINERAL NUTRITION.** (3) (3 lectures) Modularised course dealing with advanced topics in Nutrition. The core of the course will focus on vitamins and minerals.

**342-636B TECHNIQUES IN ANALYSIS OF ANIMAL BREEDING RESEARCH DATA.** (3) (3 lectures) An advanced graduate course to give training and experience in statistical techniques applied to quantitative genetics and animal breeding. To consider aspects of data handling of large data sets (100,000 observations), checks for consistency and connectedness in data. Considerations in choosing efficient analytical procedures in fitting these models and development of efficient numerical algorithms to apply these procedures.

**342-643A,B PROJECT I.** (3) Review of the literature and design of the project. This project relates to the M.Sc. Applied (non-thesis) degree.

**342-644A,B PROJECT II.** (3) Continuation of the review of the literature and design of project. This project relates to the M.Sc. Applied (non-thesis) degree.

**342-645A,B PROJECT III.** (3) Execution and write-up of project. This project relates to the M.Sc. Applied (non-thesis) degree.

**342-646A,B PROJECT IV.** (3) Continuation of write-up and submission of project. This project relates to the M.Sc. Applied (non-thesis) degree.

**342-647A,B PROJECT V.** (3) Seminar and project presentations. This oral presentation of the project relates to the M.Sc. Applied (non-thesis) degree.

**342-680A,B ANIMAL SCIENCE M.SC. THESIS I.** (7) Independent research under the direction of a supervisor toward completion of M.Sc. thesis.

**342-681A,B ANIMAL SCIENCE M.SC. THESIS II.** (7) Independent research under the direction of a supervisor toward completion of M.Sc. thesis.

**342-682A,B ANIMAL SCIENCE M.SC. THESIS III.** (7) Independent research under the direction of a supervisor toward completion of M.Sc. thesis.

**342-683A,B ANIMAL SCIENCE M.SC. THESIS IV.** (10) Final submission and approval of M.Sc. thesis.

**342-691D,N SPECIAL TOPICS IN ANIMAL SCIENCE.** (3) Prescribed reading, conference or practical work on a selected topic in the student's area of specialization, not otherwise available in other courses; under staff supervision. An approved course outline must be on file in the Departmental office prior to registration deadline.

**342-692D,N SPECIAL TOPICS IN ANIMAL SCIENCE.** (3) Prescribed reading, conference or practical work on a selected topic in the student's area of specialization, not otherwise available in other courses; under staff supervision. An approved course outline must be on file in the Departmental office prior to registration deadline.

**342-693D,N SPECIAL TOPICS IN ANIMAL SCIENCE.** (3) Prescribed reading, conference or practical work on a selected topic in the student's area of specialization, not otherwise available in other courses; under staff supervision. An approved course outline must be on file in the Departmental office prior to registration deadline.

**342-695A,B ANIMAL SCIENCE SEMINAR I.** (1) (1 hour) One of two seminars to be given by all students in an M.Sc. program. Consists of a review of literature in relation to the student's proposed research and an experimental design of the research to be conducted.

**342-696A,B ANIMAL SCIENCE SEMINAR II.** (1) (1 hour) One of two seminars to be given by all students in an M.Sc. program. Presentation of a current scientific topic which is not related to the student's research. The topic for the presentation should be cleared by the thesis supervisor.

**342-797A,B ANIMAL SCIENCE SEMINAR III.** (1) (1 hour) One of two seminars to be given by all students in a Ph.D. program. Review

of literature in relation to the student's proposed research and an experimental design of the research to be conducted.

**342-798A,B ANIMAL SCIENCE SEMINAR IV.** (1 hour) One of two seminars to be given by all students in a Ph.D. program. Presentation of a current scientific topic which is not related to the student's research. The topic for the presentation should be cleared by the thesis supervisor.

**342-701D DOCTORAL COMPREHENSIVE EXAMINATION.** (See Faculty Regulations)

**360-610A STATISTICAL METHODS II.** (3) (3 hours lectures and 2 hours lab) (Prerequisite: 360-310A or equivalent) Principles of linear models, multiple regression equations and classification models. Introduction to Analysis of Variance and common statistical designs used in agricultural and environmental sciences. Emphasis on balanced and unbalanced designs and data structures; their analysis and tests of statistical significance.

# 5 Anthropology

Department of Anthropology
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855 Sherbrooke Street W., Room 717
Montreal, QC H3A 2T7
Canada

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Fax: (514) 398-7476
Website: http://www.arts.mcgill.ca/programs/anthro

*Chair* — Michael S. Bisson

## 5.1 Staff

*Professors*
Donald W. Attwood; A.B.(Calif.), Ph.D.(McG.)
Fumiko Ikawa-Smith; B.A.(Tsuda), A.M.(Radcliffe), Ph.D.(Harv.)
Margaret Lock; B.Sc.(Leeds), M.A., Ph.D.(Calif.) *(joint appt. with Social Studies of Medicine)*
Jérome Rousseau; M.A.(Montr.), Ph.D.(Cantab.) *(on leave 2001-02)*
Philip Carl Salzman; A.B.(Antioch), M.A., Ph.D.(Chic.)
Bruce G. Trigger; B.A.(Tor.), Ph.D.(Yale), F.R.S.C. *(James McGill Professor)*
Allan Young; B.A.(Penn.), M.A.(Wash.), Ph.D.(Penn.) *(joint appt. with Social Studies of Medicine)*

*Associate Professors*
Michael S. Bisson; B.A., M.A., Ph.D.(Calif.)
Laurel Bossen; B.A.(Barnard), M.A., Ph.D.(SUNY, Albany)
Ellen Corin; B.A., M.A., Ph.D.(Louvain) *(joint appt. with Psychiatry)*
John Galaty; M.A., Ph.D.(Chic.)
Carmen Lambert; B.A.(Montr.), M.A., Ph.D.(McG.) *(on leave 2001-02)*
Toby Morantz; B.A.(Man.), M.A.(Br.Col.), Ph.D.(Tor.)
Kristin Norget; B.A.(Vic.,B.C.), M.Phil., D.Phil.(Cantab.)
James M. Savelle; B.Sc., M.Sc.(Ott.), M.A.(Ark.), Ph.D.(Alta.) *(on leave 2001-02)*
Colin H. Scott; B.A.(Regina), M.A., Ph.D.(McG.)

## 5.2 Programs Offered

The Department offers training leading to the M.A. and Ph.D. in Anthropology. Admission is to the M.A. program, except when a student already holds a Master's degree. It is expected, however, that most applicants will be oriented towards achievement of the Ph.D.

The Department offers several alternative M.A. programs:

1. M.A. with thesis;
2. M.A. with research paper;
3. M.A. in Medical Anthropology, with or without thesis.

## 5.3 Admission Requirements

**Master's**

Admission to the M.A. program is open competitively to students holding an Honours or Major B.A. in Anthropology. Outstanding candidates with B.A. degrees in other disciplines but with substantial background related to anthropology are sometimes admitted on the condition that they complete a specified number of additional courses in Anthropology.

The applicants admitted usually have undergraduate Grade Point Averages of 3.5 or above on a 4.0 point scale.

**Ph.D.**

Admission to the Ph.D. program is open competitively to students with a Master's degree in Anthropology. In very special circumstances candidates with Master's degrees in related disciplines may be admitted.

## 5.4 Application Procedures

The deadlines for receipt of all application material for September admission are as follows: those applying for admission and McGill Fellowships – January 1; those applying only for admission – February 15.

Applications will be considered upon receipt of:

1. Graduate Faculty Application Form;
2. application fee, official transcripts;
3. two letters of recommendation;
4. statement of research interests (including reasons for wanting to pursue them at McGill); and
5. test results (GRE, TOEFL), if required.
   (Canadian applicants are exempted from the GRE.)
   (For international students, a minimum TOEFL score of 550 or 213 on computer-based test is required by Graduate Faculty.)

The Department admissions committee announces its selections by April 1.

A number of teaching assistantships are available to graduate students in the Department. Applicants who wish to be considered for an assistantship, a McGill Recruitment Fellowship, or for Differential Fee Waivers (for international students) should include a note to that effect with their applications. For information regarding a variety of other fellowship programs, see the "Graduate Fellowships and Awards" section of the Faculty of Graduate Studies and Research Calendar.

Application packets, including a brochure on the Department, are available directly from the Administrative Assistant of the Department.

## 5.5 Program Requirements

**M.A. Degree**

The purpose of the M.A. program is to provide advanced level training in anthropology and to prepare students for research at the Ph.D. level.

**M.A. Degree with Thesis** (48 credits)

The Master's degree with thesis is a 48-credit program: 4 courses (12 credits) and the M.A. thesis (36 credits).

The student's program of work, which is based on his/her research interests, is developed in consultation with the student's supervisor and the two other members of his or her advisory committee. Students are required to take four courses in the form of seminars and/or tutorials. The set of four courses should be directed toward and converge in the thesis research. M.A. thesis research may take the form of fieldwork but a library thesis is strongly advised so that students can proceed more rapidly to the Ph.D.

**M.A. Degree with Research Paper** (45 credits)

The Master's degree with research paper is a 45-credit program: 5 courses (15 credits), a Proseminar (6 credits) and the research paper (24 credits).

The student's program of work is developed in consultation with the student's supervisor and the two other members of his or her advisory committee. It consists of: five courses (seminars or tutorials), only one of which is optional, a research paper proposal and the research paper. They must also attend the Proseminar. The research paper will normally be based on library research but can involve limited and preferably local fieldwork. The research paper should demonstrate the student's ability to define a problem, place it in a theoretical and factual context, collect and analyze data, and write up a report.

**M.A. Degree in Medical Anthropology** (48 credits)

The M.A. program in Medical Anthropology is given jointly by the Department of Anthropology and the Department of Social Studies of Medicine (SSOM). For additional information, including seminar offerings, please refer to the SSOM section.

The program is open to students with backgrounds in the social sciences, the medical professions, or the medical sciences. The M.A. degree is awarded by the Anthropology Department and admission is granted by a joint admissions committee made up of representatives from Anthropology and SSOM. Within the medical anthropology program, candidates will apply for permission to take one of the following courses of study:

**a) M.A. with Thesis**

This course of study is taken by students with an academic background in anthropology. Course and thesis requirements are the same as described in the M.A. in Anthropology, with thesis, with the following differences: students are required to take two Seminars in Medical Anthropology (522-605, 151-615), as two of their four courses.

**b) M.A. with Research Paper**

This option is offered as an alternative for students with a background in Anthropology. Students are required to take five courses: two Seminars in Medical Anthropology (522-605, 151-615) as well as the following courses in anthropology: Theory I, Research Methods, and Quantitative Methods. They must also attend the Anthropology Proseminar. In addition, students are required to write a research paper.

**c) Special M.A. with Research Paper**

This course of study is taken by students who lack a strong academic background in anthropology. These students are required to take eight courses (24 credits), including two seminars in Medical Anthropology (522-605, 151-615) and at least five additional graduate courses in anthropology (Theory I and Research Methods are recommended). In addition, students are required to write a research paper.

**Ph.D. Degree**

The purpose of the Ph.D. program is to enable a student to make an original contribution to anthropological research in the form of a doctoral thesis. This must be based on a comprehensive understanding of prior research relevant to the topic investigated.

All requirements for the M.A. must be completed. Students holding an M.A. from another department may be requested to take seminars covering deficiencies in their previous training. Those who hold an M.A. without thesis are required to take 2 extra courses (Advanced Theory and Advanced Methods) in either Anthropology or Archaeology.

Candidates must (1) pass a language exam; (2) demonstrate comprehensive understanding of prior research in three subfields of anthropology through the successful completion of three courses; these courses are the Ph.D. Tutorials listed below; (3) submit and orally defend a research proposal; and (4) carry out field research and submit an original thesis for examination and oral defense.

1) A language examination, normally French, must be passed before an oral examination of the research proposal may be scheduled. Francophone students can satisfy the language requirement by demonstrating competency in English. The purpose of the language requirement is to ensure that the student has access to anthropological literature in at least two languages. Under special circumstances, a language other than English or French may be substituted, provided that there is sufficient anthropological literature on the student's research topic in that language.
2) Within the first year of Ph.D. study, students will select a thesis supervisor and at least two other thesis committee members. One of the latter may be from outside the Department. The committee as a whole helps the student to develop a topic for research, to learn the state of the art regarding the topic, and to write a research proposal. To ensure that students understand prior research, they must define three subfields which intersect with the thesis topic. One of these subfields is usually the literature on the geographic region where fieldwork will be carried out. One or more committee members will tutor the student in each selected subfield, and the student will prepare a bibliography of works read and discussed as well as a concise evaluation of the material covered in each. This written work will demonstrate understanding of prior research in each subfield.
3) The thesis proposal is also prepared in consultation with the committee members and under the direction of the thesis supervisor. It contains a brief review of the literature and controversies in the three relevant subfields, and a discussion of the proposed research (background, methods and hypotheses to be tested). When the proposal is finished, it must be read and approved by all members of the committee before it is submitted for oral examination. Copies of the proposal and of the bibliographies relating to the three subfields must be made available to all professors in the Department at least one week before the hearing.

   The oral examination of the proposal and the three subfields is open to all staff and students. The first part of the examination will explore the student's general understanding of the three subfields selected. In the second part, the student may be questioned on the merits of any part of the proposal: theoretical assumptions, hypotheses, methods, understanding of the literature.
4) If the proposal is passed, the student will then carry out field research and write a thesis. Thesis drafts are read and commented on by the thesis committee. When the thesis is ready for examination, it is submitted to the Graduate Faculty, which appoints an internal examiner (usually from within the Department) and an external examiner (an acknowledged authority in the field from outside the university). If both examiners approve the thesis, an oral defense is arranged before a committee appointed by Graduate Faculty.

## 5.6 Courses for Higher Degrees

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

N.B. Most of these are 3-credit courses that take the form either of seminars or tutorials, some of which may be spread over two terms, according to need. Please contact Department for a current course list.

The course credit weight is given in parentheses after the title.

**151-547A,B,D EARLY PREHISTORY OF THE NEW WORLD.** (3)

**151-552A,B,D PROBLEMS IN THE PREHISTORY OF EASTERN NORTH AMERICA.** (3)

**151-602A,B,D THEORY I.** (3)

**151-603A,B,D THEORY II.** (3)

**151-605A,B,D CULTURE AREA.** (3)
**151-607D PROSEMINAR IN ARCHAEOLOGY.** (6)
**151-609D PROSEMINAR IN ANTHROPOLOGY.** (6)
**151-610A,B,D SOCIAL ORGANIZATION.** (3)
**151-611A,B,D RESEARCH DESIGN.** (3)
**151-612A,B,D KINSHIP.** (3)
**151-614A,B,D ECONOMIC ANTHROPOLOGY.** (3)
**151-615A,B,D SEMINAR IN MEDICAL ANTHROPOLOGY.** (3)
**151-616A,B,D POLITICAL ANTHROPOLOGY.** (3)
**151-618A,B,D STRATIFICATION.** (3)
**151-620A,B,D ETHNICITY.** (3)
**151-625A,B,D CULTURAL ECOLOGY.** (3)
**151-630A,B,D SOCIAL CHANGE.** (3)
**151-631A,B,D SYMBOLIC ANTHROPOLOGY.** (3)
**151-633A,B,D WOMEN AND DEVELOPMENT.** (3)
**151-634A,B,D ANTHROPOLOGY OF DEVELOPMENT I.** (3)
**151-635A,B,D ANTHROPOLOGY OF DEVELOPMENT II.** (3)
**151-636A,B,D URBANIZATION.** (3)
**151-638A,B,D COMPLEX SOCIETIES.** (3)
**151-640A,B,D PSYCHOLOGICAL ANTHROPOLOGY.** (3)
**151-642A,B,D ANTHROPOLOGY OF EDUCATION.** (3)
**151-646A,B,D COGNITIVE ANTHROPOLOGY.** (3)
**151-647A,B,D PEOPLING OF THE AMERICAS.** (3)
**151-648A,B,D STRUCTURAL ANTHROPOLOGY.** (3)
**151-650A,B,D ANTHROPOLOGY OF RELIGION.** (3)
**151-651A,B,D ANTHROPOLOGY AND HISTORY.** (3)
**151-652A,B,D ANTHROPOLOGY AND GENDER.** (3)
**151-653A,B,D ANTHROPOLOGY, LANGUAGE AND COGNITION.** (3)
**151-654A,B,D ANTHROPOLOGY OF CHINA.** (3)
**151-656A,B,D ANTHROPOLOGY OF ART.** (3)
**151-660A,B,D RESEARCH METHODS.** (3)
**151-665A,B,D QUANTITATIVE METHODS IN ANTHROPOLOGY.** (3)
**151-670A,B,D ARCHAEOLOGICAL THEORY I.** (3)
**151-671A,B,D ARCHAEOLOGICAL THEORY II.** (3)
**151-673A,B,D ARCHAEOLOGICAL FIELD METHODS.** (3)
**151-674A,B,D ARCHAEOLOGICAL LABORATORY METHODS.** (3)
**151-676A,B,D ARCHAEOLOGICAL AREA.** (3)
**151-678A,B,D ETHNOHISTORY.** (3)
**151-680A,B,D M.A. TUTORIAL READING.** (3)
**151-681A,B,D M.A. TUTORIAL READING.** (3)
**151-682A,B,D M.A. TUTORIAL READING.** (3)
**151-683A,B,D M.A. TUTORIAL READING.** (3)
**151-684A,B,D M.A. TUTORIAL READING.** (3)
**151-685A,B,D RESEARCH TUTORIAL 1.** (3)
**151-686A,B,D RESEARCH TUTORIAL 2.** (3)
**151-687A,B,D RESEARCH TUTORIAL 3.** (3)
**151-688A,B,D RESEARCH TUTORIAL 4.** (3)
**151-690A RESEARCH PAPER I.** (6)
**151-691B RESEARCH PAPER II.** (6)
**151-692B RESEARCH PAPER III.** (6)
**151-693B RESEARCH PAPER IV.** (6)
**151-694A,B M.A. THESIS TUTORIAL I.** (6)
**151-695A,B M.A. THESIS TUTORIAL II.** (6)
**151-696A,B,D M.A. RESEARCH PAPER.** (15)
**151-699A,B,D M.A. THESIS.** (24)
**151-700D PH.D. PRELIMINARY EXAMINATION.**
**151-702A,B,D ADVANCED ANTHROPOLOGICAL THEORY.** (3)
**151-760A,B,D ADVANCED ANTHROPOLOGICAL METHODS.** (3)
**151-770A,B,D ADVANCED ARCHAEOLOGICAL THEORY.** (3)
**151-773A,B,D ADVANCED ARCHAEOLOGICAL METHODS.** (3)
**151-780A,B,D READING AND RESEARCH.** (3)
**151-781A,B,D READING AND RESEARCH.** (3)
**151-790 A,B,D PH.D. TUTORIAL 1.** (3)
**151-791 A,B,D PH.D. TUTORIAL 2.** (3)
**151-792 A,B,D PH.D. TUTORIAL 3.** (3)

# 6 Architecture

School of Architecture
Macdonald Harrington Building
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Fax: (514) 398-7372
Website: http://www.mcgill.ca/arch

*Director* — David Covo

*Graduate Program Co-ordinator* — Alberto Pérez-Gómez (Acting)

## 6.1 Staff

*Emeritus Professors*
John Bland; B.Arch.(McG.), A.A. Dipl., D.Sc.(Carl.), R.C.A., F.R.A.I.C., O.A.Q.
Norbert Schoenauer; B.Arch.(Bud.), M.Arch.(McG.), R.C.A., F.R.A.I.C., O.A.Q., C.U.Q., M.C.I.P. *(William C. Macdonald Emeritus Professor of Architecture)*
Harold Spence-Sales; B.A.(Well.), A.A.Dipl., L.L.D.(S. Fraser)

*Professors*
Bruce Anderson; B.Arch.(McG.), M.Arch.(Harv.), F.R.A.I.C., O.A.Q., A.A.P.P.Q.
Vikram Bhatt; N.Dip Arch.(Ahmed.), M.Arch.(McG.), M.R.A.I.C.
Derek Drummond; B.Arch.(McG.), F.R.A.I.C., O.A.Q., O.A.A. *(William C. Macdonald Professor of Architecture)*
Alberto Pérez-Gómez; Dipl.Eng.(Nat.Pol.Inst.Mexico), M.A., Ph.D.(Essex) *(Saidye Rosner Bronfman Professor of Architectural History)*
Radoslav Zuk; B.Arch.(McG.), M.Arch.(M.I.T.), D.Sc.(U.A.A.), F.R.A.I.C., O.A.Q., O.A.A.

*Associate Professors*
Annmarie Adams; B.A.(McG.), M.Arch., Ph.D.(Calif.), M.R.A.I.C. *(William Dawson Scholar)*
Martin Bressani; B.Sc.(McG.), B.Arch.(McG), M.Sc.(Arch.)(MIT), D.E.A.(Paris-Sorbonne), Docteur (Paris-Sorbonne - Paris IV), O.A.Q.
Ricardo Castro; B.Arch.(Los Andes, Col.), M.Arch., M.A.(Oregon), M.R.A.I.C.
David Covo; B.Sc.(Arch.), B.Arch.(McG.), F.R.A.I.C., O.A.Q.
Avi Friedman; B.Arch.(Technion), M.Arch.(McG.), Ph.D.(Montr.), O.A.Q., I.A.A.
Robert Mellin; B.Arch., M.Sc.(Arch.) (Penn.State), M.Arch.(McG.), M.Sc., Ph.D.(U.Penn.), M.R.A.I.C., N.A.A.
Adrian Sheppard; B.Arch.(McG.), M.Arch.(Yale), O.A.Q., A.A.P.P.Q., F.R.A.I.C.
Pieter Sijpkes; B.Sc.(Arch.), B.Arch.(McG.)

*Course Lecturers*
Manon Asselin, Rhona Kenneally, Daniella Rohan

*Adjunct Professors*
Ewa Bienicka, Julia Bourke, Joseph Baker, Anne Cormier, Nathalie David, Howard Davies, François Dufaux, Gordon Edwards, François Émond, Julia Gersovitz, Dan Hanganu, Phyllis Lambert, Annie Lebel, Seymour Levine, Harry Mayerovitch, Serge Melanson, Joanna Nash, Daniel Pearl, Mark Poddubiuk, Stéphane Pratte, Richard de la Riva, Daniella Rohan, Jacques Rousseau, Richard Russell, Robert Stanley, Robert Thibodeau, André Vecsei, Eva Vecsei, Fred Weiser, Samson Yip, Jozef Zorko

## 6.2 Programs Offered

M.Arch.I (professional), M.Arch. II (post-professional), Graduate Diploma in Housing, Ph.D.

The professional M.Arch.I is accredited by the Canadian Architectural Certification Board (CACB), and is recognized as accredited by the National Council of Architectural Registration Boards (NCARB) in the U.S.A.

There are two areas of study in the M.Arch.II and Ph.D. programs: Architectural History and Theory, and Housing (which includes Affordable Homes, Domestic Environments, and Minimum Cost Housing).

Information concerning the duration of programs, documents required of applicants, etc., may be obtained from: mlanni@po-box.mcgill.ca (M.Arch.I), mking@po-box.mcgill.ca (M.Arch.II and Graduate Diploma in Housing), or hdyer@po-box.mcgill.ca (Ph.D.).

**Architectural Certification in Canada**

In Canada, all provincial associations recommend a degree from an accredited professional degree program as a prerequisite for licensure. The Canadian Architectural Certification Board (CACB), which is the sole agency authorized to accredit Canadian professional degree programs in architecture, recognizes two types of accredited degrees: the Bachelor of Architecture and the Master of Architecture. A program may be granted a five-year, three-year, or two-year term of accreditation, depending on its degree of conformance with established educational standards.

Masters degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree, which, when earned sequentially, comprise an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Since all provincial associations in Canada recommend any applicant for licensure to have graduated from a CACB-accredited program, obtaining such a degree is an essential aspect of preparing for the professional practice for architecture. While graduation from a CACB-accredited program does not assure registration, the accrediting process is intended to verify that each accredited program substantially meets those standards that, as a whole, comprise an appropriate education for an architect.

## 6.3 Admission Requirements

**M.Arch. I (professional) Program**

Students holding the McGill B.Sc.(Arch.) degree, or equivalent, with a cumulative grade point average of at least 3.0, are eligible to apply for admission.

**M.Arch. II (post-professional) and Graduate Diploma in Housing**

Students holding an accredited professional degree in architecture, or equivalent, with a cumulative grade point average of at least 3.0, are eligible to apply for admission. In special cases, candidates with a degree in a related field may be considered.

**Ph.D.**

Candidates with high standing in McGill's M.Arch.II, or who hold an equivalent degree from another university, are eligible to apply to this program. Those who do not have an appropriate background in the chosen research area may be admitted to Ph.D.I. Candidates who have an adequate background at the post-professional Master's level in the proposed area of research will be admitted to Ph.D.II.

A working knowledge of a language or languages relevant to the area of research may be required.

## 6.4 Application Procedures

**Professional Master of Architecture: M.Arch.I**

**McGill B.Sc.(Arch.) Graduates:**

1. Completed and signed application form.
2. Work experience reports.
3. A non-refundable application fee of $60 (Cdn) made payable to McGill University.

**Others:**

1. Completed and signed application form.
2. A non-refundable application fee of $60 (Cdn) made payable to McGill University.
3. Two sets of official transcripts sent directly from previous university programs.
4. Two confidential letters of reference sent directly by the referees to the School of Architecture.
5. Course calendar descriptions of previous college and/or university studies.
6. A portfolio (8 1/2" x 11"format) containing the following:
   – samples of studio work from previous studies (please use Studio Project Description Form),
   – samples of freehand drawing and sketching,
   – samples of professional work.
7. Completed Program Comparison Chart.
8. Proof of English language proficiency – minimum TOEFL score of 577 on paper-based test (or 233 on the computer-based test). Please refer to Graduate Studies General Information section 5.3.

**Post-professional programs:**
**M.Arch. II, Ph.D. and Graduate Diploma in Housing**

1. Completed and signed application form.
2. A non-refundable application fee of $60 (Cdn) made payable to McGill University.
3. Two sets of official transcripts sent directly from previous university attended.
4. Two confidential letters of reference sent directly by the referees to the School of Architecture.
5. A statement indicating the option chosen and the general area of research to be undertaken. Ph.D. applicants must submit a 3-page research proposal.
6. A portfolio (8½" x 11"format) containing at least five examples of the applicant's work. Folded drawings are unacceptable.
7. At least one example of a report or paper written by the applicant.
8. Proof of English language proficiency (TOEFL) – minimum score of 577 on the paper-based test (or 233 on the computer-based test). Please refer to Graduate Studies General Information section 5.3.

## 6.5 Program Requirements

**M.Arch. I**

McGill's professional program in Architecture is structured as a four-and-a-half-year, or nine-semester, course of study divided into two parts. The first part is a six-semester design program leading to a non-professional degree, Bachelor of Science (Architecture). Further information on the B.Sc.(Arch.) Program is contained in the Faculty of Engineering Undergraduate calender, available at http://www.aro.mcgill.ca. The second part, for students with the B.Sc.(Arch.) degree, or the equivalent, is the professional Master of Architecture program.

The professional Master of Architecture program is a one-and-a-half year, or three-semester course of studies leading to the M.Arch. I degree.

**M.Arch.I Program of Study** (45 credits)

| | | |
|---|---|---|
| 301-550 | (3) | Urban Planning I |
| 301-551 | (3) | Urban Planning II |
| 301-554 | (2) | Mechanical Services |
| 301-555 | (2) | Environmental Acoustics |
| 301-671 | (4) | Design Research and Methodology |
| 301-672 | (6) | Architectural Design I |
| 301-673 | (8) | Architectural Design II |
| 301-674 | (2) | Professional Practice I |
| 301-675 | (2) | Professional Practice II |
| 301-676 | (2) | Specifications and Building Costs |
| 301-678 | (3) | Advanced Construction |

301-679 (1) Architectural Journalism
301-680 (1) Sketching School II
6 credits of complementaries/electives, of which a minimum of 3 credits must be from an architectural complementary.

Unless otherwise indicated, the above courses are restricted to students in the professional program.

**M.Arch.II**

The post-professional Masters (M.Arch.II) is open to applicants who have a professional degree in architecture. Students holding the McGill B.Arch. (former) or M.Arch.I (new) degree, or an equivalent professional qualification, with a CGPA of at least 3.0 on a 4.0 point scale, are eligible for admission to the graduate programs. In special cases, applicants with a degree in a related field may be considered. The primary requirement for the M.Arch.II is 30 credits of course work, to be completed in the first two terms, and a 15-credit project report that can be completed during the summer, or in the following fall term. The residence requirement for the M.Arch.II degree is three academic semesters, making it possible for students who elect to work on their project report in the summer term to obtain their degree after twelve calendar months in the program.

**Ph.D.**

Doctoral candidates must have their thesis proposal approved by their advisor (301-700) before embarking on their research. A Thesis Advisory Committee is then struck and is responsible for monitoring the student's research. For course number 301-701, a comprehensive research proposal is required, as well as a demonstration of broad knowledge in the field. Candidates will submit two further reports in formal meetings with the Advisory Committee, who will review the work in progress (301-702 and 301-703). The final meeting takes place after the Committee has reviewed the full draft of the dissertation. If approved, the dissertation will then be submitted in its final form to the Thesis Office. Acceptance of the thesis by the examiners is followed by an oral defense.

**Graduate Diploma in Housing**

The Graduate Diploma in Housing is open to applicants who have a professional degree in architecture. The Diploma program is a two-semester program which is intended for professionals who have worked in the area of housing in North America or in the developing world. The program is designed for those who, while wishing to advance their knowledge in the housing field, are not able, or inclined, to undertake studies towards a Master's degree.

## 6.6 Courses

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered 2001-02.

**301-520B MONTREAL: URBAN MORPHOLOGY.** 3(2-1-6) (Prerequisite: 301-251B) Historical, geographical, demographical, and regional evolution of the metropolis of Montreal. Topics include: important *quartiers*, the Montreal urban grid, industrialization, reform movements, geographical diversity, and urban culture, local building techniques and materials, basic concepts of urban morphology and their relationships to the contemporary urban context. Section 01 reserved for Architecture students. Section 02 reserved for others, limited enrolment.

● **301-521B STRUCTURE OF CITIES.** 3(2-0-7)

**301-522A HISTORY OF DOMESTIC ARCH. IN QUEBEC.** 3(2-0-7) (Prerequisite: 301-251B) The architecture of houses in Quebec from 1650 to the present. Distinguished buildings are reviewed from the point of view of form, style, siting and material, as influenced by climate, culture and architectural antecedents in France, England and the United States. The course material is presented through alternating bi-weekly lecures and seminars. Limited enrolment; password card required.

● **301-523B SIGNIFICANT TEXTS & BUILDINGS.** 3(2-0-7) (Prerequisite: 301-251B) (Alternating with 301-524B)

**301-524B SEMINAR ON ARCHITECTURAL CRITICISM.** 3(2-0-7) (Prerequisite: 301-251B) (Alternating with 301-523B) The development and current role of architectural criticism with particular reference to its affinities with art and literary criticism. Limited enrolment; password card required.

**301-525A SEMINAR ON ANALYSIS AND THEORY.** 3(2-0-7) Analysis and evaluation of significant architectural projects with reference to contemporary architectural theories. Limited enrolment; password card required.

**301-526B PHILOSOPHY OF STRUCTURE.** 3(2-0-7) (Prerequisite: 301-202B or permission of instructor.) Philosophy of Structure aims to investigate structure in its broadest sense. The course is divided in two halves; the first one gives an overview of the development of theoretical structural frameworks such as mathematics and geometry, while the second one highlights physical structures constructed by nature (geology, turbulence), man or animals. Section 01 reserved for Architecture students. Section 02 reserved for others; password card required.

**301-527B CIVIC DESIGN.** 3(2-0-7) The elements of form in buildings and their siting design in the urban setting. Section 01 reserved for Architecture students. Section 02 reserved for others.

**301-528A HISTORY OF HOUSING.** 3(2-0-7) Indigenous housing both transient and permanent, from the standpoint of individual structure and pattern of settlements. Principal historic examples of habitat including housing in the age of industrial revolution, and contemporary housing. Section 01 reserved for B.Sc.(Arch.) students. Section 02 reserved for Masters of Architecture students. Section 03 reserved for Urban Planning students. Section 04 reserved for Urban Systems students. Section 05 reserved for Engineering students.

**301-529B HOUSING THEORY.** 3(2-0-7) (Prerequisite: 301-528A) A review of environmental alternatives in housing; contemporary housing and the physical and sociological determinants that shape it; Canadian housing. Section 01 reserved for Architecture students. Section 02 reserved for others.

**301-531A ARCH. INTENTIONS FROM VITRUVIUS TO RENAISSANCE.** 3(2-0-7) (Prerequisite: 301-251B) Architectural intentions embodied in buildings and writings of architects from Antiquity to the Renaissance. Special emphasis is placed on the cultural connections of architecture to science and philosophy. Section 01 reserved for Architecture students. Section 02 reserved for others.

**301-532B ORIGINS OF MODERN ARCHITECTURE.** 3(2-0-7) (Prerequisite: 301-251B) Examination of architectural intentions (theory and practice) in the European context (especially France, Italy and England), during the crucial period that marks the beginning of the modern era. Section 01 reserved for Architecture students. Section 02 reserved for others.

**301-540A,B SELECTED TOPICS IN ARCHITECTURE I.** 3(2-0-7) A course to allow the introduction of new topics in Architecture as needs arise, by regular and visiting staff.

**301-541A,B SELECTED TOPICS IN ARCHITECTURE II.** 3(2-0-7) A course to allow the introduction of new topics in Architecture as needs arise, by regular and visiting staff.

**301-550B URBAN PLANNING I.** 3(2-0-7) (Prerequisite: B.Sc.(Arch.) or permission of instructor.) Theory and practice. An examination of different basic approaches to urban planning with special reference to Quebec. Section 01 reserved for Architecture students. Section 02 reserved for others, limited enrolment, password card required.

**301-551A URBAN PLANNING II.** 3(2-0-7) (Prerequisite: 301-550B) Urban design and project development, theory and practice. Detailed analysis of selected examples of the development process and of current techniques in urban design. Includes case studies from Quebec and elsewhere. Section 01 reserved for Architecture students. Section 02 reserved for others, limited enrolment, password card required.

**301-554A MECHANICAL SERVICES IN BUILDINGS.** 2(2-0-4) (Prerequisite: 301-405A or permission of instructor.) Problems encountered in providing mechanical services in buildings. Physiological and environmental aspects of heat, ventilation and air conditions, estimation of heating and cooling loads and selection and specification of equipment. Sprinkler systems and plumbing. Construction problems produced by installations of this equipment. Section 01 reserved for Architecture students. Section 02 reserved for others, limited enrolment, password card required.

**301-555B ENVIRONMENTAL ACOUSTICS.** 2(2-0-4) (Prerequisite: 301-405A or permission of instructor.) Acoustics in architectural design, and in environmental control of buildings. Acoustical requirements in the design of auditoria such as theatres, lecture halls, opera houses, concert halls, churches, motion picture theatres, studios. Principles of noise and vibration control, sound insulating in building construction. Practical noise control in various types of buildings. Section 01 reserved for Architecture students. Section 02 reserved for others, limited enrolment, password card required.

**301-622A CRITICAL WRITING.** 3(2-1-6) Seminar to critically review an architectural topic.

**301-623B PROJECT PREPARATION.** 3(2-1-6) Guided background preparation for the project.

**301-624C HISTORY & THEORY PROJECT.** 15(0-15-30) Visit of a chosen city for a minimum of 2 weeks. The course work includes three separate stages: 1) surveying, 2) preparation of text and architectural drawings, and 3) development of an alternative guide to the city.

**301-627A RESEARCH METHODS.** 3(2-1-6) Different approaches and research methods in housing. Setting of goals and objectives, identification of appropriate research methods, collection and evaluation of information, analysis and synthesis of data, and presentation of the findings.

**301-628C HOUSING PROJECT REPORT.** 15(0-15-30) A supervised project report based on material developed by candidates in the project preparation course. It may include on-site explorations of housing projects, surveying and documentation, critical analysis, and creative mapping of the same, plus an evaluation report.

**301-630A, 301-631B HOUSING SEMINAR I, II.** 3(2-0-7) Strategies for affordable and low-cost housing. Investigation of cost-saving measures both at urban and dwelling unit levels. An analysis of recent low-cost housing projects.

**301-634B HOUSING REPORT.** 6(2-10-6) Human settlements problems in poverty areas; design of components and servicing systems for low cost housing; economic and technological evaluation of housing designs. Lectures and studio work leading to a comprehensive project report.

**301-635A,B SELECTED TOPICS IN HOUSING I.** 3(3-0-6) Special topics related to housing.

**301-636A,B SELECTED TOPICS IN HOUSING II.** 3(3-0-6) Special topics related to housing.

**301-644C SHELTER FIELD OPERATIONS.** 6(0-0-18) Fieldwork related to housing research.

**301-645A, 301-646B HOUSING PROJECT I, II.** 6(2-10-6) Innovative housing designs; lectures and studio work leading to a design project.

**301-650A ARCHITECTURAL HISTORY SEMINAR I.** 8(3-5-16) Western Architectural history from Antiquity to the Renaissance. A hermeneutic reading of primary sources, i.e. a section or chapter of an historical treatise, a frontispiece or image, in the framework of recent scholarship on the subject.

**301-651B ARCHITECTURAL HISTORY SEMINAR II.** 8(3-5-16) Early Modern European theory of architecture, 17th - 19th centuries. A hermeneutic reading of primary sources, i.e. a section or chapter of an historical treatise, a frontispiece or image, in the framework of recent scholarship on the subject.

**301-652A ARCHITECTURAL THEORY SEMINAR I.** 4(4-0-8) Phenomenology and hermeneutics.

**301-653B ARCHITECTURAL THEORY SEMINAR II.** 4(4-0-8) The experience of modernity in cultural criticism, philosophy, literature and art.

**301-671B DESIGN RESEARCH AND METHODOLOGY.** 4(1-4-7) An architectural design problem is selected, bibliographic research undertaken, site selection established: program developed and theoretical approach evolved in preparation for course 301-673A.

**301-672A ARCHITECTURAL DESIGN I.** 6(2-10-6) A series of complex architectural and urban design issues are addressed with the intention of improving the student's facility to critically assess existing design solutions, to seek alternatives and to articulate clearly the rational and the impact of alternative proposals.

**301-673A ARCHITECTURAL DESIGN II.** 8(2-14-8) (Prerequisite: 301-671 and 301-672) An individual, student-selected and faculty-approved study of complex architectural design objectives involving site and building program constraints, the integration of building systems and the demonstration of comprehensive design and presentation skills.

**301-674A PROFESSIONAL PRACTICE I.** 2(2-0-4) The architect's relationship to his/her client: responsibility, business conduct, supervision, arbitration, issuing of certificates, competitions, standard forms of contracts, payments, liens, servitudes, public health, building regulations, fees.

**301-675B PROFESSIONAL PRACTICE II.** 2(2-0-4) (Prerequisite: 301-674A) The construction process will be examined. Topics include project and construction management, contracting methods, tendering, sureties, site safety, negotiations, cost control, quality control, delay claims, legal hypothecs. Standard documentation and procedures will be reviewed, including CCDC contract, OAQ forms, CSC MasterFormat.

**301-676B SPECIFICATIONS AND BUILDING COSTS.** 2(2-0-4) Principles of writing architectural specifications; discussion of actual specifications and practice in specifying for common trades; essays on common building materials; costing of materials and building assemblies.

**301-678A ADVANCED CONSTRUCTION.** 3(2-0-7) (Prerequisite: 301-674A) An exploration of construction in relation to architectural design; research in advanced methods of construction and structure related to design problems and built projects; appropriate technologies and alternatives.

**301-679A ARCHITECTURAL JOURNALISM.** 1(0-0-3) (Prerequisite: 301-674A) The project deals with the review and criticism of a recently constructed controversial building,

**301-680A SKETCHING SCHOOL II.** 1(0-0-3) An eight-day supervised field trip in the late summer to sketch places or things having specific visual characteristics.

**301-690A,B,C THESIS RESEARCH I.** 3(0-2-7) Ongoing research pertaining to thesis.

**301-691A,B,C THESIS RESEARCH II.** 6(0-2-16) Ongoing research pertaining to thesis.

**301-692A,B,C THESIS RESEARCH III.** 6(0-2-16) Ongoing research pertaining to thesis.

**301-693A,B,C THESIS RESEARCH IV.** 12(0-2-34) Ongoing research pertaining to thesis.

**301-700 PRELIMINARY PH.D. EXAMINATION.**

**301-701 PROGRESS REPORT I.**

**301-702 PROGRESS REPORT II.**

**301-703 PROGRESS REPORT III.**

# 7 Art History

Department of Art History and Communication Studies
Arts Building,W-225 (West Wing, top floor)
853 Sherbrooke Street West
Montreal, QC H3A 2T6
Canada

Telephone: (514) 398-6541
Fax: (514) 398-7247
Website: http://www.arts.mcgill.ca/programs/AHCS

*Chair* — Christine Ross *(on leave Jan.-Dec. 2001)*

*Director, Graduate Programs in Art History — Hans J. Böker*
*Director, Graduate Programs in Communication —* Will Straw

## 7.1 Staff

*Emeritus Professors*
John M. Fossey; B.A.(Birm.), D.U.(Lyon II), F.S.A., R.P.A.
George Galavaris; M.A.(Athens), M.F.A., Ph.D.(Prin.), F.R.S.C.
George Szanto; B.A.(Dart.), Ph.D.(Harv.)

*Professor*
Hans J. Böker; Ph.D.(Saarbrücken), Dr. Ing.-habil(Hannover)

*Associate Professors*
David Crowley; B.A.(Johns H.), M.Sc.(Penns.), Ph.D.(McG.)
Christine Ross; M.A.(C'dia.), Ph.D.(Paris I) *(on leave Jan. to June 2001)*
Will Straw; B.A.(Carl.), M.A., Ph.D.(McG.)

*Assistant Professors*
Ting Chang; B.A.(McG.), M.A.(Tor.), Ph.D.(Sussex)
Sheryl N. Hamilton; L.L.B.(Sask.), B.A., M.A.(Carl.), Ph.D.(C'dia)
Bronwen Wilson; B.A., M.A.(U.B.C.), Ph.D.(Northwestern)

*Assistant Professor (Special Category)*
Johanne Sloan; B.F.A.(C'dia), M.A.(Montr.), Ph.D.(Kent)

*Adjunct Professors*
David W. Booth; B.A., M.A., M.Phil., Ph.D.(Tor.)
Johanne Lamoureux; B.A., M.A.(Montr.), Ph.D.(E.H.E.S.S., Paris)
Louis De Moura Sobral; M.A., Ph.D.(Louvain)
Grant McCracken; B.A.(Antioch), M.A., Ph.D.(Chic.)
Don McGregor; B.A.(Tor.), M.A.(Carl.), Federal Government Interchange Canada
Constance Naubert-Riser; B.A., M.A.(Ott.), Ph.D.(Lyon III)
Jocelyne Picot; B.A.(Montr.), M.A.(Con.), Ph.D.(S. Fraser)

## 7.2 Programs Offered

M.A. and Ph.D.

Areas of Specialization:
1. Classical and Aegean Archaeology
2. Greek Epigraphy
3. Archaeological Methods and Archaeometry
4. Western Medieval Art
5. Medieval Architecture
6. Post Medieval Architecture
7. Renaissance Art
8. Baroque Art
9. Late Eighteenth, Nineteenth and Early Twentieth-Century Art
10. The Art of W.W. I to the Present
11. Canadian Art
12. Methodology
13. Feminist Art History

For programs in Communications refer to section 18.

## 7.3 Admission Requirements

Entrance into either the M.A. or Ph.D. programs is limited to the best qualified applicants. A minimum CGPA of 3.3 or the equivalent, i.e. 75%, is required.

To apply to the M.A. program, candidates are normally expected to have a B.A. Honours degree either in Art History alone or in Art History and one other closely related field. But regardless of the program, the Department normally requires a minimum of 39 credits (at least 13 courses) in Art History with emphasis on European art and architecture. For candidates from institutions not offering the above number of credits in Art History, provision is made, upon consultation with the Director of Graduate Studies, for a program of study which would then qualify the candidate to apply for M.A. work.

In order to apply to the Ph.D. program, candidates must normally hold an M.A. degree preferably in Art History or an M.A. degree in a closely related field together with an appropriate number of Art History credits such as are described for entrance into the M.A. program. Applicants are strongly encouraged to consult with the Director of Graduate Studies. The number of entrants to the doctoral program is necessarily limited to the most highly qualified applicants.

It should be noted that courses in studio practice, although useful, cannot be counted among the 39 Art History credits for either the M.A. or Ph.D programs. Also please see as well the language requirements given under the degree programs below.

The Department also requires a 200-250 word statement outlining the candidate's major interest in Art History as well as an example of his/her written work. Applicants should send complete dossiers by January 15 to the Admissions Coordiantor, Department of Art History and Communication Studies, McGill University, 853 Sherbrooke St. West, Montreal, QC. H3A 2T6.

## 7.4 Application Procedures

Applications will be considered upon receipt of:

1. Application form.
2. $60 application fee.
3. Transcripts (2 official copies).
4. Letters of Recommendation (2 official letters).
5. Written samples (2 samples, English or French translations).
6. Statement of Interest (4 copies).
7. Proof of Citizenship.
8. TOEFL (minimum score of 550 on paper-based test or 213 on the computer-based test).

Deadline for application is January 15.

Inquiries regarding the Program should be addressed to the Admissions Coordinator, Department of Art History and Communication Studies, McGill University, 853 Sherbrooke Street West, Montreal, QC H3A 2T6.

## 7.5 Program Requirements

### Master of Arts

**M.A. Degree** (48 credits)
1. Five 3-credit courses approved by the Department of which, with the approval of the Director of Graduate Studies, not more than two may be taken outside the Department. (1 5credits)
2. The M.A. written examinations. (123-601, 123-602) (9 credits)
3. Thesis (123-699) on a topic approved by the Department in one of the following areas:
   Classical and Aegean Archaeology, Greek Epigraphy, Archaeological Method and Archaeometry, Western Medieval Art, Medieval Architecture, Post Medieval Architecture, Renaissance Art, Baroque Art, Late Eighteenth, Nineteenth and Early Twentieth-Century Art, The Art of W.W.I to the Present, Canadian Art, Methodology, Feminist Art History (24 credits)

Language requirements for the M.A. degree: reading knowledge of English and French and a minimum of one additional approved classical or modern language, before admission to the second year of the M.A. program.

### Ph.D. Degree

The Ph.D. requirements are fulfilled progressively with five 3-credit courses of which, with the approval of the Director of Graduate Studies, not more than two may be taken outside the Department.

The Ph.D. examinations both written and oral, the Doctoral dissertation and its oral defence.

Language requirements for the Ph.D. degree: reading knowledge of three modern languages and, depending on the field, at least one classical language, approved by the Department.

The Department is prepared to direct dissertations in fields wherein adequate supervision and resources can be provided: see section 7.2. Candidates are also advised to consult the General Information and Regulations section of the Faculty of Graduate Studies and Research Calendar.

### 7.6 Courses for Higher Degrees

Each year, courses, given in the form of seminars or tutorials (the material varies yearly), are offered in some of the areas listed below. For a precise list of topics for the forthcoming session, students should contact the Graduate Coordinator.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

▭ Denotes limited enrolment.

**123-601A,B MASTERS COMPREHENSIVE PREPARATION.** (3)

**123-602A,B MASTERS COMPREHENSIVE EXAM.** (6)

The general examination for the M.A. degree (123-602, 6 credits; including preparation for it, 123-601, 3 credits) carries a total of nine (9) credits.

**123-617A,B MODERN ART.** (3)

**123-618A,B STUDIES IN ART HISTORY FROM 1400-1900 I.** (3)

**123-619A,B STUDIES IN ART HISTORY FROM 1400-1900 II.** (3)

**123-641A,B GREEK ART AND ARCHAEOLOGY I.** (3)

**123-642A,B GREEK ART AND ARCHAEOLOGY II.** (3)

**123-643A,B GREEK ART AND ARCHAEOLOGY III.** (3)

**123-645A,B MEDIEVAL ART AND ARCHAEOLOGY I.** (3)

**123-646A,B MEDIEVAL ART AND ARCHAEOLOGY II.** (3)

**123-648A,B ART OF THE ITALIAN RENAISSANCE I.** (3)

**123-649A,B ART OF THE ITALIAN RENAISSANCE II.** (3)

**123-650A,B NORTHERN RENAISSANCE ART I.** (3)

**123-651A,B NORTHERN RENAISSANCE ART II.** (3)

**123-654A,B BAROQUE ART AND ARCHITECTURE I.** (3)

**123-655A,B BAROQUE ART AND ARCHITECTURE II.** (3)

**123-657A,B 19TH CENTURY PAINTING AND SCULPTURE I.** (3)

**123-658A,B 19TH CENTURY PAINTING AND SCULPTURE II.** (3)

▭ **123-660A,B CONTEMPORARY ART AND CRITICISM I.** (3)

▭ **123-661A,B CONTEMPORARY ART AND CRITICISM II.** (3)

**123-675A,B RENAISSANCE AND POST-RENAISSANCE STUDIES I.** (3)

**123-678A,B RENAISSANCE AND POST-RENAISSANCE STUDIES II.** (3)

**123-679A,B ROMAN ART AND ARCHAEOLOGY I.** (3)

**123-680A,B ROMAN ART AND ARCHAEOLOGY II.** (3)

**123-681A,B ROMAN ART AND ARCHAEOLOGY III.** (3)

**123-684A,B SEMINAR IN THE ART OF BYZANTIUM.** (3)

**123-687A,B PROBLEMS IN WESTERN MEDIEVAL ARCHITECTURE AND SCULPTURE.** (3)

**123-689A,B STUDIES IN MANUSCRIPT ILLUMINATION I.** (3)

**123-690A,B STUDIES IN MANUSCRIPT ILLUMINATION II.** (3)

**123-693A,B ARTISTIC THEORY IN THE RENAISSANCE.** (3)

**123-699D THESIS RESEARCH.** (24)

**123-701D PH.D. COMPREHENSIVE EXAMINATION.** (6)

**123-713A,B STUDIES IN THE GRAPHIC ARTS.** (3)

**123-714A,B RESEARCH IN MODERN ART AND ARCHITECTURE – 1750 TO THE PRESENT I.** (3)

**123-715A,B RESEARCH IN MODERN ART AND ARCHITECTURE – 1750 TO THE PRESENT II.** (3)

**123-719A,B SEMINAR IN URBAN PLANNING AND TOPOGRAPHY.** (3)

**123-722A,B STUDIES OF DRAWINGS.** (3)

**123-723A,B ART CRITICISM I.** (3)

**123-724A,B ART CRITICISM II.** (3)

**123-725A,B METHODS IN ART HISTORY.** (3)

**123-730A,B CURRENT PROBLEMS IN ARCHITECTURAL HISTORY I.** (3)

**123-731A,B CURRENT PROBLEMS IN ARCHITECTURAL HISTORY II.** (3)

## 8 Atmospheric and Oceanic Sciences

Department of Atmospheric and Oceanic Sciences
Burnside Hall
805 Sherbrooke Street West, Room 945
Montreal, QC H3A 2K6
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*Chair* — C.A. Lin

### 8.1 Staff

*Emeritus Professors*
R.R. Rogers; B.S.(Texas), S.M.(M.I.T.), Ph.D.(N.Y.)
E.J. Stansbury; M.A., Ph.D.(Tor.)

*Professors*
J.F. Derome; B.Sc., M.Sc.(McG.), Ph.D.(Mich.)
L.A. Mysak; B.Sc.(Alta.), M.Sc.(Adel.), A.M. Ph.D.(Harv.), F.R.S.C.
I.I. Zawadzki; B.Sc.(Buenos Aires), M.Sc., Ph.D.(McG.)

*Associate Professors*
J.R. Gyakum; B.Sc.(Penn.St.), M.Sc., Ph.D.(M.I.T.)
H.G. Leighton; B.Sc., M.Sc.(McG.), Ph.D.(Alta.)
C.A. Lin; B.Sc.(Br.Col.), Ph.D.(M.I.T.)
D. Straub; B.S., M.S.(SW Louisiana), Ph.D.(Wash.)
M.K. Yau; S.B., S.M., Sc.D.(M.I.T.)

*Assistant Professors*
P. Ariya; B.Sc., Ph.D.(York) *(William Dawson Scholar) (joint appt. with Chemistry)*
F. Fabry; B.Sc., M.Sc., Ph.D.(McG.) *(joint appointment with McGill School of Environment)*

*Assistant Professor (Special Category)*
P. Bartello; B.Sc., M.Sc., Ph.D.(McG.)

*Lecturer*
A.P. Schwartz

*Adjunct Professors*
J.-P. Blanchet, G. Brunet, E. Carmack, R.G. Ingram, R. Laprise, S. Laroche

### 8.2 Programs Offered

The Department of Atmospheric and Oceanic Sciences offers courses and research opportunities in atmospheric, physical oceanographic, and climate fields leading to the M.Sc. and Ph.D. degrees. Research programs include the main areas of atmospheric science, such as cloud and precipitation physics, dynamic meteorology, numerical weather prediction, atmospheric chemistry, radar and satellite meteorology, and mesoscale meteorology. Research projects in physical oceanography include the modelling of ocean circulations as well as studies of sea ice and paleoclimates. Some faculty members are associated with the Centre for Climate and Global Change Research, which brings together researchers from several departments to work on problems affecting the evolution of our planet, with emphasis on climate-related questions. Topics of research of this nature in the Department

include large scale air/sea interaction, air/sea-ice interaction, interannual and longer term variability of the atmosphere and oceans, and cloud-radiation climate interaction.

Other faculty members are associated with the Cooperative Centre for Research in Mesometeorology which also includes researchers in several other departments at McGill, in the Département de Physique at the Université du Québec à Montréal, and in Montreal offices of the Meteorological Service of Canada. The objective of the Centre is to study the evolution, maintenance and decay of mesoscale precipitation systems. Such systems, whose sizes range from 10 to 300 km, are important for the precipitation climatology of southern Quebec.

Facilities include the J. Stewart Marshall Radar Observatory, a radar wind profiler and a laser ceilometer and several years of global atmospheric data. Graduate students have access to large and small computers, including the NEC supercomputer of the Meteorological Service of Canada. Financial assistance in the form of research or teaching assistantships is available for all qualified graduate students.

## 8.3 Admission Requirements

Applicants for the M.Sc. program must meet the general requirements of the Faculty of Graduate Studies and Research and hold a bachelor's degree with high standing in atmospheric science, physics, mathematics, engineering, or equivalent.

The normal requirement for admission to the Ph.D. program is an M.Sc. degree in atmospheric science, physical oceanography, or related discipline with acceptably high standing. Students without a Master's degree in Atmospheric Science (Meteorology) or Physical Oceanography but with a strong background in related disciplines (physics, mathematics, engineering) may be admitted to the Ph.D. program. They enter at the Ph.D. I rather than the Ph.D. II level, and devote the first year of the program mainly to course work.

Inquiries should be addressed directly to the Chair of Admissions, Department of Atmospheric and Oceanic Sciences.

## 8.4 Program Requirements

### M.Sc. Degree

Depending on their background, students must take from 9 to 27 credits of courses chosen from any course offered by the Department at the 500 and 600 levels, up to but not including 195-691. In some instances, courses in this Department may be replaced by courses given by other departments at the 500 level or higher with the approval of the Department. Usually, students with no previous background in atmospheric science (or physical oceanography) are required to take 27 credits of courses, while students with a strong B.Sc. or Diploma in meteorology or a related field may take as few as 9 credits of courses.

Students must also complete a minimum of 24 thesis-research credits from 195-691, 195 -692, 195-693, 195-694, 195-695, 195-696 and 195-699. All students must take seminar course 195-694 and complete 195-699. The M.Sc. degree requires a minimum of 45 credits in total. This includes course credits, a minimum of 12 thesis credits and the completion of a thesis satisfying all the requirements of the Faculty of Graduate Studies and Research. Normally the equivalent of 12 months of full-time work is required to obtain these thesis-research credits, in addition to the time needed for the courses mentioned in the preceding paragraph. It is possible for students to write a thesis based on research in atmospheric, oceanic, or climate topics.

### Ph.D. Degree

The Ph.D. program consists of supervised research and normally a minimum of two approved courses. Candidates are required to submit a written thesis proposal, to present a Ph.D. proposal seminar and to take the Ph.D. oral comprehensive examination. The ordinary Faculty requirements concerning a thesis must be satisfied.

Ph.D. students may also register in the Collaborative McGill-UQAM Ph.D. program. These students register at McGill University but are supervised by a faculty member at l'Université du Québec à Montréal. Further details are available from the Department's Graduate Coordinator and from the Chair.

## 8.5 Courses for Higher Degrees

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered 2001-02.

**195-512A ATMOSPHERIC AND OCEANIC DYNAMICS.** (3) (3 hours) Introduction to the fluid dynamics of large-scale flows of the atmosphere and oceans. Stratification of atmosphere and oceans. Equations of state, thermodynamics and momentum. Kinematics, circulation, and vorticity. Hydrostatic and quasi-geostrophic flows. Brief introduction to wave motions, flow over topography, Ekman boundary layers, turbulence.

**195-513B WAVES AND STABILITY.** (3) (3 hours) Linear theory of waves in rotating and stratified media. Geostrophic adjustment and model initialization. Wave propagation in slowly varying media. Mountain waves; waves in shear flows. Barotropic, baroclinic, symmetric, and Kelvin-Helmholtz instability. Wave-mean flow interaction. Equatorially trapped waves.

● **195-515B TURBULENCE IN THE ATMOSPHERE AND OCEANS.** (3) (3 hours)

**195-530A CLIMATE DYNAMICS I.** (3) (3 hours) Introduction to the components of the climate system. Review of paleoclimates. Physical processes and models of climate and climate change.

**195-531B CLIMATE DYNAMICS II.** (3) (3 hours) The general circulation of the atmosphere and oceans. Atmospheric and oceanic general circulation models. Observations and models of the El Niño and Southern Oscillation phenomena.

**195-540A SYNOPTIC METEOROLOGY I.** (3) (2-hour lecture, 2-hour lab) Analysis of current meteorological data. Description of a geostrophic, hydrostatic atmosphere. Ageostrophic circulations and hydrostatic instabilities. Kinematic and thermodynamic methods of computing vertical motions. Tropical and extratropical condensation rates. Barotropic and equivalent barotropic atmospheres.

● **195-541B SYNOPTIC METEOROLOGY II.** (3) (2-hour lecture, 2-hour lab)

**195-546B CURRENT WEATHER DISCUSSION.** (1) (1.5 hours) Thrice-weekly briefings on atmospheric general circulation and current weather around the world using satellite data, radar observations, conventional weather maps, and analyses and forecasts produced by computer.

**195-550A SPECIAL TOPICS IN METEOROLOGY AND OCEANOGRAPHY I.** (1) (1 hour) Lectures and seminars on special topics such as hydrology, agricultural meteorology, the limits of predictability, planetary atmospheres, atmospheric and oceanic pollution, coastal currents, and research reviews.

● **195-551B SPECIAL TOPICS IN METEOROLOGY AND OCEANOGRAPHY II.** (1) (1 hour)

● **195-558B NUMERICAL METHODS AND LABORATORY.** (3) (1 hour lecture; 4 hours lab)

**195-568B OCEAN PHYSICS.** (3) (3 hours) (Prerequisite: 195-512A or permission of instructor) Research methods in physical oceanography including data analysis and literature review. Course will be divided into five separate modules focussing on temperature-salinity patterns, ocean circulation, boundary layers, wave phenomena and tides.

● **195-616A OR B TOPICS IN GEOPHYSICAL FLUID DYNAMICS.** (3) (3 hours)

★ **195-619B ADVANCED ATMOSPHERIC CHEMISTRY.** (4) ( 3hours) (Prerequisites: 180-213, 180-273, 189-222 and 189-315 or equiv-

alents, or permission of instructor) (Restriction(s): Offered in odd years. Students should register in 180-619 in even years. Not open to students who have taken or are taking 195-419, 180-419, or 180-619.) Selected areas of atmospheric chemistry from field and laboratory to theoretical modelling are examined. The principles of atmospheric reactions (gas, liquid and heterogeneous phases in aerosols and clouds) and issues related to chemical global change will be explored.

**195-620A PHYSICAL METEOROLOGY I.** (3) (2 hours) Thermodynamics of the atmosphere. Instability and convection. Solar and terrestrial radiation. Radiative transfer. Radiation budgets.

**195-621B PHYSICAL METEOROLOGY II.** (3) (2 hours) Atmospheric aerosols, nucleation of water and ice. Formation and growth of cloud droplets and ice crystals. Initiation of precipitation. Severe storms and hail. Weather modification. Numerical cloud models.

- **195-626A OR B ATMOSPHERIC AND OCEANIC REMOTE SENSING.** (3) (3 hours)
- **195-646A OR B MESOSCALE METEOROLOGY.** (3) (3 hours)

**195-666B TOPICS IN OCEAN CIRCULATION.** (3) (3 hours) Recent observations of mesoscale and large-scale ocean circulation. Inverse methods and their application to tracer distributions and deep ocean circulation. Review of modern theoretical developments such as geostrophic turbulence, homogenization of potencial vorticity, ventilated thermoclines, wind and buoyancy driven ocean circulation models, and coupled ice-ocean circulation models.

**195-670A,B,C READING COURSE IN METEOROLOGY I.** (3) Assigned reading of a specialized topic in meteorology with formal evaluation.

**195-671A,B,C READING COURSE IN METEOROLOGY II.** (3) Assigned reading of a specialized topic in meteorology with formal evaluation.

**195-672A,B,C READING COURSE IN OCEANOGRAPHY I.** (3) Assigned reading of a specialized topic in oceanography with formal evaluation.

**195-673A,B,C READING COURSE IN OCEANOGRAPHY II.** (3) Assigned reading of a specialized topic in oceanography with formal evaluation.

**195-691A,B,C MASTER'S THESIS LITERATURE REVIEW.** (3) Review of relevant literature in preparation for the M.Sc. research.

**195-692A,B,C MASTER'S THESIS RESEARCH I.** (6) Independent research under the supervision of the student's M.Sc. supervisor.

**195-693A,B,C MASTER'S THESIS RESEARCH II.** (6) Independent research under the supervision of the student's M.Sc. supervisor.

**195-694A,B,C MASTER'S THESIS REPORT AND SEMINAR.** (3) Written report on the M.Sc. research progress and oral presentation of the report in seminar form to staff and students.

**195-695A,B,C MASTER'S THESIS RESEARCH III.** (6) Independent research under the supervision of the student's M.Sc. supervisor.

**195-696A,B,C MASTER'S THESIS RESEARCH IV.** (6) Independent research under the supervision of the student's M.Sc. supervisor.

**195-699A,B,C MASTER'S THESIS.** (12) Independent research under the supervision of the student's M.Sc. supervisor leading to the M.Sc. thesis.

**195-700A,B,C PH.D. PROPOSAL SEMINAR.**

**195-701D PH.D. COMPREHENSIVE. (GENERAL)**

**195-751D SEMINAR IN PHYSICAL METEOROLOGY.** (1) Seminars on topics in physical meteorology. Students are required to present one or more seminars during the year on their thesis research and to participate actively in the seminars given by others.

**195-752D ATMOSPHERIC, OCEANIC & CLIMATE DYNAMICS SEMINAR.** (1) Seminars on topics in atmospheric, oceanic and climate dynamics. Students are required to present one or more seminars during the year on their thesis research and to participate actively in the seminars given by others.

# 9 Biochemistry

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*Chair* — David Y. Thomas.

## 9.1 Staff

*Emeritus Professors*
Angus F. Graham; M.Sc., 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.(C'nell), F.R.S.C.
Leonhard S. Wolfe; M.Sc.(N.Z.), Ph.D.(Cantab.), F.R.S.C.

*Professors*
Rhoda Blostein; B.Sc., M.Sc., Ph.D.(McG.)
Philip E. Branton; B.Sc., M.Sc., Ph.D.(Tor.) *(Gilman Cheney Professor of Biochemistry)*
Peter E. Braun; B.Sc., M.Sc.(Br.Col.), Ph.D.(Berk.)
Vincent Giguère; B.Sc., Ph.D.(Laval) *(joint appt. with Oncology)*
Philippe Gros; B.Sc., M.Sc.(Montr.), Ph.D.(McG.)
Annette A. Herscovics; B.Sc. M.Sc. Ph.D(McG.) *(joint appt. with Oncology)*
Robert E. MacKenzie; B.Sc.(Agr.) (McG.), M.N.S., Ph.D.(C'nell)
Edward A. Meighen; B.Sc.(Alta.), Ph.D.(Berk.)
Walter E. Mushynski; 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.)
John R. Silvius; B.Sc., Ph.D.(Alta.)
Nahum Sonenberg; M.Sc., Ph.D.(Weizmann Inst.) F.R.S.C.
Clifford P. Stanners; B.Sc.(McM.), M.A., Ph.D.(Tor.) *(joint appt. with Oncology)*
David Y. Thomas; B.Sc.(Bristol), M.Sc., Ph.D.(Lond.)
Maria Zannis-Hadjopoulos; B.Sc., M.Sc., Ph.D.(McG.) *(joint appt. with Oncology)*

*Associate Professors*
Nicole Beauchemin; B.Sc., M.Sc., Ph.D.(Montr.) *(joint appt. with Oncology)*
Alain Nepveu; B.Sc., M.Sc.(Montr.), Ph.D.(Sher.) *(joint appt. with Oncology)*
Morag Park; B.Sc., Ph.D.(Glas.) *(William Dawson Scholar) (joint appt. with Oncology)*
Jerry Pelletier; B.Sc., Ph.D.(McG.)
Michel L. Tremblay; B.Sc., M.Sc.(Sher.), Ph.D.(McM.)

*Assistant Professors*
Kalle Gehring; M.Sc.(Mich.), Ph.D.(Berk.)
Alice Vrielink; B.Sc., M.Sc.(Cal.), Ph.D.(Lond.)

*Associate Members*
John J. Bergeron *(Anatomy & Cell Biology)*; Katherine Cianflone *(Exp. Medicine, RVH)*; L.Fernando Congote *(Exp. Medicine, RVH)*; Robert Dunn *(Exp. Medicine, MGH)*; Mark S. Featherstone *(Oncology)*; William C. Galley *(Chemistry)*; Michael A. Parniak (JGH, Lady Davis Inst.) Peter J. Roughley *(Shriners' Hosp.)*; Erwin Schurr *(Exp. Medicine, RVH)*; Charles Scriver *(Pediatrics, MCH)*; Bernard Turcotte *(Exp. Medicine, RVH);* Simon Wing *(Medicine);* Xiang-Jiao Yang *(Mol. Oncol., RVH)*

*Adjunct Professors*
Michael Cordingley *(Boehringer-Ingelheim)*; Mirek Cygler *(B.R.I.)*; Jacques Drouin *(Clin. Res. Inst.)*; Feng Ni *(B.R.I.)*; Donald Nicholson *(Merck Frosst)*; Maureen D. O'Connor-McCourt *(B.R.I.)*; Sophie Roy; B.Sc., M.Sc., Ph.D.(McG.) *(Merck Frosst)*;

Marc Therrien *(Clin. Res. Inst.)*; Andrew C. Storer *(B.R.I.)*; André Veillette *(Clin. Res. Inst.)*; Lee A. Wall *(U. de Mtl.)*

## 9.2 Programs Offered

The Department of Biochemistry offers training at both the M.Sc. and Ph.D. levels. There are a wide variety of areas in which specialized training for the Ph.D. can be obtained.

The Department concentrates on the following key areas of research: signal transduction; molecular genetics; gene regulation; oncogenes; structure, function & regulation of proteins; membrane structure, function and assembly; intracellular protein targeting; embryonic development and cellular neurobiology. A summary of the research interest of faculty members is available on the Department homepage at http://www.biochem.mcgill.ca.

### Funding

All graduate students in Biochemistry receive financial support. Any faculty member who agrees to supervise a graduate student who does not have their own funding (i.e. a fellowship), is financially responsible for that student. All students can expect a minimum of $15,692 per annum.

Prospective students are urged to make every effort to secure their own funding. Applications may be made for a variety of fellowships administered by the University or by various private, provincial or federal agencies. Deadlines for completion of most fellowship applications vary from October to February for studies beginning the following September. For more information on fellowships and awards, see the Faculty of Graduate Studies and Research website http://www.mcgill.ca/fgsr/.

## 9.3 Admission Requirements

Candidates holding a B.Sc. in biochemistry or in related disciplines (e.g. biology, chemistry, physics, physiology and microbiology) are eligible to apply to a graduate program in Biochemistry. The minimum cumulative GPA for admission is 3.3 (75%).

All successful applicants to the graduate program must be accepted by a research director in the department prior to registration.

Applicants who are considered inadequately prepared for research in Biochemistry, may, upon recommendation by the Graduate Admissions Committee (GAC), be admitted to a Qualifying Year (QY). The courses to be taken in the QY are determined by the GAC. A QY does not automatically guarantee admission to the graduate program.

### International Applicants

International students whose undergraduate degree was received outside of North America and whose mother tongue is not English, are required to submit the following documents in order to be considered for admission to the graduate program:

TOEFL: **Minimum score of 600 (250 on computer-based test)**.

GRE: Subject Test in **Biochemistry, Cell and Molecular Biology** with a **minimum score of 550.**

## 9.4 Application Procedures

Applications will be considered upon receipt of:

1. completed application form including C.V.;
2. application fee ($60);
3. two (2) letters of recommendation from professors;
4. two (2) official transcripts;
5. test results (GRE,TOEFL).

All information is to be submitted to the Student Affairs Officer. Interested candidates should contact the Department for an application package. Email requests should be addressed to: admbioch@med.mcgill.ca

### Deadlines

Applications should be submitted as early as possible in order to meet the following deadlines:

October 1st for September term and March 1st for January term **for visa students**;

March 1st for September admission;
May 1st for January admission.

## 9.5 Program Requirements

All students are required to complete two 3-credit courses at the 400-600 level as part of their M.Sc. or Ph.D. program. The Graduate Admissions Committee may stipulate additional course work depending on the background of the student.

**Departmental Seminars:** Members of the staff and visiting scientists present their work to the Department at weekly and bi-weekly intervals respectively throughout the academic year. Graduate students are required to attend all the above seminars and other informal seminars, and are encouraged to attend meetings of scientific communities.

### Master's

The requirements for the M.Sc. comprises a minimum of 45 credits: Research Seminar 507-696A,B,C – 3 credits; Thesis I 507-697A,B,C – 9 credits; Thesis II 507-698A,B,C – 12 credits; Thesis III 507-699A,B,C – 15 credits and a minimum 6 credits of course credits. Additional courses may be required, depending on the student's background.

The M.Sc. program usually requires a minimum of two years of study. Students in the M.Sc. program are required to complete all course requirements and submit a thesis.

### Transfer to the Ph.D.

After 21 months students may transfer to the Ph.D. program if all transfer requirements have been fulfilled. This includes completion of a preliminary seminar (Research Seminar I) and the successful completion of a transfer seminar (Ph.D. Thesis Proposal). The M.Sc. thesis requirement is then waived.

### Student Comprehensive Seminars

M.Sc. students in the Department who plan to proceed to the Ph.D. degree as well as students entering at the Ph.D. level must present and pass the following seminars: Research Seminar I (507-701); the Ph.D. Thesis Proposal (507-702) and, lastly, Research Seminar II (507-703).

### Ph.D.

Candidates who have fulfilled the M.Sc. degree requirements, as described above, with satisfactory standing from this Department or candidates who have completed an acceptable M.Sc. degree from another university enter the graduate program at the Ph.D. level. Students in the Ph.D. program are required to complete all course requirements as well as the Student Comprehensive seminars, submit a thesis and defend it orally.

## 9.6 Graduate Courses

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered in 2001-02.

★ Denotes courses offered in alternate years.

**507-503B IMMUNOCHEMISTRY.** (3) (Prerequisites: 507-311A, 507-312B) This course, presented in lecture format, emphasizes the molecular, genetic and structure function events that occur in the humoral immune response. Interleukins and other mediators of inflammation, a field in which rapid changes are occurring, are discussed. The clinical significance of fundamental biochemical findings is described.

**507-603B RECENT ADVANCES IN MOLECULAR GENETICS.** (3) (Prerequisites: 507-454A and permission of instructor.) Recent

advances in our understanding of gene function and its control in normal and diseased cellular systems will be discussed in depth. Course given based on minimum registration of 10 students. Contact Student Affairs Officer for information.

● ★ **507-604A MACROMOLECULAR STRUCTURE.** (3) (Prerequisite: 507-450A or equivalent) (Lectures in French and English)

**507-696A,B,C RESEARCH SEMINAR.** (3) (Open to M.Sc. Biochemistry students only.) Compulsory participation in the departmental seminar series. Graded pass/fail, based on participation.

**507-697A,B,C THESIS RESEARCH I.** (9)

**507-698A,B,C THESIS RESEARCH II.** (12)

**507-699A,B,C THESIS RESEARCH III.** (15)

**507-701A,B RESEARCH SEMINAR I.** (Biochemistry graduate students.) Presentation on original current laboratory research carried out by student.

**507-702A,B PH.D. THESIS PROPOSAL.** (Biochemistry graduate students.) Disseration presented to Committee.

**507-703A,B RESEARCH SEMINAR II.** (Ph.D. students in Biochemistry.) Presentation of the planned thesis including central findings and original contribution to knowledge in the field of research.

**516-615B MEMBRANE CARBOHYDRATES.** (3) The structure, function and biosynthesis of glycoproteins, glycolipids and glycoaminoglycans, and the biological role of complex carbohydrates at the cell surface.

**ADVANCED UNDERGRADUATE COURSES**

**507-311A METABOLIC BIOCHEMISTRY.** (3) (Prerequisites: 177-200A, 177-201B, or 507-212B, 180-222A,B) The generation of metabolic energy in higher organisms with an emphasis on its regulation at the molecular, cellular and organ level. Chemical concepts and mechanisms of enzymatic catalysis are also emphasized. Included: selected topics in carbohydrate, lipid and nitrogen metabolism; complex lipid and biological membranes; hormonal signal transduction.

**507-312B BIOCHEMISTRY OF MACROMOLECULES.** (3) (Prerequisites: 507-311A, 177-200A, 507-212B or 177-201B) Gene expression from the start of transcription to the synthesis of proteins, their modifications and degradation. Topics covered: purine and pyrmidine metabolism; transcription and its regulation; mRNA processing; translation; targeting of proteins to specific cellular sites; protein glycosylation; protein phosphorylation; protein turn-over; programmed cell death (apoptosis).

**507-404B BIOPHYSICAL CHEMISTRY.** (3) (Prerequisites: 180-204A,B, 180-214B or equivalent.) (This course is also listed as Chemistry 180-404B. Not open to students who have taken or are taking 180-404B) Hydrodynamic and electrophoretic methods for separation and characterization of macromolecules. Optical and magnetic resonance spectroscopy of biopolymers, and applications to biological systems.

**507-450A PROTEIN STRUCTURE AND FUNCTION.** (3) (Prerequisites: 507-311A, 507-312B and/or sufficient organic chemistry. Intended primarily for students at the U3 level.) Primary, secondary, tertiary, and quaternary structure of enzymes. Active site mapping and site-specific mutagenesis of enzymes. Enzyme kinetics and mechanisms of catalysis. Multienzyme complexes.

**507-454A NUCLEIC ACIDS.** (3) (Prerequisites: 507-311A, 507-312B or permission of the instructor.) Chemistry of RNA and DNA, transcription and splicing of RNA and their control, enzymology of DNA replication. Special topics on transgenics, genetic diseases, and cancer.

**507-455B NEUROCHEMISTRY.** (3) (Prerequisites: 507-311A, 507-312B or permission of instructor.) Covers biochemical mechanisms underlying central nervous system function. Introduces basic neuroanatomy, CNS cell types and morphology, neuronal excitability, chemically mediated transmission, glial function. Biochemistry of specific neurotransmitters, endocrines effects on brain, brain energy metabolism and cerebral ischemia (stroke). With examples, where relevant, of biochemical processes disrupted in human CNS disease.

**507-458B MEMBRANES AND CELLULAR SIGNALING.** (3) (Prerequisites: 507-212B, 504-262B; one of 552-201A, 552-209A or 177-205B; one of 507-312B or 504-365A; and 507-311A or permission of instructors.) (This course is also listed as 504-458B. Not open to students who have taken or are taking 504-458B or 507-456B.) An integrated treatment of the properties of biological membranes and of intracellular signaling, including the major role that membranes play in transducing and integrating cellular regulatory signals. Biological membrane organization and dynamics: membrane transport; membrane receptors and their associated effectors; mechanisms of regulation of cell growth, morphology, differentiation and death.

# 10 Bioethics

For information, write to:
Chair, Master's Specialization in Bioethics
Biomedical Ethics Unit
3690 Peel Street
Montreal, QC H3A 1W9
Canada

Telephone: (514) 398-6980 or (514) 398-7406
Fax: (514) 398-8349
Email: bioethics@falaw.lan.mcgill.ca
Website: http://www.biomedicalethicsunit.mcgill.ca

*Chair* — W. Glannon

## 10.1 Staff

E. Bereza, N. Gilmore, W. Glannon, K. Glass, D. Jones, L. Turner, K. Young

## 10.2 Programs Offered

Master's Specialization in Bioethics

The Master's Specialization in Bioethics is sponsored by the:
Faculty of Medicine, Department of Experimental Medicine;
Faculty of Law, Institute of Comparative Law;
Faculty of Religious Studies; and
Faculty of Arts, Department of Philosophy.

Students receive an M.A., LL.M. or M.Sc. degree in the discipline chosen with a specialization in Bioethics.

## 10.3 Admission Requirements

M.D., bachelor's level professional training in a health science, or bachelor's degree in law, philosophy or religious studies. Other students may be considered on an individual basis.

Enrolment is limited to 12 students.

## 10.4 Application Procedures

Applications are made initially through the Biomedical Ethics Unit in the Faculty of Medicine, which administers the program and teaches the core courses.

Applicants must be accepted first by the appropriate Faculty and then by the Bioethics Graduate Studies Advisory Committee.

## 10.5 Program Requirements

The curriculum is composed of required courses (for 6 credits) offered in the Biomedical Ethics Unit, bioethics courses ( 3credit minimum) offered by the base faculty or department and any graduate courses required or accepted by a base faculty for the granting of a Master's degree, for a total of 18 to 21 credits. A minimum of 45 credits is required including the thesis.

Registration Requirements: Depending upon the requirements of the base discipline, a minimum of three terms is required for completion of the program, including course work and thesis.

Thesis Supervision: Thesis supervision for students in the specialization is provided by a participating faculty member in the program. Those students whose supervisors are not appointed to a student's base discipline will have a co-supervisor appointed from the base discipline. Thesis examination will be conducted according to the base discipline norms.

**Required Courses – Biomedical Ethics Unit** (6 credits)
508-680A (3) Bioethics Theory
508-681B (3) Bioethics Practicum

**Required Course – base faculty** (3 credits)
one of the following:
508-682 (3) Seminar: Medical Basis of Bioethics
389-642 (3) Seminar: Law and Health Care
107-543 (3) Seminar: Medical Ethics
260-571 (3) Religion and Medicine

**Complementary Courses** (12 credits)
the remaining credits are to be taken in any graduate courses required or accepted by the base faculty for the granting of a Master's degree

**Thesis Component – Required** (24 credits)
508-690 (3) Thesis Literature Survey
508-691 (3) Thesis Research Proposal
508-692 (6) Thesis Research Progress Report
508-693 (12) Thesis

### 10.6 Courses

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

**Biomedical Ethics Unit Courses**

**508-680A BIOETHICS THEORY.** (3) (Limited enrolment.) A survey of some of the main problem areas and common argument forms used in current bioethics. Problem areas include consent, decisions to withhold or withdraw treatment, allocation of scarce resources, research with human subjects and confidentiality. Argument forms include those drawn from diverse ethical theories and traditions.

**508-681B BIOETHICS PRACTICUM.** (3) (Limited enrolment.) Four hours per week supervised placement within health care settings (e.g., intensive care, family practice, clinical ethics committees). In addition, students shall be assigned for the last month of the term to a single intensive placement. Participation in rounds, care discussions, and a weekly seminar.

**508-690 THESIS LITERATURE SURVEY.** (3)

**508-691 THESIS RESEARCH PROPOSAL.** (3)

**508-692 THESIS RESEARCH PROGRESS REPORT.** (6)

**508-693 THESIS.** (12)

**Base Faculty Courses**

**508-682 SEMINAR: MEDICAL BASIS OF BIOETHICS.** (3) (Limited enrolment.) The seminar examines the medical basis of timely ethical dilemmas in health care. Content includes: clinical concepts of pathogenesis, disease, screening, diagnosis, therapeutic interventions and prognosis; decision-making in clinical care and institutional policy development; organization of health care systems including socialized medicine, public health and institutions providing health care; medical research.

**389-642 SEMINAR: LAW AND HEALTH CARE.** (3) (Limited enrolment.) Topics in this seminar will include philosophical and ethical foundations of law as applied in medicine, legal structures and their impact on health care, law and ethics of the health care professions, administrative and legal control of health care systems and other selected issues.

**107-543 SEMINAR: MEDICAL ETHICS.** (3) (Limited enrolment.) An advanced seminar devoted to a particular philosophical problem as it arises in the context of medical practice or the application of medical technology.

**260-571B RELIGION AND MEDICINE.** (3) Every world religion has its own way of understanding what we now call "bioethical" problems (surrogacy, abortion, euthanasia, circumcision, cloning). A selected problem will be studied in connection with the ethical system of religions such as Hinduism, Buddhism, Confucianism, Taoism, Judaism, Christianity and Islam.

## 11 Biology

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*Chair* — Paul F. Lasko

*Chair of Graduate Program* — Robert Levine

### 11.1 Staff

*Emeritus Professors*
F. Clarke Fraser; O.C., B.Sc.(Acad.), M.Sc., Ph.D., M.D., C.M.(McG.), D.Sc.(Acad.), F.R.S.C., F.R.C.P.S.(C) (*Molson Emeritus Professor of Genetics) (joint appt. with Human Genetics)*
Sarah P. Gibbs; A.B., M.S.(C'nell), Ph.D.(Harv.), F.R.S.C. *(Macdonald Emeritus Professor of Botany)*
John B. Lewis; B.Sc., M.Sc., Ph.D.(McG.)
Gordon A. Maclachlan; B.Sc., M.A.(Sask.), Ph.D.(Man.), F.R.S.C. *(Macdonald Emeritus Professor of Botany*)
Barid B. Mukherjee; B.Sc.(Calc.), M.S.(Brig.Young), Ph.D.(Utah) *(joint appt. with Human Genetics)*
Rolf O. Sattler; B.Sc.(Tübingen), Ph.D.(Munich), F.R.S.C.

*Professors*
Graham A.C. Bell; B.A., D.Phil.(Oxon.), F.R.S.C. *(James McGill Professor) (Molson Professor of Genetics)*
Gregory G. Brown; B.Sc.(Notre Dame), Ph.D.(N.Y.) *(on leave)*
A. Howard Bussey; B.Sc., Ph.D.(Brist.), F.R.S.C.
Robert L. Carroll; B.Sc.(Mich.), M.A., PhD.(Harv.), F.R.S.C. (*Strathcona Professor of Zoology*)
Ronald Chase; A.B.(Stan.), Ph.D.(M.I.T.)
Rajinder S. Dhindsa; B.Sc., M.Sc.(Punj.), Ph.D.(Wash.)
Jacob Kalff; M.S.A.(Tor.), Ph.D.(Ind.)
Donald.L. Kramer; B.Sc.(Boston Coll.), Ph.D.(U.B.C.)
Paul F. Lasko; A.B. (Harv.), Ph.D.(M.I.T.) *(joint appt. with Anatomy & Cell Biology)*
Martin J. Lechowicz; B.A.(Mich. St.), M.S., Ph.D.(Wis.)
Ronald J. Poole; B.Sc., Ph.D.(Birm.)
Rima Rozen; B.Sc.,PhD.(McG.)
Daniel J. Schoen; B.Sc., M.Sc.(Mich.), Ph.D.(Calif.) (*Macdonald Professor of Botany)*

*Associate Professors*
Siegfried Hekimi; M.Sc., Ph.D.(Geneva)
Louis Lefebvre; B.Sc., M.A., Ph.D.(Montr.)
Robert L. Levine; B.Sc.(Brooklyn), M.Sc., Ph.D.(Yale)
Yutaka Nishioka; B.A., M.A.(Tokyo), Ph.D.(Col.)
Gerald S. Pollack; M.A., Ph.D.(Prin.) (*on leave*)
Catherine Potvin; B.Sc., M.Sc.(Montr.), Ph.D.(Duke) (*on leave*)
Neil M. Price; B.Sc.(U.N.B.), Ph.D.(U.B.C.)
Joseph Rasmussen; B.Sc., M.Sc.(Alta.), Ph.D.(Cal.)
Beat Suter; Dip., Ph.D.(Zur)
Candace S. Waddell; B.A.(Va.), Ph.D.(U.C.S.F.)

*Assistant Professors*
Thomas E. Bureau; B.Sc.(Calif), Ph.D.(Texas)
Joseph Dent; B.Sc.(Mich), Ph.D.(Colo.)
Kevin McCann; B.A.(Dart), M.Sc., Ph.D.(Guelph)
Laura Nilson; B.A.(Colgate), Ph.D.(Yale)
Richard Roy; B.Sc.(Bishop's), Ph.D.(Laval)
Amanda Vincent; B.Sc.(W. Ont.), M.Sc.(U.B.C), Ph.D.(Camb.) *(William Dawson Scholar)*

*Associate Members*
Salvatore Carbonetto *(Mtl. General Hospital)*; Hugh Clarke *(Royal Victoria Hospital)*; Pierre Drapeau (*Mtl. General Hospital*); Robert Dunn (*Mtl. General Hospital*); Michael Ferns (*Mtl. General Hospital*); David Green (*Redpath Museum)*; Kenneth Hastings (*Mtl. Neurological Ins.*); Paul Holland (*Mtl. Neurological Inst.)*; Roberta Palmour (*Allan Memorial Institute*); David Rosenblatt (*Royal Victoria Hospital)*; Guy Rouleau (*Mtl. General Hospital*); Charles R. Scriver (*Mtl. Children's Hospital Research Inst.*); Teruko Taketo (*Royal Victoria Hospita*l); Harriet S. Tenenhouse (*Mtl. Children's Hospital Research Inst.*); David Y.Thomas *(Biochemistry Dept.)*

*Adjunct Professors*
Wing Y. Cheung (DNA Landmarks); Wayne Hunte (U. West Indies); Benoit S. Landry (DNA Landmarks); William C. Leggett B.A., M.Sc. (Wat), Ph.D.(McG.), F.R.S.C. (Queen's University); Malcolm S. Whiteway, B.Sc.(Dal.), Ph.D.(Alta.) (Bio Tech Inst.)

## 11.2 Programs Offered

The Department offers graduate training in many areas of biology with particular strengths in Molecular Genetics and Development, Evolutionary and Behavioural Ecology, Human Genetics, Limnology, Marine Biology, Neurobiology, and Experimental Plant Biology.

Graduate programs leading to the M.Sc. and Ph.D. degrees are offered. The emphasis in both programs is on development of the intellectual and technical skills necessary for independent research. The main component of both degrees is a thesis embodying the results of original research. Formal course requirements are few and are largely intended to fill gaps in the student's background.

The Stewart Biology Building is well equipped for graduate training and research in a wide variety of areas of biology. Its resources are greatly extended by affiliation with other organizations such as the Redpath Museum; the Groupe Interuniversitaire de Recherches Océanographiques du Québec (GIROQ); the Biotechnology Research Institute of the National Research Council of Canada; Macdonald Campus; the Montreal Neurological Institute; the Jewish General Hospital; the Montreal General, Montreal Children's and Royal Victoria Hospitals. Field research facilities include the Mont St. Hilaire Field Station (Québec); the Huntsman Marine Science Centre (New Brunswick); the Subarctic Research Laboratory (Québec); the Bellairs Research Institute (Barbados); and the Memphremagog Field Station (Québec).

The Department specifies a minimum level of support for all graduate students. This amount is $12,500 per annum plus tuition fees. The required minimum duration of support is 2 years for the M.Sc. program, 5 years for a Ph.D. student entering as Ph.D.1 (from a Bachelor's) and 4 years for a Ph.D. student entering as Ph.D.2.

## 11.3 Admission Requirements

Applicants must have a B.Sc. in a discipline relevant to the proposed field of study with an overall Cumulative Grade Point Average (CGPA) of 3.0/4.0 or a CGPA of 3.2/4 for the last 2 full-time academic years. Graduate Record Examination (GRE) scores are not required, but may be submitted. The Test of English as a Foreign Language (TOEFL) is required of students who have graduated from a non-English language university outside of Canada. A score of 550 on the paper-based TOEFL (213 on the computer-based test) or 6.5 on IELTS, is the minimum standard for admission.

Admission is based on an evaluation by the Graduate Training Committee and on acceptance by a research director who can provide adequate funding for personal and research expenses. Prospective graduate students are encouraged to contact staff members with whom they wish to study before applying for admission.

## 11.4 Application Procedures

Application packages must be obtained directly from the Department. The application package contains specific information on the application process, program information, a summary of the research areas of the staff and contact information.

Deadlines for applications and all supporting documents are March 1 for September admission (February 1 for international applicants) and October 15 for January admission (August 15 for international applicants). If application materials are received after these dates, it may be necessary to delay review of the applicant's file until the following admittance period. All inquiries pertaining to admission procedures should be directed to the Graduate Admissions Secretary.

## 11.5 Program Requirements

The graduate program of each student is established and regularly evaluated by a three-member supervisory committee appointed by the Graduate Training Committee and chaired by the student's thesis supervisor.

All graduate students are required to participate regularly in the various seminar series and journal clubs offered by the Department.

### M.Sc. Requirements

**Length of Program** – Three full-time terms of resident study at McGill University is the minimum time requirement to complete the Master's degree. The normal and expected duration is 2 years.

**Course Requirements** – Forty-five credits are required for the M.Sc. degree. Students must complete the courses 177-697, 177-698 and 177-699 (Master's Thesis Research I, II, III). The research courses each carry a credit weight of 13 credits. In addition, six course credits are required and may be taken in Biology or in other departments and must be numbered -500 or higher. Additional course work may be required if the student's background is insufficient. A graduate pass (65% or better) is mandatory for all courses required for the M.Sc. degree.

**Thesis** – In Biology, the M.Sc. degree is considered to be a research degree and the candidate must present a thesis which should contain original contributions to knowledge.

**Transfer from M.Sc to Ph.D. Program** – The student's Supervisory Committee may recommend to the Graduate Training Committee that the student be permitted to transfer to the Ph.D. program. This is normally done at the end of the first year of the Master's program. Students who transfer into the Ph.D. program are required to take their Ph.D. Qualifying Examination within eight months of the transfer.

### Ph.D. Requirements

**Length of Program** – Candidates entering Ph.D.1 must complete at least three years of full-time resident study (6 terms). The normal and expected duration of the Ph.D. program is 4-5 years. A student who has obtained a Master's degree at McGill, or at an approved institution elsewhere, and is proceeding in the same subject towards a Ph.D. degree may, upon the recommendation of the Graduate Training Committee, enter at the Ph.D.2 level.

**Course Requirements** – Students are required to take 6 course credits. These courses may be taken in Biology or in other departments and must be numbered -500 or higher. Additional courses may be required if the student's background is insufficent. A graduate pass (65% or better) is mandatory for all courses required for the Ph.D. degree.

**Ph.D. Qualifying Examination** – The Qualifying exam is a formal evaluation of the student's ability to proceed to the attainment of

the Ph.D. Students must pass the Qualifying Examination (177-700D) no later than 15 months from the date of registration in the program. Students who transfer from the Master's program must take the exam within 8 months. Students who enter the Ph.D. program after completing an M.Sc. in Biology at McGill must take the exam within 12 months.

**Ph.D. Seminar** – All Ph.D. students must deliver a research seminar (177-702D) at some time during the academic session (September -April) towards the end of their studies and preferably at least 3 months prior to the thesis submission.

**Thesis** – The Ph.D. is a research degree. The candidate must present a thesis which represents high scholastic attainment in a specialized field, demonstrated by independent and original research. After the thesis has been submitted and approved, the candidate is required to orally defend their thesis in an open forum.

## 11.6 Courses

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered in 2001-02.

★ Denotes courses offered in alternate years.

### GENERAL COURSES

**177-650 (A, B OR C) RECENT ADVANCES IN BIOLOGY I.** (3) Directed reading, seminar and discussion courses in subjects of current interest in biological research. Intended for students working individually or in classes on selected areas under the supervision of one or more staff members. Content and form are flexible to allow the Department to meet specific student demands or needs. Such courses are arranged by consultation with individual staff.

**177-651 (A, B OR C) RECENT ADVANCES IN BIOLOGY II.** (3) Directed reading, seminar and discussion courses in subjects of current interest in biological research. Intended for students working individually or in classes on selected areas under the supervision of one or more staff members. Content and form are flexible to allow the Department to meet specific student demands or needs. Such courses are arranged by consultation with individual staff.

**177-652 (A, B OR C) RECENT ADVANCES IN BIOLOGY III.** (3) Directed reading, seminar and discussion courses in subjects of current interest in biological research. Intended for students working individually or in classes on selected areas under the supervision of one or more staff members. Content and form are flexible to allow the Department to meet specific student demands or needs. Such courses are arranged by consultation with individual staff.

**177-655 (A, B OR C) LABORATORY PROJECTS AND TECHNIQUES I.** (3) Directed training in selected methods used in areas of current interest in biological research. Intended for individuals or classes working in selected areas under the supervision of one or more staff members. Form and content are flexible to allow the Department to meet specific student demands and needs. Each course is arranged by consultation with individual staff.

**177-656 (A, B OR C) LABORATORY PROJECTS AND TECHNIQUES II.** (3) Directed training in selected methods used in areas of current interest in biological research. Intended for individuals or classes working in selected areas under the supervision of one or more staff members. Form and content are flexible to allow the Department to meet specific student demands and needs. Each course is arranged by consultation with individual staff.

**177-697 (A, B OR C) MASTER'S THESIS RESEARCH I.** (13) Independent research work under the direction of the Thesis Supervisor and the Supervisory Committee.

**177-698 (A, B OR C) MASTER'S THESIS RESEARCH II.** (13) Independent research work under the direction of the Thesis Supervisor and the Supervisory Committee.

**177-699 (A, B OR C) MASTER'S THESIS RESEARCH III.** (13) Independent research work under the direction of the Thesis Supervisor and the Supervisory Committee.

**177-700D PH.D. QUALIFYING EXAMINATION.** The oral Qualifying Examination is a formal evaluation of the candidate's ability to proceed to the attainment of the Ph.D. Candidates must submit a thesis proposal in advance of the exam.

**177-702D PH.D. SEMINAR.** Doctoral candidates are required to give a public oral presentation of their major results before submitting a thesis.

### SPECIFIC COURSES

**177-505B DIVERSITY AND SYSTEMATICS SEMINAR.** (3) (3 hours seminar) (Prerequisites: 177-204A/177-304A, 177-305B, or permission.) A course dealing in depth with a particular aspect of biological diversity and/or systematics. Topics may include the systematics of a particular taxon, issues in biodiversity, systematics theory and practice, etc. The class will discuss aspects of the chosen topic and prepare individual seminar reports.

**177-516B GENETICS OF DEVELOPMENT.** (3) (3 hours lecture) (Prerequisites: 177-202B or 177-274A, 177-300A, 177-303B; permission. Not open to students who have taken 177-416.) This course aims to examine problems, theories, and experimental evidence on several concepts of mammalian developmental processes at molecular to organogenesis levels. Most topics are in the mouse model system, where various techniques for genetic manipulation are available. (Awaiting University Approval)

**177-518B EUKARYOTIC CELL GENETICS.** (3) ( 2hours seminar) (Prerequisite: 177-300A and permission.) This course is designed for advanced undergraduate and graduate students. Readings from recent journal articles and reviews. Variable topics, including: cell differentiation, function of oncogenes and anti-oncogenes, growth regulation and cell cycle, gene transfer, recombination, mobile genetic elements, regulation of gene expression, cellular and viral replication, signal transduction.

**177-520B GENE ACTIVITY IN DEVELOPMENT.** (3) (3 hours lecture and discussion) (Prerequisites: 177-300A and 177-303B or permission. Not open to students who have taken 177-420.) An analysis of the role and regulation of gene expression in several models of eukaryotic development. The emphasis will be on critical evaluation of recent literature concerned with molecular or genetic approaches to the problems of cellular differentiation and determination. Recent research reports will be discussed in conferences and analyzed in written critiques. (Awaiting University Approval)

**★177-522B PLANT MOLECULAR BIOLOGY SEMINAR.** (3) ( 2hours seminar, 1 hour tutorial per week) (Prerequisite: 177-300A or permission.) This course deals with current topics in plant development, with particular emphasis on genetic and molecular approaches. This advanced course will include readings from the primary literature, as well as oral presentations and a written NSERC-styled grant proposal.

**177-524A TOPICS IN MOLECULAR BIOLOGY.** (3) (Prerequisite: 177-300A, 177-303B or permission.) Recent literature in the fields of molecular genetics and molecular biology. Topics include: signal transduction, cell function, genetic diseases in eukaryotes.

**★177-526B PLANTS AND EXTREME ENVIRONMENTS.** (3) (1 hour lecture and 2hours seminar/ discussion) (Prerequisites: 177-205B, 177-357A, or permission.) Cellular and molecular responses of organisms to extremes of temperature, water availability, mineral ion concentrations, pollutants and hydrostatic pressure. Mechanisms of resistance and tolerance to these stressful environments.

● ★**177-530B NEURAL BASIS OF BEHAVIOUR.** (3) (1 hour lecture, 2 hours seminar) (Prerequisite: 177-306A or 552-311A or 204-308A. Not open to students who have taken 177-430.)

**177-531A NEUROBIOLOGY LEARNING MEMORY.** (3) (3 hours lecture and discussion) (Prerequisite: 177-306A or permission. Not open to students who have taken 177-431.) Properties of nerve cells that are responsible for learning and memory. Recent advances in the understanding of neurophysiological, biochemical and structural processes relevant to neural plasticity. Emphasis on a few selected model systems involving both vertebrate and invertebrate animals. (Awaiting University Approval)

**177-532B DEVELOPMENTAL NEUROBIOLOGY SEMINAR.** (3) ( 1hour lecture, 2 hours seminar) (Prerequisites: 177-303B and 177-306A or permission.) Discussions of all aspects of nervous system development including pattern formation, cell lineage, pathfinding and targetting by growing axons, and neuronal regeneration. The basis for these discussions will be recent research papers and other assigned readings.

**177-535B POLITICAL ECOLOGY.** (3) (3 hour seminar) (Prerequisite: 177-208A/308B or permission of instructor.) This student-led seminar course will investigate the relationship between scientific understanding and political process, from the perspective of ecology. It will examine why policy decisions on environmental issues often fail to satisfy biological concerns, and what can be done to enhance scientific contributions. Students will each research one environmental policy (legal act and/or legislative decision) for group analysis.

● ★**177-542B MARINE BIOLOGY.** (3) (2 hours lecture, 1 laboratory or conference. Not open to students who have taken 177-442.) (Prerequisite: 177-208A/308B or permission.)

★**177-544A GENETIC BASIS OF LIFE SPAN.** (3) (1 hour lecture, 2 hours seminar) (Pre-requisites: 177-202B, 177-300A; 177-303B recommended or permission. Not open to students who have taken 177-444.) The course will consider how gene action is determining the duration of life in various organisms focusing on the strengths and limitations of the genetic approach. The course will focus particularly on model organisms such as yeast, Caenorhabditis, Drosophila and mouse, as well as on the characterization of long-lived mutants. (Awaiting University Approval)

**177-551A MOLECULAR BIOLOGY: CELL CYCLE.** (3) ( 3hours lecture) (Prerequisites: 177-200A, 177-201B, 177-300A. Not open to students who have taken 177-451.) Cytological studies, biochemical and genetical information are integrated to explain molecular form and function in the eukaryotic cell. The mitotic cell cycle and its coordination with cell growth and division; maintenance of cellular architecture, protein targeting, self-assembly of macromolecular complexes, organelle biogenesis, and DNA replication and segregation are examined. (Awaiting University Approval)

**177-553B NEOTROPICAL ENVIRONMENTS.** (3) (24 hours lecture and 36 hours field work over a 4-week period) Prerequisites: 144-218, 189-203, and 177-208A/308B, or equivalents, and permission of Program Coordinator. Corequisites: 170-451B, 183-498B and 336-450B. Not open to students who have taken 177-453.) (Restriction: location in Panama. Students must register for a full semester of studies in Panama.) Ecology theory revisited in view of tropical conditions. Exploring species richness. Historical and contemporaneous factors structuring neotropical communities. Measuring biodiversity. Conservation status of ecosystems, communities and species. Guest Lecturers: Staff from Smithsonian Tropical Research Institute and Panamanian Universities. (Awaiting University Approval)

★**177-555L FUNCTIONAL ECOLOGY OF TREES.** (3) (Lectures and laboratory taught in residence at the Gault Nature Reserve) (Prerequisites: 177-204A/304A, 177-205B, 177-357A) Functional organization in trees: physiology, architecture, and life history. Emphasis on trees in natural habitats.

**177-560A AQUATIC CONSERVATION.** (3) ( 2lecture hours, 1 conference) (Prerequisites: 177-208A/308B and 177-365A or permission. Not open to students who have taken 177-460.) An advanced conservation course, focused on marine and freshwater environments. Begins with the ultimate, distal and proximate processes that explain current global calamities. Then considers management responses such as fisheries modifications, protected areas, alternative livelihoods, and habitat restoration. Conferences include group work to produce real conservation action plans. (Awaiting University Approval)

● ★**177-562B EVOLUTION OF LIFE CYCLES.** (3) ( 2hours lecture, 1 hour seminar) (Prerequisites: Core Program in Biology. Not open to students who have taken 177-462.)

**177-570B ADVANCED SEMINAR IN EVOLUTION.** (3) ( 3hours seminar) (Open to undergraduates by permission.) Detailed analysis of a topic in evolutionary biology, involving substantial original research.

★**177-572A MOLECULAR EVOLUTION.** (3) (4 hours lecture/seminar) (Prerequisite: 177-300A. Not open to students who have taken 177-472.) Course is concerned with the rates and patterns of change in the genetic material (DNA sequences) and its products (proteins), through evolutionary time. The emphasis will be on the processes responsibile for evolutionary change at the molecular level, such as selective neutrality, gene duplication, shuffling of exons, and transposition. (Awaiting University Approval)

**177-588A MOLECULAR/CELLULAR NEUROBIOLOGY.** (3) (1½ hours lecture, 1½ hours seminar) (Prerequisites: 177-300A and177-306A or permission.) Discussion of fundamental molecular mechanisms underlying the general features of cellular neurobiology. An advanced course based on lectures and on a critical review of primary research papers.

**177-632A LIMNOLOGY.** (3) (2 hours lecture; 3 hours laboratory) (Prerequisites: 177-206A and/or permission.) A study of the physical, chemical and biological properties of inland waters, with emphasis on their functioning as systems.

# 12 Biomedical Engineering

Department of Biomedical Engineering
Duff Medical Building
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Fax: (514) 398-7461
Website: http://www.bmed.mcgill.ca

*Chair* — R.E. Kearney

## 12.1 Staff

*Professors*
T.M.S. Chang; B.Sc., M.D., C.M., Ph.D.(McG.), F.R.C.P.(C)
*(joint appt. with Physiology)*
A.C. Evans; B.Sc.(Liv.), M.Sc.(Sur.), Ph.D.(Leeds)
*(joint appt. with Neurology & Neurosurgery)*
H.L. Galiana; B.Eng., M.Eng., Ph.D.(McG.)
*(joint appt. with Otolaryngology)*
R.E. Kearney; B.Eng., M.Eng., Ph.D.(McG.)
*(joint appt. with Physiology)*

*Associate Professors*
J.D. Bobyn; B.Sc., M.Sc.(McG.), Ph.D.(Tor.)
*(joint appt. with Surgery)*
W.R.J. Funnell; B.Eng., M.Eng., Ph.D.(McG.)
*(joint appt. with Otolaryngology)*
G.B. Pike; B.Eng., M.Eng., Ph.D.(McG.)
*(joint appt. with Neurology & Neurosurgery)*

*Assistant Professors*
D.L. Collins; B.Sc., M.Eng, Ph.D.(McG.)
*(joint appt. with Neurology & Neurosurgery)*
S. Prakash, B.Sc., M.Sc.(BHU-India), Ph.D.(McG.)
M. Tabrizian, B.Sc.(Iran), M.Sc., Ph.D.(PMC-France), M.B.A.(HEC) *(joint appt. with Dentistry)*

*Associate Members*
J. Gotman *(Neurology & Neurosurgery)*; B.N. Segal *(Otolaryngology)*; T. Steffen (Surgery); C. Thompson *(Neurology & Neurosurgery)*

*Adjunct Professors*
J.H.T. Bates (VT); W.F. Decraemer (U. Antwerp); I.W. Hunter (M.I.T.), T.M. Peters (U.W.O.), P.L. Weiss (Hebrew)

*Research Associates*
C. Baker, D. Guitton, A. Katsarkas

## 12.2 Programs Offered

The Department offers a graduate training program leading to Master's (M.Eng.) and Ph.D. degrees in Biomedical Engineering.

It provides instruction and opportunities for interdisciplinary research in the application of engineering, mathematics, and the physical sciences to problems in medicine and the life sciences. Courses are offered for graduate students in the life sciences and in engineering and the physical sciences.

Excellent laboratory facilities for basic and applied research are available in the Department and in the laboratories of associated staff located elsewhere in the Medical Faculty. The Department operates a network of high performance workstations and well-equipped mechanical and electronics workshops.

Basic research in the Department concentrates on the application of quantitative engineering analysis methods to basic biomedical research problems. Currently active areas of research include: neuromuscular and postural control, muscle mechanics, the vestibular system, oculomotor control, the auditory system, joint prosthetics, biomaterials, artificial cells and organs, and medical imaging. Staff members are also active in more applied research related to the development of quantitative analysis tools and instruments for biomedical research. Areas of activity here include: signal analysis, system identification, modeling, simulation and parameter estimation, image processing, pattern recognition, ultrasound, and biorobotics.

## 12.3 Admission Requirements

See minimum admission requirements in Section 5 of the General Information section of the Graduate Faculty Calendar.

## 12.4 Application Procedures

Please address enquiries directly to the Department.

## 12.5 Program Requirements

Master's degrees (M.Eng.) require students to complete a minimum of 45 credits (24 thesis credits and 21 graduate course credits).

Graduate students may also be registered through departments of Medicine, Science and Engineering, and must then fulfill the requirements for advanced degrees imposed by their respective departments.

In addition, all students are required, through course work and independent study, to achieve a degree of inter-disciplinary competence appropriate to their area of specialization.

## 12.6 Courses for Higher Degrees

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

**399-501A SELECTED TOPICS IN BIOMEDICAL ENGINEERING.** (3) An overview of how techniques from engineering and the physical sciences are applied to the study of selected physiological systems and biological signals. Using specific biological examples, systems will be studied using: signal or finite-element analysis, system analysis and identification, modelling and simulation, computer control of experiments and data acquisition.

**399-502B BME MODELING AND IDENTIFICATION.** (3) (Prerequisites: Undergraduate basic statistics and: either 399-519A, or Signals and Systems (e.g., 304-303 & 304-304) or equivalent). Methodologies in biological control systems or distributed multi-dimentional biological processes, with interactive sessions using real biological data in a Matlab environment. System themes include parametric vs non-parametric system representations; linear/non-linear; noise, transients and time variation; and relevant identification approaches in continuous and discrete time formulations.

**399-503B BIOMEDICAL INSTRUMENTATION AND MEASUREMENT TECHNIQUE.** (3) (2 hours lecture, 1 hour laboratory) A review of the principles and practice of making biological measurements in the laboratory, including theory of linear systems, data sampling, computer interfaces, basic electronic circuit design and machining. Laboratory facilities allow students to experiment with computer-based data acquisition.

**399-519A ANALYSIS OF BIOMEDICAL SYSTEMS AND SIGNALS.** (3) (Prerequisites: Satisfactory standing in U3 Honours Physiology (Neurophysiology option); or U3 Major in Physics-Physiology; or permission of instructor.) An introduction to the theoretical framework, experimental techniques and analysis procedures available for the quantitative analysis of biomedical systems and signals. Lectures plus laboratory work using the Biomedical Engineering computer system. Topics include: amplitude and frequency structure of signals, filtering, sampling, correlation functions, time and frequency-domain descriptions of systems.

**563-607A INTRODUCTION TO MEDICAL IMAGING.** (3) ( 3hours lectures/week) A review of the principles of medical imaging as applied to conventional diagnostic radiography, digital subtraction radiography, computed tomography and magnetic resonance imaging. The course emphasizes a linear system approach to the formation, processing and display of medical images.

**399-650B ADVANCED MEDICAL IMAGING.** (3) (Prerequisite: 563-607A) Review of advanced techniques in medical imaging including: fast magnetic resonance imaging (MRI), functional MRI, MR angiography and quantitative flow measurement, spiral and dynamic x-ray computed tomography, 2D/3D positron emission tomography (PET), basic PET physiology, tracer kinetics, surgical planning and guidance, functional and anatomical brain mapping, 2D and 3D ultrasound imaging, and medical image processing.

**399-690 THESIS RESEARCH I.** (3)
**399-691 THESIS RESEARCH II.** (3)
**399-692 THESIS RESEARCH III.** (3)
**399-693 THESIS RESEARCH IV.** (6)
**399-694 THESIS RESEARCH V.** (6)
**399-695 THESIS SUBMISSION.** (12)

**Related courses offered in other departments include the following:**

*Computer Science*
308-538B Person-Machine Communication. (3)
308-540B Matrix Computations. (3)

*Electrical Engineering*
304-512A Digital Signal Processing I. (3)
304-523B Speech Communications. (3)
304-526B Artificial Intelligence. (3)
304-529A Image Processing & Communication. (3)
304-626B Computer Vision. (4)

*Mechanical Engineeering*
305-561B Biomechanics of Musculoskeletal Systems. (3)

*Physiology*
552-423A Physiological Dynamics. (3)
552-502B Exercise Physiology. (3)
552-517B Artificial Internal Organs. (3)
552-518A Artificial Cells. (3)

For full course descriptions refer to appropriate Calendar entry.

Other courses can be found in related departments.

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

# 13 Chemical Engineering

Department of Chemical Engineering
M.H. Wong Building
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*Chair* — R.J. Munz

## 13.1 Staff

*Professors*
D.G. Cooper; B.Sc., Ph.D.(Tor.)
J.M. Dealy; B.S.(Kansas), M.S.E., Ph.D.(Mich.), Eng.
W.J.M. Douglas; B.Sc.(Queen's), M.S.E., Ph.D.(Mich.)
M.R. Kamal; B.S.(Ill.), M.S., Ph.D.(Carn.-Mellon), Eng.
R.J. Munz; B.A.Sc., M.A.Sc.(Wat.), Ph.D.(McG.), Eng.
A.D. Rey; B.Ch.E.(C.C.N.Y.), Ph.D.(Calif.)
J.H. Vera; B.Mat.(Chile), Ing.Quim.(U.T.E.), M.S.(Calif.), Dr.Ing.(Santa Maria), Eng.
B. Volesky; M.Sc.(Czech. Tech. Univ.), Ph.D.(W.Ont.)
M.E. Weber; B.S.E.(Prin.), Sc.D.(M.I.T.), P.Eng.

*Associate Professors*
D. Berk; B.Sc.(Bosphorus), M.E.Sc.(W.Ont.), Ph.D.(Calg.), P.Eng.
J.-M. Charrier; Dipl.Ing., (E.N.S.A.M. Paris), M.S., Ph.D.(Akron), Eng.
J.-L. Meunier; D.Ing.(E.P.F.L.), M.Sc., Ph.D.(I.N.R.S.), Eng.
J. Simandl; B.Eng.(McG.), Ph.D.(Calg.), P.Eng.

*Assistant Professors*
W.A. Brown; B.Eng, M.Eng., Ph.D.(McG.), P. Eng.
S. Omanovic; B.Sc., Ph.D.(Zagreb)

*Paprican Adjunct Professor*
G.J. Kubes; B.Sc., M.Sc.(Prague), Ph.D.(Bratislava), P.Eng.

*Adjunct Professors*
B. Alince, R. Beils, P. Bisaillon, R. Campeau, N.E. Cooke, M. Côté, P. Csakany, M. Davidovsky, E. Denman, A. Garcia-Rejon, S. Gendron, R.W. Gooding, S. Guiot, N. Gurnagul, B. Huang, R.B. Kerr, T. Kudra, R. Lemieux, N. Liebergott, D.J. McKeagan, C. Miguez, A.S. Mujumdar, R. Nassef, R. Nayar, M. Perrier, N.P. Peters, I.I .Pikulik, A. Roche, J. Sarlis, S. Surveyer, G. Thibault, R.C. Urquhart, L.A. Utracki

*Associate Members*
T.M.S. Chang *(Physiology)*
R.H. Crotogino; H.L. Goldsmith *(Experimental Medicine)*

## 13.2 Programs Offered

The Department offers programs leading to the Master of Engineering, the Master of Science and the Doctor of Philosophy degrees.

Two options are available for the M.Eng. degree: the thesis option and the project option. The M.Eng. (Thesis) is a research-oriented degree requiring a limited number of courses and a research thesis; the M.Eng. (Project) is a course-oriented degree which includes a project. Three specialized versions of the M.Eng. (Project) are offered: specialization in pulp and paper; specialization in petrochemicals, polymers and plastics; specialization in environmental engineering.

The M.Sc. degree is appropriate for science graduates wishing to complete a Master's thesis without acquiring a broad engineering background. The requirements for the M.Sc. are similar to those for the M.Eng. (Thesis).

The Ph.D. is a research degree requiring a thesis which makes a distinct contribution to knowledge.

The Department's offices and research laboratories are located in the M.H. Wong Building, which was completed in 1996. Members of the Department are active in a number of research areas, including heat transfer; mass transfer; separation processes; coupled transport processes; thermodynamics and transport properties; chemical reaction engineering; plasma reactor studies; biochemical engineering; environmental engineering; polymer engineering and rheology. Most staff are members of one or more research groups.

Researchers in Polymer Engineering are members of Polymer McGill which also includes researchers from the Department of Chemistry and Paprican. The group cooperates with researchers at Ecole Polytechnique de Montréal and the Industrial Materials Institute of the National Research Council of Canada.

Research in Biochemical Engineering involves both the microbiology and technology of the production of new products, the development of novel biological reactors including their control and optimization as well as down-stream processing.

Research in Thermal Plasma Technology includes fundamental studies in high temperature transport phenomena and reactor design, as well as applied studies in plasma processing and torch design. Close collaboration is maintained with the the Université de Sherbrooke through the Interuniversity Plasma Technology Research Centre (CRTP) and with the thermal plasma technology group of Hydro-Québec.

Research related to the Environment is pursued on many fronts; for example, the polymer group is exploring the recycling of plastics into chemicals by thermal and chemical means, the plasma group is investigating plasma-assisted incineration, the biochemical group is evaluating biosorbents for heavy metals. Other projects involve dewatering sludges by electroosmosis, electrokinetic soil remediation, membrane distillation to remove volatile organic compounds from waster, etc.

Research in Pulp & Paper is closely associated with the Pulp & Paper Research Institute of Canada (Paprican). Specialized equipment and facilities of the Paprican main laboratory near Montreal are made available, and several staff are associated jointly with the Paprican and the Department.

## 13.3 Admissions Requirements

Admission to graduate study requires a minimum CGPA of 3.0/4.0 (or equivalent) for the complete Bachelor's program or a minimum GPA of 3.2/4.0 (or equivalent) in the last two years of full-time studies. Non-Canadian applicants whose mother tongue is not English must achieve a minimum TOEFL score of 577 on the paper-based test (233 on the computer-based test) prior to admission.

**M.Eng. (Thesis), M.Eng. (Project)**

Admission requires a Bachelor's degree (or equivalent) in chemical or other engineering. Students whose degrees are not in chemical engineering may be required to complete some undergraduate courses during their studies. Students with Bachelor's degrees in science wishing to pursue the M.Eng. first enter a Qualifying Program, normally of two semesters, to prepare for entry into the M.Eng. program.

**M.Sc.**

Admission requires a Bachelor's degree (or equivalent) in science. In some cases, depending on the area of research, the student may be required to complete one or two extra courses as part of the graduate program.

**Ph.D.**

Admission requires a Master's degree (or equivalent) from a recognized university. Students in the Department's M.Eng. (Thesis) or M.Sc. program may transfer to the Ph.D. program after one year without submitting the Master's thesis following a formal "fast track" procedure.

## 13.4 Application Procedures

A preliminary application form and application information are available at the following web address, http://chegrad.chemeng.

mcgill.ca. The completed preliminary application form is evaluated by the Admissions Committee who send the formal application form only if there is a reasonable probability of admission.

Applications will be considered when the Graduate Admissions Committee has received:

1. application form of the Faculty of Graduate Studies and Research;
2. official transcripts;
3. two letters of reference;
4. application fee of $60 Canadian;
5. TOEFL test results (if required).

Application deadlines are March 1 for September (Fall term) admission, September 15 for January (Winter term) admission and January 31 for May (Summer term) admission.

## 13.5 Program Requirements

**M.Eng., M.Sc.**

The Master's degrees require the completion of 45 credits and three terms of residence at McGill.

**M.Eng. (Thesis), M.Sc.**

Courses: 12 credits (a minimum of 9 credits in chemical engineering)
Research: 33 credits which include completion of a thesis proposal, presentation of a seminar and submission of a thesis

**M.Eng. (Project)**

Courses: 33-39 credits (a minimum of 18 credits in chemical engineering)
Project: (design or research): 6-12 credits

The specialized versions of the M.Eng. (Project) follow the above distribution between courses and project.

The specialization in Pulp and Paper, which is offered in cooperation with the Pulp and Paper Research Institute of Canada, consists of a sequence of courses over three consecutive semesters (12 months) beginning in May. The project and the majority of the courses are specialized in pulp and paper. Since the 3 term sequence begins with the summer term, entry into the Pulp and Paper program is only in May.

The specialization in petrochemicals, polymers and plastics, which is offered in cooperation with the Institute Français du Pétrole (IFP), requires that the Winter semester be spent at IFP in Paris where 15 course credits are completed. This program may be entered in September, January or May.

The specialization in environmental engineering requires the completion of a Core of 12 credits of environmental engineering courses and a research or design project related to the environment.

**Ph.D.**

The Ph.D. requires three years of residence at McGill.
Courses: 2 chemical engineering courses.
Research: completion of a thesis proposal, its defense, presentation of 2 seminars, and submission and defense of a thesis.

## 13.6 Courses

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered in 2001-02.

**302-571B SMALL COMPUTER APPLICATIONS IN CHEMICAL ENGINEERING.** (3) The use of small computers employing a high level language for data acquisition and the control of chemical processes. Real-time system characteristics and requirements, analog to digital conversion, digital to analog conversion and computer control loops.

**302-581B POLYMER COMPOSITES ENGINEERING.** (3) Characteristics of thermoplastic and thermosetting polymeric matrices and particulate/fibre dispersed elements. Associated structure characterization. Processing techniques. Quantitative engineering analyses to correlate structure with properties and processing. Product/process design. Applications in chemical process equipment, construction, transportation (land, marine, aerospace), general industrial and consumer goods.

**302-591B ENVIRONMENTAL BIOREMEDIATION.** (3) Presence and role of microorganisms in the environment, role of microbes in environmental remediation either through natural or human-mediated processes. Application of microbes in pollution control and in monitoring of environmental pollutants.

**302-611B HEAT AND MASS TRANSFER.** (4) Heat and mass transfer in laminar and turbulent flows; scaling; models for interphase transport.

**302-621B THERMODYNAMICS.** (4) Theory and application of phase and chemical equilibria in multicomponent systems.

● **302-630T STRUCTURE & PROPERTIES OF PAPER.** (4)

**302-631A FOUNDATIONS OF FLUID MECHANICS.** (4) Rigorous derivation of equations of motion; creeping flow inviscid flow; boundary layer theory; hydrodynamic stability; turbulent flow, separated flows, drag on submerged bodies.

● **302-632T PULPING ENGINEERING.** (4)

● **302-633A BLEACHING AND RECOVERY.** (3)

● **302-636T UNIT OPERATIONS OF PAPERMAKING.** (4)

● **302-638T TOPICS IN PULP AND PAPER.** (4)

**302-641A CHEMICAL REACTION ENGINEERING.** (4) Interpretation of chemical reaction data, especially for heterogeneous systems. Residence time, complete segregation, maximum mixedness, other advanced concepts. Reactor design.

**302-643B THERMAL PLASMA TECHONOLOGY.** (3) (Prerequisite: Permission of the instructor) An introduction to thermal (high temperature) plasmas as applied to chemical and materials engineering. Degree of ionization, velocity distribution function, plasma parameters, collisions and diffusion, energy states, plasma generation, diagnostic techniques for plasma and particles, particle-plasma interaction, mathematical modelling of plasma systems, applications.

● **302-652T DRYING: PRINCIPLES AND PRACTICE.** (2)

● **302-653A ADVANCED PROCESS DESIGN.** (3)

● **302-655B PULP & PAPER DESIGN PROJECT.** (6)

**302-662A COMPUTATIONAL METHODS.** (4) Methods of weighted residuals; solution to non-linear algebraic equations; stability in nonlinear equations; bifurcations; mesh refinement strategies; convection dominated transport; hyperbolic equations, particle simulation methods.

**302-672A PROCESS DYNAMICS AND CONTROL.** (4) (Prerequisite 302-455A) Process representation and identification and simulation; sensor stability; sensitivity of feedback control systems; feedward control; discrete representation of continuous systems; controller tuning; adaptive control.

● **302-674B CONTROL IN PULP AND PAPER.** (3) (Prerequisite 302-672A or permission of instructor.)

**302-681A POLYMER CHEMICAL ENGINEERING.** (3) Application of chemical engineering fundamentals to the preparation and processing of polymers. Classification and characterization of polymers, reaction media and kinetics of polymerization, reactor design, viscoelasticity and rheology, processing techniques, extrusion, molding, composite formation, adhesion.

**302-682A ENGINEERING PROPERTIES OF POLYMERIC MATERIALS.** (3) Mechanical and transport properties of non-crystallizing and crystallizing thermoplastics, rigid thermosets, fibers, films, elastomers and composites with particle and fiber reinforcement. Elasticity, visco-elasticity, ultimate properties, diffusion of liquids and gases, thermal and electrical properties.

● **302-683B POLYMER RHEOLOGY.** (3)

**302-684A POLYMER PROCESSING.** (3) Survey of engineering properties of polymers and processing operations, degradation of

polymers, extrusion, injection molding, fiber spinning, film blowing, blow molding, thermoforming, miscellaneous other processes. Lectures, plant visits, problem assignments.

**302-685A POLYMER PRODUCT AND PROCESS DESIGN PROJECT.** (3) Principles of product design, optimization and processing conditions for the production of plastics articles. Selection of resins, process and equipment and tool design, considering cost, safety and environmental aspects of production. Students undertake projects to define specifications for the manufacture of selected plastics articles.

**302-686A POLYMER ENGINEERING LABORATORY.** (3) Study of experimental aspects of polymer characterization. Areas of study are selected from molecular weighlt determination, polymer morphology, mechanical and rheological behaviour. Polymer processing areas available for study include extrusion, mixing and injection and compression molding.

**302-690A,B,T RESEARCH TECHNIQUES.** (3) This course introduces techniques and develops skills necessary for commencing a particular thesis research project. A written report is required.

**302-692A,B,T SELECTED TOPICS IN CHEMICAL ENGINEERING.** (2)

**302-693A,B,T SELECTED TOPICS IN CHEMICAL ENGINEERING.** (3)

**302-694A,B,T SELECTED TOPICS IN CHEMICAL ENGINEERING.** (4)

**302-695A,B,T PROJECT IN CHEMICAL ENGINEERING.** (6) Independent work under the general direction of a full-time staff member, on a problem of industrially-oriented design or research leading to a comprehensive report.

**302-696A,B,T EXTENDED PROJECT.** (6) Extended independent work on a problem of industrially-oriented design or research, leading to a comprehensive project report.

**302-697A,B,T THESIS PROPOSAL.** (6) Independent work under the supervision of the thesis advisor(s) leading to a thesis proposal.

**302-698A,B,T THESIS RESEARCH I.** (12) (Prerequisite 302-697) Ongoing research pertaining to thesis.

**302-699A,B,T THESIS RESEARCH II.** (15) (Prerequisite 302-698) Ongoing research pertaining to thesis.

**302-795A,B,T PH.D. THESIS PROPOSAL.** Independent work under the supervision of the thesis advisor(s) leading to a thesis proposal.

**302-796A,B,T PH.D. PROPOSAL DEFENCE.** Presentation and defence of thesis proposal at an oral examination.

**302-797A,B,T PH.D. SEMINAR.** (Prerequisite 302-796) Required for all Ph.D. candidates. Presentation of a seminar on an aspect of their thesis work.

# 14 Chemistry

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*Chair* — D.N. Harpp

*Director of Graduate Studies* — M. Dahma

## 14.1 Staff

*Emeritus Professors*
B.C. Eu; B.Sc.(Seoul), Ph.D.(Brown)
J.F. Harrod; B.Sc., Ph.D.(Birm.)
A.S. Hay; B.Sc.(Alta.), Ph.D.(Ill.), F.R.S.
M. Onyszchuk; B.Sc.(McG.), M.Sc.(W.Ont.), Ph.D.(Cantab), Ph.D.(McG.), F.C.I.C.
D. Patterson; M.Sc.(McG.)
A.S. Perlin; M.Sc., Ph.D.(McG.), F.C.I.C., F.R.S.C.
W.C. Purdy; B.A.(Amh.), Ph.D.(M.I.T.), F.C.I.C.
L.E. St-Pierre; B.Sc.(Alta.), Ph.D.(Notre Dame), F.C.I.C.
M.A. Whitehead; B.Sc., Ph.D., D.Sc.(Lond.), F.C.I.C.

*Professors*
I.S. Butler; B.Sc., Ph.D.(Brist.), F.C.I.C.
T.H. Chan; B.Sc.(Tor.), M.A., Ph.D.(Prin.), F.C.I.C., F.R.S.C.
M. Damha; B.Sc., Ph.D.(McG.)
A. Eisenberg; B.S.(Wor. Poly.), M.A., Ph.D.(Prin.), F.C.I.C.
P.G. Farrell; B.Sc., Ph.D., D.Sc.(Ex.)
D.F.R. Gilson; B.Sc.(Lond.), M.Sc., Ph.D.(Br.Col.), F.C.I.C.
D.N. Harpp; A.B.(Middlebury), M.A.(Wesleyan), Ph.D.(N.Carolina), F.C.I.C.
G.E. Just; Ing.Chem.(E.T.H. Zürich), Ph.D.(W.Ont.), F.C.I.C.
R.B. Lennox; B.Sc., M.Sc., Ph.D.(Tor.)
R.H. Marchessault; B.Sc.(Montr.), Ph.D.(McG.), F.C.I.C., F.R.S.C.
D.M. Ronis; B.Sc.(McG.), Ph.D.(M.I.T.)
E.D. Salin; B.Sc.(Calif.), Ph.D.(Oregon)
B.C. Sanctuary; B.Sc., Ph.D.(Br.Col.)
A.G. Shaver; B.Sc.(Carl.), Ph.D.(M.I.T.)

*Associate Professors*
M.P. Andrews; B.Sc., M.Sc., Ph.D.(Tor.)
D.H. Burns; B.Sc.(Puget Sound), Ph.D.(Wash.)
W.C. Galley; B.Sc.(McG.), Ph.D.(Calif.)
A. Kakkar; B.Sc., M.Sc.(Chan. U., India), Ph.D.(Wat.)
R.J. Kazlauskas; B.Sc.(Clev. State), Ph.D.(M.I.T.)
J.F. Power; B.Sc., Ph.D.(C'dia)
L. Reven; B.A.(Carl.), Ph.D.(Ill.)

*Assistant Professors*
P. Ariya; B.Sc., Ph.D.(York)
B.A. Arndtsen; B.A.(Carl.), Ph.D.(Stan.)
C.J. Barrett; B.Sc., M.Sc., Ph.D.(Queen's)
J.L. Gleason; B.Sc.(McG.), Ph.D.(Va.)
H. Sleiman; B.Sc.(A.U.B.), Ph.D.(Stanford)

*Lecturers*
J. Finkenbine, G. Wilczek

*Paprican Adjunct Professors*
D. Argyropoulos, D.G. Gray, R. St. John Manley, T.G.M. Van de Ven

*Associate Members*
J.A. Finch (Mining and Metallurgical Engineering), O.A. Mamer (University Clinic, RVH), B.I. Posner (Medicine) K. Gehring (Biochemistry)

*Adjunct Professors*
G.R. Brown, A. Fenster, Y. Guindon, J. Schwarcz, Y. Tsantrizos, I. Wharf, R. Zamboni

## 14.2 Programs Offered

M.Sc., Ph.D. and the M.Sc. (Applied).

**Research in Chemistry**
Members of the Department are active in directing research in the following fields:

**Analytical** – Atomic and molecular spectroscopy; laboratory automation; artificial intelligence; instrument design; optimization of data processing techniques; application of modern analytical techniques to biochemical and medical systems; detectors for liquid chromatography; photothermal analytical methods; thermal wave imaging; development of analytical techniques for studies of diffusion and photodegradation in thin films. Technique development for quantitative spectroscopy in scattering media. Micronano-sensors; Chemoinfomatics. Analytical spectroscopy of bioenergetics.

**Bio-organic** – Enzyme chemistry; protein and nucleic acid structure and function; drug design and modification; active site stereochemistry; molecular basis of regulation and pharmacological action; lipid and lipid analogue chemistry.

**Biophysical** – Excited electronic states of proteins and nucleic acids; spectroscopic probes of biopolymer conformation; sensi-

tized photochemistry in biopolymers; dynamics of protein and nucleic acid conformations. Spectroscopic analysis of oxygen transport in aerobic metabolism.

**Colloid and Polymer** – Monomolecular layers; solution properties of high polymers; molecular morphology; rheology and stability of dispersions; phase transitions in polymers and polymer blends; polymer reinforcement; radiation effects and solid-state polymerization; mechanisms of polymerization reactions; wetting and spreading; the glass transition; molecular dynamics and polymer properties; ionic polymers; cellulose and paper; carbohydrate biopolymers; pollution abatement; polymer melt rheology; synthetic latex; rheo- and electro-optical phenomena; polymers at interfaces.

**Inorganic** – Synthesis of new classes of organometallic complexes and inorganic polymers; homogeneous catalysis; catenated polysulfur and polysulfoxide complexes; organosilicon chemistry; spectroscopic studies (e.g., FT-IR, laser Raman, multinuclear NMR, and mass) of complexes; kinetics and mechanisms of inorganic and organometallic reactions; bioinorganic chemistry; inorganic materials chemistry; asymmetric catalysis; surface chemistry.

**Organic** – Synthesis and structure of heterocyclic compounds; natural products; carbohydrates; cellulose; plant-growth regulators; organic sulphur, chemistry; stereochemistry; reaction mechanisms; charge transfer complexes; new synthetic methods; conformational analysis; solvation effects; substituent effects; polymer supports; nucleic acids, anti-sense and anti-gene oligonucleotides.

**Physical** – Laser excited luminescence and novel optical materials. Order-disorder phenomena in molecular crystals and liquid crystals. Vibrational spectroscopy at high pressures. Nuclear quadrupole resonance spectroscopy.

**Pulp and Paper** – Research in areas of chemistry of interest to the Canadian pulp and paper industry is also performed at the Pulp and Paper Research Centre, adjacent to the Chemistry Department. Current research topics include cellulose and lignin chemistry, the chemistry of pulping and bleaching, colloidal aspects of papermaking, physical chemistry of cellulosic materials, and de-inking and recycling of paper.

**Theoretical** – Non-equilibrium statistical mechanics, kinetic theory of fluids and plasmas, non-equilibrium thermodynamics of non-linear transport processes for systems far from equilibrium and fluid dynamics. Theories of nuclear magnetic resonance and multiquantum NMR spectra are developed with emphasis on the determination of the structures of proteins from NMR. Molecular structure, chemical bonding, intermolecular forces in solids and isolated molecules in dimers and metastable polymers are studied quantum mechanically.

## 14.3 Admission Requirements

The minimum academic standard for admission to research thesis M.Sc., Ph.D. and the M.Sc. (Applied) degree programs is a minimum standing equivalent to a Cumulative Grade Point Average (CGPA) of 3.0 out of a possible 4 or a CGPA of 3.2/4.0 for the last two full-time academic years. Applicants from other institutions should have an academic background equivalent to that of a McGill graduate in the Chemistry Honours/Major programs. If possible, candidates should specify the field of research in which they are interested.

## 14.4 Application Procedures

All inquiries concerning graduate work in the Department should be addressed to the Director of Graduate Studies, Department of Chemistry.

### FINANCIAL ASSISTANCE

### M.Sc. and Ph.D. Degrees

Financial assistance for accepted graduate students who do not hold fellowships or scholarships is normally available in the form of laboratory demonstratorships/assistantships, and occasionally by payment from research funds. Graduate students devote 12 hours per week (contact hours, plus grading of reports, etc.) during the academic session to their teaching duties. Financial assistance during the remainder of the year is provided from research funds. Most students receive partial fee waivers. Scholarship holders, such as NSERC or awards of similar value, receive a tuition fee waiver.

### M.Sc. (Applied) Degree

Financial assistance for candidates in the M.Sc. (Applied) program is not available during the two academic sessions when courses are taken, unless candidates are recipients of scholarships. During the four-month project, candidates are paid at rates established by participating companies.

## 14.5 Program Requirements

### M.Sc.* and Ph.D. Degrees

1. Students must take such examinations as may be required in (a) assigned courses given in the Department of Chemistry, (b) assigned cognate courses given in other departments. Courses are assigned after taking into consideration the student's previous training and research interest.
2. Students must successfully complete a research project and submit an acceptable thesis.
3. Students must satisfy the examiners in an oral examination on the thesis and related subjects (required only of candidates for the Ph.D. degree).
4. All the usual requirements of the Faculty of Graduate Studies and Research must be satisfied.

* This program requires 45-50 credits.

A minimum of 6 credits of course work is required; the balance of credits will be made up from either a combination of course work (graduate and undergraduate) and thesis credits, or from thesis research credits only. There will be a minimum of 24 credits in the thesis research component.

### M.Sc. (Applied) Degree

This program requires a minimum of 45 credits, 30 credits of course work (graduate and undergraduate) plus a 15-credit project in some aspect of chemical industry, normally completed during a four-month project.

### Examinations in Chemistry

1. Examinations in assigned courses are normally taken by the candidates in December and May. In special circumstances, and with the permission of the Department and the Faculty, they may be taken in September.
2. A candidate for the Ph.D. degree shall pass all such examinations, other than those in certain special courses, before the final year, except in special circumstances and then only with the approval of the Department.

## 14.6 Courses for Higher Degrees

### Advanced Undergraduate Courses

Undergraduate courses may be required of a student who is admitted to the Graduate Faculty if deficiencies are perceived in the student's previous training. Descriptions of undergraduate courses may be found in the Faculty of Science Calendar.

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered in 2001-02.

**180-503A DRUG DESIGN AND DEVELOPMENT 1.** (3) (Prerequisites: 180-302, 177-200, 177-201 or 507-212, 549-300 or 549-301 or

549-303 or permission of instructor.) Selected thematic blocks covering chemistry, mechanisms of action and steps in drug development. Lectures and discussions will convey ideas, principles and problems in drug design.

**180-504B DRUG DESIGN AND DEVELOPMENT 2.** (3) Prerequisite: 180-503A and permission of instructor.) Groups of 2-4 students with different backgrounds will form a team. Each team will select the lead compound, design the analogues, propose the preclinical and clinical studies, present possible untoward effects and reasons for drug (dis)approval.

**180-531B CHEM. OF INORGANIC MATERIALS.** (3) (3 lectures) (Prerequisite: 180-381) Structure, bonding, synthesis, properties and applications of covalent, ionic, metallic crystals, and amorphous solids. Defect structures and their use in synthesis of specialty materials such as electronic conductors, semiconductors, and superconductors, and solid electrolytes. Basic principles of composite materials and applications of chemistry to materials processing.

**180-534A NANOSCIENCE AND NANOTECHNOLOGY.** (3) (Prerequisites: 180-345 or 198-357 or 198-446 or permission of instructor.) Topics discussed include scanning probe microscopy, chemical self-assembly, computer modelling, and microfabrication/ micromachining.

**180-543A CHEMISTRY OF PULP AND PAPER.** (3) (2 lectures plus a reading/research project.) (Prerequisite: 180-302 or permission of instructor.) The industrial processes for converting wood to paper are described with emphasis on the relevant organic, physical, surface chemistry and colloid chemistry. The structure and organization of the polymeric constituents of wood are related to the mechanical, optical and other requisite properties of paper.

**180-547B LABORATORY AUTOMATION.** (3) (Two 1.5 hour lectures, lab) (Prerequisite: 180-377B, equivalent or permission of instructor.) Automation and data handling with respect to modern chemical laboratory instrumentation. Basic electronics, data aquisition, evaluation of laboratory needs, data processing methodologies.

**180-552B PHYSICAL ORGANIC CHEMISTRY.** (3) (Prerequisite: 180-302) The correlation of theory with physical measurements or organic systems; an introduction to photochemistry; solvent and substituent effects on organic reaction rates, etc.; reaction mechanisms.

**180-555A NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY.** (3) (3 lectures) (Prerequisite: 180-355 or equivalent.) Interpretation of proton and carbon-13 nuclear magnetic resonance spectroscopy in one dimension for structural identification.

**180-556A ADVANCED QUANTUM MECHANICS.** (3) (3 lectures) (Prerequisites: 180-345, 198-242) Quantum mechanical treatment of species of chemical interest. Introduction to perturbation theory, both time-dependent and time-independent. Treatment of the variational principle. Introduction to atomic spectra. Chemical bonding in terms of both the valence bond and molecular orbital theory. Elementary collision theory. Interaction of radiation with molecules.

**180-567A CHEMOMETRICS: ANALYSIS OF CHEMICAL DATA.** (3) (Prerequisite: Linear Algebra and experience in some computer programming language, or permission of instructor.) The course is designed to provide a background in mathematical methods for chemical experimental design, system optimization, and sensor calibration. Topics covered include; factorial analysis of chemical spectra, pattern recognition from multisensor data, linear and nonlinear optimization for the determination of optimal reaction conditions molecular modeling, multisensor calibration, etc.

**180-571B POLYMER SYNTHESIS.** (3) (3 lectures) (Prerequisites: 180-302 or equivalent, or permission of instructor.) A survey of polymer preparation and characterization; mechanisms of chain growth, including free radical, cationic, anionic, condensation and transition metal-mediated polymerization, and the effects of these mechanisms on polymer architecture; preparation of alternating, block, graft and stereoblock copolymers; novel macromolecular structures including dendrimers and other nanostructures.

- **180-572B SYNTHETIC ORGANIC CHEMISTRY.** (3) (3 lectures) (Prerequisite: 180-382)

- **180-574B OPTICAL METHODS AND MATERIALS.** (3) (Prerequisite: 180-355)

**180-575B CHEMICAL KINETICS.** (3) (3 lectures) (Prerequisites: 180-273 and 180-255) (Not open to students who have taken 180-475.) Kinetic laws, measurement of reaction rates, transition state and collision theory, elementary gas phase reactions. Elementary reactions in solution, reaction mechanisms in solution, reactions on surfaces and in solid state. Complex reactions and mechanisms, laser techniques, molecular beams, chemiluminescence, computer generated studies. Explosions. Dynamic simulation by computer.

- **180-576B QUANTUM CHEMISTRY.** (3) (Lecture and/or reading course) (Prerequisite: 180-345) (Not open to students who have taken 180-476)

- **180-577B ELECTROANALYTICAL CHEMISTRY.** (3)

**180-581B INORGANIC TOPICS I.** (3) (Prerequisite: 180-381) (Not open to students who have taken 180-481.) An introduction to some areas of current interest in inorganic chemistry. Each year a selection of several particularly active areas will be chosen.

**180-585B COLLOID CHEMISTRY.** (3) (Prerequisite: Chemistry core curriculum or equivalent.) Principles of the physical chemistry of phase boundaries. Electrical double layer theory; van der Waals forces; Brownian motion; kinetics of coagulation; electrokinetics; light scattering; solid/liquid interactions; adsorption; surfactants; hydrodynamic interactions; rheology of dispersions.

**180-587A SELECTED TOPICS IN MODERN ANALYTICAL CHEMISTRY.** (3) (Prerequisites: 180-367 and 180-377) Current theories of aqueous and nonaqueous solutions, with application to analytical chemistry; recent advances in analytical techniques. Topics may include: chromatography; applications of kinetics, solvent extraction and thermal analysis, with emphasis on their theoretical basis.

**180-591B ADVANCED COORDINATION CHEM.** (3) (3 hours) (Prerequisite: 180-381) (For Honours and Major Chemistry students or with permission.) In-depth treatment of advanced topics in coordination chemistry, such as bio-inorganic chemistry and transition metal catalysis and solid state inorganic chemistry.

**180-593B STATISTICAL MECHANICS.** (3) ( 2lectures) (Research project) (Prerequisite: 180-345. Recommended: 180-355) (Not open to students who have taken 180-493.) Basic hypotheses of statistical thermodynamics; ideal monatomic, diatomic and polyatomic gases; Einstein and Debye models of solids; statistical theory of black-body radiation; Debye-Hückel theory of electrolyte solutions; absolute reaction rate theory of rate processes; theories of solutions. (name change awaiting University approval)

**180-597A ANALYTICAL SPECTROSCOPY.** (3) (2 lectures; 3 hours lab) (Prerequisites: 180-367 and 180-377, or permission of instructor.) The design and analytical use of spectroscopic instrumentation with respect to fundamental and practical limitations. Classical emission, fluorescence, absorption and chemical luminescence. Topics may include photo-acoustic spectroscopy, multielement analysis, X-ray fluorescence and modern multiwavelength detector systems.

- **180-603A INFRARED AND RAMAN SPECTROSCOPY.** (5)

- **180-611A INORGANIC TOPICS II.** (4)

**180-612B ORGANOMETALLIC CHEMISTRY.** (5) A first course at the graduate level in organometallic chemistry. The theory and practice of the field is treated starting from basic principles of inorganic and organic chemistry.

**180-621A RECENT ADVANCES IN ORGANIC CHEMISTRY.** (5) A systematic survey of the mechanisms of the most common organic reactions from studies of reactions in the current literature.

**180-623A ORGANIC STEREOCHEMISTRY.** (5) Stereoisomers, their nomenclature and configuration - Conformational analysis and molecular modelling. Separation of stereoisomers. Stereocontrol in organic synthesis.

- **180-624A SPECIAL TOPICS IN ORGANIC CHEMISTRY.** (4)

- **180-626D THE FUNDAMENTALS OF MEDICINAL CHEMISTRY.** (4)
- **180-627B SPECIAL TOPICS II.** (5)

**180-629B ORGANIC SYNTHESIS.** (5) An advanced course in the synthesis of organic molecules with an emphasis on stereoselective transformations. Topics will include multiple bond formation, functional group interconversions, carbon-carbon bond formation and stereoselective oxidations and reductions.

**180-631D SELECTED TOPICS IN ANALYTICAL CHEMISTRY.** (4) A directed reading course with individual student-professor conferences, and intended mainly for students specializing in analytical chemistry. Topics are chosen to meet the individual needs of each student.

**180-634B SEMINAR IN ADVANCED MATERIALS.** (3) A series of research-level seminars about topics of current interest in advanced materials. Topics include molecular and nanoelectronics, computational approaches to materials design and property predictions, new techniques in molecular and atomic imaging, advances in materials preparation, quantum devices and quantum computing.

**180-636A,B CHEMICAL LABORATORY AUTOMATION II.** (5) (Prerequisite: 180-547) Students will undertake a chemical laboratory automation project. Design and implementation problems will be discussed by the students in seminars and advanced topics in automated chemical instrumentation will be presented. Several experiments will be required.

**180-643A ORGANIC CHEMISTRY OF WOOD COMPONENTS.** (4) The course concerns the organic chemistry of the wood components with emphasis on their biosynthesis and biodegradation, isolation and structural elucidation, analysis, synthesis and reactions.

**180-645A QUANTUM MECHANICS.** (5) Brief review of solvable problems in non relativistic quantum mechanics; theory of many-electron systems and its application to molecules and atoms. Additional topics are chosen to meet the interests of the students.

**180-646A ADVANCED STATISTICAL MECHANICS.** (4) Intermediate and advanced topics in statistical mechanics. Material to be covered will include: graphical methods, modern theories of dense gases and liquids, static and dynamic critical phenomena, time-correlation functions, light-scattering and nonequilibrium phenomena.

**180-650A SEMINARS IN CHEMISTRY.** (1) (1 seminar) (Required of first year graduate students in Chemistry.) A seminar course designed for graduate students in chemistry which in conjunction with McGill Chemical Society will provide exposure to a broad range of special topics within the discipline.

**180-651B SEMINARS IN CHEMISTRY.** (1) (1 seminar) (Required of first year graduate students in Chemistry.) A seminar course designed for graduate students in chemistry which in conjunction with McGill Chemical Society will provide exposure to a broad range of special topics within the discipline.

**180-655B ADVANCED NMR SPECTROSCOPY.** (4) (1 lecture) (Prerequisite: 180-555 or equivalent.) Advanced techniques of nuclear magnetic resonance spectroscopy, Fourier transform methods, multiple pulsing, two-dimensional pulse sequencing.

**180-661A LITERATURE REVIEW AND PROPOSAL.** (3) (Restricted to graduate students in Chemistry.) Students will review the relevant literature concerning their particular area of research and describe plans for future work.

**180-662A RESEARCH REPORT I.** (3) (Restricted to graduate students in Chemistry.) Students will prepare a research proposal, and give a seminar.

**180-666D SPECIAL TOPICS.** (6) Critical and original essays are required on various subjects of current interest in chemistry.

**180-667A,B SPECIAL TOPICS.** (4) Critical and original essays are required on various subjects of current interest in chemistry.

- **180-672B THE POLYMER SOLID STATE.** (4)
- **180-673B POLYMERS IN SOLUTIONS.** (4)

**180-674A INTRODUCTORY PHYSICAL CHEMISTRY OF POLYMERS.** (4) A survey course on the structure of polymers; kinetics and mechanisms of polymer synthesis; molecular weight distributions; polymer configurations and the thermodynamics of polymer solutions; rubber, elasticity, osmometry and viscosity.

**180-675A MECHANICAL PROPERTIES AND RHEOLOGY OF POLYMERS.** (4) Mechanical properties of polymers; glass transition, visco-elasticity, rubber elasticity, failure. Relation to molecular properties, mechanical spectroscopy, dielectric properties, birefringence.

**180-686B WET-END PAPERMAKING CHEMISTRY.** (3) (Restricted to graduate students in Chemistry or Chemical Engineering or permission of instructor.) (Prerequisites: 180-543 and 180-585) Review of the chemistry of various additives used in papermaking, such as wet and dry strength agents, sizing agents, fillers, filler retention aids, antifoam agents, biocides, dyes, dewatering agents, drainage and formation aids. The course also addresses the chemistry of deinking of waste papers and the treatment of effluents.

**180-691A,B,C M.SC. THESIS RESEARCH.** (3) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-692A,B,C M.SC. THESIS RESEARCH.** (6) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-693A,B,C M.SC. THESIS RESEARCH.** (9) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-694A,B,C M.SC. THESIS RESEARCH.** (12) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-695A,B,C M.SC. THESIS RESEARCH.** (15) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-696A,B,C M.SC. THESIS RESEARCH.** (6) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-697A,B,C M.SC. THESIS RESEARCH.** (9) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-698A,B,C M.SC. THESIS RESEARCH.** (12) Independent research work leading to writing of M.Sc. thesis for final submission to the Faculty of Graduate Studies and Research.

**180-699A,B,C PROJECT.** (15) Restricted to students in the M.Sc. (Applied) program in Chemistry and designed to give them practical experience through a four-month project in some aspect of chemical industry

**180-721B ORGANIC CHEMISTRY RESEARCH SEMINAR.** (3) Upon completion of the organic cumulative examinations, students will present a seminar on their research work (including background and future plans).

**180-763A RESEARCH REPORT 2.** (3) (Restricted to graduate students in Chemistry.) Students will present a seminar on a complete or nearly complete research project and discuss these results.

# 15 Civil Engineering and Applied Mechanics

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*Chair* — D. Mitchell

*Chair of Graduate Program* — TBA

## 15.1 Staff

*Emeritus Professors*
Louis J. Arcand; B.Sc., M.Eng.(McG.), Q.L.S., M.C.I.S., M.A.S.P.
Philip J. Harris; B.Sc.(Man.), M.Eng., Ph.D.(McG.), F.E.I.C., F.C.S.C.E., Eng.
Stuart B. Savage; B.Eng.(McG.), M.S.Eng.(Cal.Tech.), Ph.D.(McG.), F.R.S.C.

*Professors*
V.H. Chu; B.S.Eng.(Taiwan), M.A.Sc.(Tor.), Ph.D.(M.I.T.), Eng.
M.S. Mirza; M.S., B.Eng.(Karachi), M.Eng., Ph.D.(McG.), F.E.I.C., F.C.S.C.E., F.A.C.I., Hon.F.I.E.P., Eng.
D. Mitchell; B.A.Sc., M.A.Sc., Ph.D.(Tor.), F.A.C.I., Eng.
V.T.V. Nguyen; B.M.E.(Vietnam), M.C.E.(A.I.T.), D.A.Sc.(Montr.), Eng. *(on leave 2001-02)*
A.P.S. Selvadurai; M.S.(Stan.), Ph.D., D.Sc.(Nott.), F.E.I.C., F.I.M.A., F.C.S.C.E., P.Eng.
S.C. Shrivastava; B.Sc.(Eng.) (Vikram), M.C.E.(Del.), Sc.D.(Col.), Eng.

*Associate Professors*
L. Chouinard; B.Ing., M.Ing.(Montr.), B.C.L.(McG.), Sc.D.(M.I.T.), Eng.
R. Gehr; B.Sc.(Eng.) (Witw.), M.A.Sc., Ph.D.(Tor.), P.Eng.
G. McClure; B.Ing.(Mont.), S.M.C.E.(M.I.T.), Ph.D.(Mont.), Eng. *(on leave 2001-02)*
J. Nicell; B.A.Sc., M.A.Sc., Ph.D.(Windsor), P.Eng.

*Assistant Professors*
S.J. Gaskin; B.Sc.(Eng.) (Queen's), Ph.D.(Cant.)
S. Ghoshal; B.C.E.(India), M.S.(Missouri), Ph.D.(Carnegie Mellon)
C. Rogers; B.A.Sc., M.A.Sc. (Waterloo), Ph.D.(Sydney), P.Eng.
Y. Shao; B.Sc., M.S.(Tongji), Ph.D.(Northwestern)

*Adjunct Professors*
S. Babarutsi, A. Beaubien, P. Boucher, S. Guiot, J. Gussow, L. Hervieux, G. Holder, R.D. Japp, J. Mirza, R. G. Redwood, S.B. Savage, P. Trottier, A. Zaki, R. Zaloum

## 15.2 Programs Offered

Advanced courses of instruction and laboratory facilities are available for engineering graduate students desiring to proceed to the degrees of M.Eng., M.Sc. and Ph.D.

Graduate studies and research are at present being conducted in the fields of structures and structural mechanics, rehabilitation, fluid mechanics and hydraulics, materials engineering, soil behaviour, soil mechanics and foundations, water resources engineering, and environmental engineering.

**M.Eng. (Project) Degree in Civil Engineering – Option in Rehabilitation of Urban Infrastructure**
This program is offered to students with a university undergraduate degree in engineering who want to specialize in the field of maintenance and rehabilitation of urban infrastructures. It is offered jointly by McGill University and École de Technologie Supérieure, École Polytechnique de Montréal, and Institut National de la Recherche Scientifique - Urbanisation. A student registered at McGill is required to take courses at the other four institutions.

**M. Eng. (Environmental Engineering Option) Degree**
This program is offered to students with a university undergraduate degree in engineering who desire graduate education in the environmental engineering field. This option is within the context of the existing M.Eng. (Project Option) and M.Sc. (Applied) programs currently offered in the Departments of Agricultural and Biosystems, Chemical, Civil, and Mining and Metallurgical Engineering This program will emphasize interdisciplinary fundamental knowledge courses, practical applications in diverse environmental contexts, and functional skills need for solving environmental problems. Candidates must possess a Bachelor's degree in engineering with superior academic achievement (a minimum of CGPA of 3.0 out of a possible 4.0).

**M.Sc. Degree**
Candidates with a Bachelor's degree in a discipline other than Engineering, such as Science or Arts, may be accepted into a M.Sc. program in the Department. Such students would typically study in the fluid mechanics, water resources, or environmental engineering areas, and would follow the Thesis Option program, as outlined above.

## 15.3 Admission Requirements

The general rules of the Faculty apply and are detailed in the General Information and Faculty Regulations section. The minimum academic standard for admission is normally a Cumulative Grade Point Average (CGPA) of 3.0/4.0 or better. The General Test of the GRE is required of all applicants whose university degree(s) were obtained outside of North America.

Applicants whose native language is not English or French, and who have not completed an undergraduate degree in Canada, are expected to achieve a grade of 580 or better on the paper-based (237 on the computer-based) Test of English as a Foreign Language (TOEFL) for entry to the Ph.D. program, and 550 on the paper-based (213 on the computer-based) TOEFL for other programs. The test is administered by the Educational Testing Service and is easily available throughout the world. The results reach McGill approximately eight weeks after the test is taken. It is the student's responsibility to make the necessary arrangements with the examining board to write the test in the country of residence. Full information about the Test and a registration form may be obtained by writing to: Test of English as a Foreign Language, Box 6191, Princeton, New Jersey 08540-6151, U.S.A.

## 15.4 Application Procedures

Applications will be considered upon receipt of:
1. Application form
2. Two official transcripts
3. Two confidential letters of reference
4. $60 application fee
5. Test results (GRE, TOEFL)

Applicants for entry into a graduate program are requested to address their completed forms for admission to the Chair of the Graduate Studies Admissions Committee, Department of Civil Engineering and Applied Mechanics.

Applications for September admission should be submitted by April 1, and those for January admission by August 1 (international students) and October 1 (Canadian students).

## 15.5 Program Requirements

**M.Eng. Degree**

Candidates may satisfy the requirements for the M.Eng. degree by following one of two options:

**Thesis Option** program (45 credits) requires a research thesis (27 credits) and a minimum of five courses (18 credits). The thesis describing the candidate's research is to be submitted in accordance with the rules of the Faculty.

**Project Option** program requires a minimum of 30 credits of course work plus a project, the total amounting to 45 credits. The credits assigned to the project can vary between 5 and 15 depending on the amount of work involved.

Both programs normally require that at least 12 of the coursework credits be at the 600 level. The above minimum course requirements for both options pertain to well prepared students; others may be required to take additional courses as a condition of acceptance or as determined in consultation with their director of studies or research.

Three terms of resident study at McGill are required for the degree. This is a minimum requirement and usually a longer period will be necessary. This residence requirement can also be satisfied by Project Option students through part-time (evening) studies over a period of three or more years.

**Master of Engineering (Environmental Engineering Option) Degree**

The program consists of a minimum of 45 credits, of which, depending on the student's home department, a minimum of 5 and a maximum of 15 may be allotted to the project. The balance is earned by coursework, of which one to three approved undergraduate (below 500-level) courses are allowed.

To complete the option, students must:
- complete four (4) required core courses (see section A below);
- complete a minimum of two (2) engineering courses (see section B below);
- complete a minimum of two (2) non-engineering courses (each course should be chosen from a different department) (see section C below)
- complete a design or research project of 5 to 15 credits
- complete all the remaining courses (to a total of at least 45 credits) as required in the student's departmental program (these courses must be approved by the student's Academic Advisor); and
- obtain a grade of 65% (or B-)or better in all required and approved courses

**Prerequisite**
(Not credited to the Master Environmental Engineering Option Program) 303-225B Environmental Engineering or equivalent environmental engineering courses

**A. Required Core Courses**
302-591B Environmental Bioremediation
303-555B Environmental Data Analysis
or 360-611B Experimental Designs
303-615A Environmental Engineering
392-612A Principles of Toxicology
or 333-505B Health Risks of Toxicants

**B. Elective Engineering Courses**
These are to be chosen from a list of specific courses offered by the following Engineering Departments:
Agricultural and Biosystems Engineering
Chemical Engineering
Civil Engineering and Applied Mechanics
Mechanical Engineering
Mining and Metallurgical Engineering

**C. Elective Non-engineering Courses**
These are to be chosen from a list of specific courses offered by the following faculties and Departments:
Faculty of Agricultural and Environmental Sciences
Department of Atmospheric and Ocean Sciences
Department of Biology
Department of Chemistry
Department of Earth and Planetary Sciences
Department of Economics
Department of Epidemiology and Biostatistics
Department of Geography
Faculty of Law
Faculty of Management
Department of Occupational Health
Department of Political Science
Department of Religious Studies
Department of Sociology
School of Urban Planning

The environmental Engineering Option Program is administered by the Faculty of Engineering. Further information may be obtained from the Program Coordinator, Department of Civil Engineering and Applied Mechanics.

**M.Eng. (Project) Degree in Civil Engineering – Option in Rehabilitation of Urban Infrastructure**

This program is offered jointly by McGill University and École de Technologie Supérieure, École Polytechnique de Montréal, and Institut National de la Recherche Scientifique - Urbanisation. A student registered at McGill is required to take courses at the other four institutions.

The program leads to a professional non-thesis (Project Option) degree with a minimum of 45 credits divided in three modules described below. Depending on their background and interests, students would specialize in one or two out of three possible areas: (1) underground water supply and drainage systems; (2) road infrastructure; (3) bridges, overpasses and tunnels. Students registered at McGill can specialize in area 3 or jointly in areas 2 and 3: students interested in other program scenarios are encouraged to register at one of the other four participating institutions.

**Module 1 Required courses** (15 credits)
CIV(1) 6313 Méthodologie de réhabilitation des infrastructures urbaines
MGC(2) 810 Gestion des projets de construction et de réhabilitation
303-512(3) Advanced Civil Engineering Materials (required for McGill students)
or GCI(4) 715 Matériaux pour la réhabilitation des infrastructures urbaines
RIU(5) 9500 Analyse du processus de décision et choix technologiques
RIU 9501 Financement des infrastructures et finances publiques locales

**Module 2 Specialized courses** (15 credits)
Elective courses in rehabilitation (6 to 12 credits)
Area 1 Underground water supply and drainage systems
CIV 6314 Évaluation des systèmes d'alimentation en eau et d'assainissement
GCI 745 Réhabilitation des systèmes d'alimentation en eau et d'assainissement

Area 2 Road Infrastructure
MGC 835 Évaluation des chausées
MGC 840 Conception et réhabilitation des chausées

Area 3 Bridges, overpasses and tunnels
303-527 Renovation and preservation of infrastructure
303-617 Design and rating of highway and railway bridges (required for McGill students)
or CIV 6511 Conception et évaluation des ponts

Other graduate electives (3 to 9 credits) to be approved by the inter-university program coordination committee. McGill students specializing in area 3 are required to take at least 6 credits at McGill, while those specializing in areas 2 and 3 must take 3 credits at McGill.

**Module 3 Integration** (15 credits)
Research project (15 credits)

(1) Course offered by École Polytechnique de Montréal
(2) Course offered by École de Technologie Supérieure
(3) Course offered by McGill University
(4) Course offered by Université de Sherbrooke (Longueuil Campus)
(5) Course offered by Institut National de la Recherche Scientifique - Urbanisation

Documentation outlining the program and giving additional information is available on request.

**M.Sc. Degree**

Candidates with a Bachelor's degree in a discipline other than Engineering, such as Science or Arts, may be accepted into a M.Sc. program in the Department. Such students would typically study in the fluid mechanics, water resources, or environmental engineering areas, and would follow the Thesis Option program, as outlined above.

**Ph.D. Degree**

Candidates normally register for the M.Eng. degree, Thesis Option, or M.Sc. degree in the first instance. Those who have a Master's degree acceptable to the Department may, however, be considered for direct registration for the Ph.D. degree (Ph.D.II).

The Ph.D. program consists of a research project and courses as required to develop the candidate's background. Candidates are expected to take a comprehensive preliminary oral examination (course 303-701) within the first year of their Ph.D. registration. They must fulfill the requirements outlined in the general rules of the Faculty. There is no foreign language requirement.

## 15.6 Courses for Higher Degrees

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

Not all of the courses listed below are given each year; a list of courses to be offered is made available in the Department prior to each term.

- Denotes courses not offered in 2001-02.

**303-512 A ADVANCED CIVIL ENGRG. MATERIALS.** (3) (Prerequisite: 303-202B) Production, structure and properties of engineering materials; ferrous alloys, treatments, welding, special steels, cast iron; ceramic materials; polymers; composite materials; concrete, admixtures, structure, creep, shrinkage; asphalt and asphaltic materials; clay materials and bricks; impact of environment on material response, durability, quality assessment and control, industrial specifications; recent advances.

**303-514A STRUCTURAL MECHANICS.** (3) Stress, strain, and basic equations of linear elasticity. General and particular solutions of plane and axisymmetric problems. St. Venant's theory. Stress concentration and failure criteria. Formulation and applications of energy principles, and their connection to finite-element and boundary-element methods. Unsymmetrical bending of beams; shear centres; torsion of thin-walled structural members. Curved beams.

**303-526B SOLID WASTE MANAGEMENT.** (3) (Prerequisite: 303-225B) Characterization of municipal and industrial solid wastes. Review of solid and hazardous waste impact, regulations and treatment options. Collection and transportation of solid wastes. Methods of reclamation and disposal. Introduction to the design of landfill sites and incinerators.

**303-527A RENOVATION AND PRESERVATION OF INFRASTRUCTURE.** (3) (Prerequisite: 303-202B) Maintenance, rehabilitation, renovation and preservation of infrastructure; infrastructure degradation mechanisms; mechanical, chemical and biological degradation; corrosion of steel; condition surveys and evaluation of buildings and bridges; repair and preservation materials, techniques and strategies; codes and guidelines; case studies.

**303-540A URBAN TRANSPORTATION PLANNING.** (3) (Prerequisite: 303-319B or permission of instructor) Process and techniques of urban transportation engineering and planning, including demand analysis framework, data collection procedures, travel demand modelling and forecasting, and cost-effectiveness framework for evaluation of project and system alternatives.

**303-541B RAIL ENGINEERING.** (3) Principles of rail system design, including vehicle motion calculations, supporting way design, and rail vehicle design. Planning and operational characteristics for rail freight systems and urban rail systems, with an assessment of operational and technological developments.

- **303-546A,B SELECTED TOPICS IN CIVIL ENGINEERING.** (3)

**303-550A WATER RESOURCES MANAGEMENT.** (3) A review of state-of-the-art water resources management techniques; case studies and their application to Canadian situations; identification of major issues and problem areas; interprovincial and international river basins; implications of development alternatives; institutional arrangements for planning and development of water resources; legal and economic aspects.

**303-553B STREAM POLLUTION AND CONTROL.** (3) Water quality standards. Physical and chemical pollution, and bacterial contamination of surface waters. Effects of specific types of pollution such as thermal, point and non-point sources. Stream self purification. Effects on lake eutrophication. Pollution surveys and methods of control.

**303-555B ENVIRONMENTAL DATA ANALYSIS.** (3) Application of statistical principles to design of measurement systems and sampling programs. Introduction to experimental design. Graphical data analysis. Description of uncertainty. Parametric and nonparametric statistical tests. Trend analysis. Statistical analysis of censored data. Model parameter estimation methods. Linear and nonlinear regression methods.

**303-570A WAVES AND COASTAL ENGINEERING.** (3) (Prerequisite: 303-327B) Waves: wave transformation and prediction, waterlevels; coastal geomorphology: geology, sediment transport, coastal processes; coastal engineering: shore protection, harbours, dredging, coastal management.

**303-572A COMPUTATIONAL HYDRAULICS.** (3) (Prerequisite: 303-327B) Computation of unsteady flows in open channels; abrupt waves, flood waves, tidal propogations; method of characteristics; mathematical modelling of river and coastal currents.

**303-573A HYDRAULIC STRUCTURES.** (3) (Prerequisites: 303-323A and 303-327B) Hydraulic aspects of the theory and design of hydraulic structures. Storage dams, spillways, outlet works, diversion works, drop structures, stone structures, conveyance and control structures, flow measurement and culverts.

**303-574 A FLUID MECHANICS OF WATER POLLUTION.** (3) (Prerequisite: 303-327B or equivalent.) Mixing, dilution and dispersion of pollutants discharged into lakes, rivers, estuaries and oceans; salinity intrusion in estuaries and its effects on dispersion; biochemical oxygen demand and dissolved oxygen as water quality indicators; thermal pollution; oil pollution.

**303-576B HYDRODYNAMICS.** (3) (Corequisite: 303-428A) Equations of motion, stress and rate of strain, vorticity, potential flows, virtual mass, complex variables and conformal mapping. Free surface flows. Shallow water flows, method of characteristics, waves of finite amplitude. Flows on a geophysical scale, Ekman layers, homogenous lake circulation, seiches. Refraction and diffraction around breakwaters. (Awaiting University approval)

**303-577A RIVER ENGINEERING.** (3) (Corequisite: 303-428A) Fluvial geomorphology; sediment properties; river turbulence; mechanics of the entrainment, transportation and deposition of solids by fluids; threshold of movement; bed forms; suspended load, bed load and total load equations; stable channel design and regime rivers; river modeling; river engineering and river management.

**303-579B WATER POWER ENGINEERING.** (3) (Prerequisites: 303-323A, 306-310A,B) A practical approach to the planning and design of hydro-electric power installations. Fundamental theory of water availability and demand; flow, power and load duration curves; classification of power sources; project planning; economic analysis including costs and benefits; special features of hydro plants; and appurtenances for hydro plants.

**303-585A GROUNDWATER HYDROLOGY.** (3) (Prerequisite: permission of instructor.) Groundwater geology; steady-state and transient-state regional groundwater; infiltration and recharge; hydrological cycle; chemical constituents; adsorption/desorption processes; Groundwater exploration techniques; pumping tests; groundwater pollution; diffusion and dispersion; thermal processes; groundwater resource management.

- **303-586B EARTHWORK ENGINEERING.** (3)

**303-587B PAVEMENT DESIGN.** (3) Properties of bituminous materials, design of bituminous concrete mixes, construction control; evaluation of design parameters, factors controlling their variability; soil stabilization; frost effects; stresses and displacements in layered systems, analysis of rigid and flexible pavement systems; design of highway and airport pavements; pavement evaluation and strengthening; recycling.

**303-602B FINITE ELEMENT ANALYSIS.** (4) (Prerequisite: 303-514A) Development of displacement based simple and high order, one, two and three dimensional elements for linear elastic stress analysis. Variational and other methods for element formulation. Plate bending and shell elements. Finite element programming. Use of package programs in static analysis of structures.

**303-603B STRUCTURAL DYNAMICS.** (4) Dynamic loads on structures; equations of motion of linear single- and multiple-degree-of-freedom systems and of continuous systems; free and forced vibrations; damping in structures; modal superposition and time-history analysis; earthquake effects; provisions of the National Building Code of Canada for seismic analysis.

- **303-604B THEORY OF PLATES AND SHELLS.** (4)

**303-605B STABILITY OF STRUCTURES.** (4) Buckling of elastic columns by equilibrium analysis. Buckling of inelastic columns. Energy analysis and approximate methods. Stability of frames. Torsional buckling of columns and flexural-torsional buckling of beams. Buckling of plates and axially compressed circular cylindrical shells. Stability analysis using the finite element method.

**303-607A ADVANCED DESIGN IN METALS.** (4) Physical properties of metals, residual stresses, design concepts. Column theories, column strength, beam-column design, structural frames. Plastic design concepts, ultimate strength, axial forces with bending, shear forces with bending. Economic design considerations.

**303-609B RISK ENGINEERING.** (4) Quantitative analysis of uncertainty in planning, design, construction, operation and rehabilitation of engineered facilities. Interprets fundamentals of probabilities, random processes, statistics, and decision analysis in the context of engineering applications, in particular description of variability of loads and environmental conditions, material properties performance prediction, system reliability analysis, and risk-based decision analysis.

- **303-610A,B SPECIAL TOPICS IN STRUCTURAL MECHANICS.** (4)

**303-612A EARTHQUAKE-RESISTANT DESIGN OF STRUCTURES.** (4) Static and dynamic analyses, design codes, effects of local ground conditions, ductility demands on structural components. Inelastic behaviour of beams, columns, joints, shear walls and bracing under cyclic loading of steel concrete and masonry structures. Design applications.

- **303-613A,B NUMERICAL METHODS IN STRUCTURAL ENGINEERING.** (4)

**303-614A COMPOSITES FOR CONSTRUCTION.** (4) Fibre reinforced plastics (FRP), civil engineering applications; fibre, matrix, processing; plymechanics, strength, rigidity, stability, durability; FRP rebars and tendons for concrete, laminates for strengthening, pultruded beams and columns, FRP stay-in-place formwork for concrete, FRP - glulam beams; design criteria, design project.

**303-615A ENVIRONMENTAL ENGINEERING SEMINAR.** (3) The course will expose the students to various environmental engineering issues. Lectures will be given by faculty and invited speakers from industry. Each student is required to prepare a written technical paper and make oral presentation.

- **303-617 B DESIGN AND RATING OF HIGHWAY AND RAILWAY BRIDGES.** (4)

**303-618A DESIGN IN CONCRETE I.** (4) Concrete physical properties, creep, shrinkage; review of ultimate strength design; combined loadings; design of frames and flat plates; limit design, yield line theory; prestressed concrete, partial prestressing and load balancing. The course will include group projects.

- **303-621A BEHAVIOUR OF CONCRETE STRUCTURES.** (4)

**303-622 A PRESTRESSED CONCRETE.** (4) Material properties; prestressing methods and systems; the behaviour and design of members subjected to axial forces, bending, shear and torsion; prestress losses; design of statically determinate and indeterminate structures; composite precast construction; prestressed concrete floor systems. Application to bridge design.

**303-623A DURABILITY OF MATERIALS.** (4) Safety, serviceability, durability and service life; quality assurance and quality control; material structures, properties and degradation; concrete materials, as-built properties; steel corrosion and protection; steel, timber and masonry properties; deterioration mechanisms; condition survey; maintenance and repair strategies, materials and processes; economic appraisal, recent development; case studies.

**303-624B DURABILITY OF STRUCTURES.** (4) Basic concepts, safety, durability, repair and strengthening; reliability analysis; deterioration mechanisms, preventive and corrective measures; design for durability; parking structures; bridges; steel, timber and masonry structures; municipal infrastructure; strengthening and retrofitting; management systems; case studies. This course will involve field trips and group design exercises.

**303-630A,B,C THESIS RESEARCH I.** (3)

**303-631A,B,C THESIS RESEARCH II.** (3)

**303-632A,B,C THESIS RESEARCH III.** (3)

**303-633A,B,C THESIS RESEARCH IV.** (6)

**303-634A,B,C THESIS RESEARCH V.** (6)

**303-635A,B,C THESIS RESEARCH VI.** (6)

- **303-648A,B SPECIAL TOPICS IN CIVIL ENGINEERING.** (4)

**303-651 A THEORY OF WATER AND WASTEWATER TREATMENT.** (4) Theoretical aspects of the chemistry of water and wastewater treatment. This will include acid-base and solubility equilibria; redox reactions; reaction kinetics; reactor design; surface and colloid chemistry; gas transfer; mass transfer; stabilization and softening; disinfection; corrosion.

**303-652 A BIOLOGICAL TREATMENT OF WASTEWATERS.** (4) Process kinetics and reactors. Population kinetics of microorganisms and their role in the various waste treatment processes. Unit processes for wastewater treatment, such as suspended-growth, attached-growth processes, sludge treatment, and nutrient removal. Biological treatment techniques for groundwater decontamination. Laboratory pilot plant exercises.

**303-659B CHEMICAL ANALYSIS OF WATERS AND WASTES.** (4) Theoretical aspects and laboratory analyses for water and wastewater quality, including pH, acidity, alkalinity, hardness, colour, conductivity, solids, turbidity, chlorine, BOD, COD, TOC, TKN, nitrates, phosphorus, oil and grease; also spectroscopic and chromatographic methods.

**303-660B CHEMICAL AND PHYSICAL TREATMENT OF WATERS.** (4) Theory and design of specific processes used for the physical and/or chemical purification of waters and wastewaters, including mixing, flocculation, sedimentation, flotation, filtration, disinfection, adsorption, ion exchange, aeration, membrane processes, distillation, removal of specific inorganics and organics, taste and odour control, process control, sludge treatment. Laboratory exercises will complement theoretical aspects.

- **303-664A MODELLING IN ENVIRONMENTAL/WATER RESOURCES ENGINEERING.** (4)

- **303-666B ENVIRONMENTAL AND WATER RESOURCES SYSTEMS.** (4)

- **303-678B GRAVITY CURRENTS AND RELATED PHENOMENA.** (4)

**303-680A FUNDAMENTALS OF SOIL BEHAVIOUR.** (4) Soil mineralogy, composition and structure; clay minerals and soil identification techniques; clay - water interactions; soil water potential; soil stability; physical properties of soils; chemical properties of solutions and ground water; flow in saturated and unsaturated soils; soil engineering properties (volume change, swelling, and strength); environmental properties (hydraulic conductivity, diffusivity, and adsorption)

**303-683A ADVANCED FOUNDATION DESIGN.** (4) Design of shallow foundations, bearing capacity and settlement, combined footings and rafts; eccentric and inclined loads, footings in slopes, machine foundations. Deep foundations; caissons and piers, piles, pile groups, tension piles. Tunnels and tunnel linings, flexible culverts. Earth pressures, retaining walls, sheeting and bracing, cofferdams. Case records of foundation performance including failures.

**303-684B GROUNDWATER POLLUTION AND TRANSPORT PROCESSES.** (4) Advective flow; diffusion transport; diffusion and dispersion coefficients; partition coefficients; adsorption isotherms; conditioned partition coefficients; accumulation and attenuation; irreversible thermodynamic modelling; Fickian models; calibration and validation requirements; field predictions and calibrations; monitoring and validation; spatial and temporal variability of transport phenomena and coefficients.

**303-686B SITE REMEDIATION.** (4) Field investigations; geotechnical and geophysical techniques; hydrogeological conditions; risk assessment; contaminant transport; remedial action plan; containment systems (gas, surface water, and ground water); on-site and off-site treatment techniques (solidification, stabilization, landfilling, and soil washing); In-situtreatment techniques (physical, biological, and chemical).

● **303-689A DYNAMICS OF FOUNDATIONS AND EARTH STRUCTURES.** (4)

**303-691A,B,C RESEARCH PROJECT.** (1)

**303-692A,B,C RESEARCH PROJECT.** (2)

**303-693A,B,C RESEARCH PROJECT.** (3)

**303-694A,B,C RESEARCH PROJECT.** (4)

**303-695A,B,C RESEARCH PROJECT.** (5)

**303-696A,B,C RESEARCH PROJECT.** (6)

**303-697A,B,C RESEARCH PROJECT.** (7)

**303-701A,B,C PH.D. PRELIMINARY ORAL EXAM.**

# 16 Classics

Graduate Program in Classics
Department of History
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## 16.1 Staff

*Emeritus Professors*
P. F. McCullagh; B.A.(Tor.), M.A.(McG.), Ph.D.(Chic.)
P. Vivante; B.A.(Oxon.), Dott.Lett.(Florence)

*Professors*
Anne Carson; B.A., M.A., Ph.D.(Tor.) *(John MacNaughton Professor of Classics)*
T. Wade Richardson; B.A.(McG.), A.M., Ph.D.(Harv.)

*Associate Professor*
Michael J. Silverthorne; B. Litt., M.A., D. Phil.(Oxon.)

## 16.2 Programs Offered

**M.A. with Thesis**
(48 credits over 4 terms, in 18 or 24 months)

**M.A. non-Thesis option**
(48 credits over 3 or 4 terms, in 18 months)

**Ph.D.**

## 16.3 Admission Requirements

**M.A. Program**
Candidates are required to have a B.A. Honours in Classics or equivalent.

**Ph.D. Program**
Candidates are required to have a McGill M.A. in Classics or equivalent.

## 16.4 Application Procedures

No applications will be accepted for 2001-02 as the program has been temporarily suspended. Further information may be obtained from the Department of History.

## 16.5 Program Requirements

Please consult the Department for detailed regulations.

**M.A. with thesis**
1) Course work: 18 credits
2) Special subjects: 6 credits (695D)
3) Thesis: 24 credits:
   I: 114-696A – Methods (3)
   II: 114-697B – Proposal (3)
   III: 114-698A – Preparation (6)
   IV: 114-699B – Completion (12)

**M.A. non-thesis option**
1) Course work: 24 credits;
2) Special subjects:12 credits (114-685D, 114-686D);
3) Research papers: 12 credits
   I: 114-681A (3)
   II: 114-682B (3)
   III: 114-683A (3)
   IV: 114-684B (3)

**Ph.D.**
1) Course work: 24 credits;
2) Reading list;
3) Thesis and Oral Defence.

## 16.6 Courses Offered

**NOTE:** All undergraduate courses administered by the Faculties of Arts and of Science (courses at the 100- to 500-level) have limited enrolment.

The names of course instructors are listed on the Course Timetable available on ***info*McGill** via the Web http://www.mcgill.ca/students/courses/.

The course credit weight is given in parentheses after the title.

● Denotes courses not offered in 2001-02.

**114-515D LATIN AUTHORS.** (6)

**114-525D ANCIENT GREEK AUTHORS.** (6)

● **114-614A LATIN POETRY.** (3)
● **114-653B LATIN PROSE.** (3)
● **114-664A GREEK PROSE.** (3)
● **114-681A RESEARCH PAPER I.** (3)
● **114-682B RESEARCH PAPER II.** (3)
● **114-683A RESEARCH PAPER III.** (3)
● **114-684B RESEARCH PAPER IV.** (3)
● **114-685D SPECIAL SUBJECTS.** (6)
● **114-686D SPECIAL SUBJECTS.** (6)
● **114-691A SEMINAR.** (3)
● **114-695D SPECIAL SUBJECTS.** (6)
● **114-696A THESIS I.** (3)
● **114-697B THESIS II.** (3)
● **114-698A THESIS III.** (6)
● **114-699B THESIS IV.** (12)

**114-701D COMPREHENSIVE EXAMINATION.**

● **114-714A,B TUTORIAL/PROJECT IN CLASSICS.** (3)

The Graduate Units section is divided into six parts, for access to the others click on the link below to return to the Front Page of the Calendar.