45 Mathematics and Statistics

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45.1 Staff

Emeritus Professors
M. Barr; A.B., Ph.D.(Penn.) *(Peter Redpath Emeritus Professor of Pure Mathematics)*
J.R. Choksi; B.A.(Cantab.), Ph.D.(Manc.)
J. Lambek; M.Sc., Ph.D.(McG.), F.R.S.C.*(Peter Redpath Emeritus Professor of Pure Mathematics)*
A.M. Mathai; M.Sc.(Kerala), M.A., Ph.D.(Tor.)
W.O.J. Moser; B.Sc.(Manit.), M.A.(Minn.), Ph.D.(Tor.)
V. Seshadri; B.Sc, M.Sc.(Madras), Ph.D.(Oklahoma)
J.C. Taylor; B.Sc.(Acad.), M.A.(Queen's), Ph.D.(McM.)

Professors
W.J. Anderson; B.Eng., Ph.D.(McG.)
W. Brown; B.A.(Tor.), M.A.(Col.), Ph.D.(Tor.)
M. Bunge; M.A., Ph.D.(Penn.)
H. Darmon; B.Sc.(McG.), Ph.D.(Harv.)
S. Drury; M.A., Ph.D.(Cantab.)
K. GowriSankaran; B.A., M.A.(Madr.), Ph.D.(Bomb.)
J. Hurtubise; B.Sc.(Montr.), D.Phil.(Oxon.)
N. Kamran; B.Sc., M.Sc.(Bruxelles), Ph.D.(Wat.)
O. Kharlampovich; M.A., (Ural State), Ph.D.(Lenin.), Dr. of Sc., (Steklov Inst.)
M. Makkai; M.A., Ph.D.(Bud.)
S. Maslowe; B.Sc.(Wayne St.), M.Sc., Ph.D.(Calif.)
C. Roth; M.Sc.(McG.), Ph.D.(Hebrew)
K.P. Russell; Vor. Dip.(Hamburg), Ph.D.(Calif.)
G. Schmidt; B.Sc.(Natal), M.Sc.(S.A.), Ph.D.(Stan.)
G. Styan; M.A., Ph.D.(Col.)
K.K. Tam; M.A., Ph.D.(Tor.)
L. Vinet; B.Sc., M.Sc., Ph.D.(Montr.), Doctorat 3^{e} cycle(Paris VI) *(joint appt. with Physics)*
D. Wolfson; M.Sc.(Natal), Ph.D.(Purdue)
K.J. Worsley; B.Sc., M.Sc., Ph.D.(Auck.)
J.J. Xu; B.S.(Beijing), Ph.D.(Ren. Poly.)
S. Zlobec; M.Sc.(Zagreb), Ph.D.(Northwestern)

Associate Professors
W. Jonsson; M.Sc.(Manit.), Dr.Rer.Nat.(Tubingen)
I. Klemes; B.Sc.(Tor.), Ph.D.(Cal.Tech.)
J. Labute; B.Sc.(Windsor), M.A., Ph.D.(Harv.)
B. Lawruk; M.Sc., Ph.D.(Lwow)
J. Loveys; B.A.(St.Mary's), M.Sc., Ph.D.(S. Fraser)
R. Rigelhof; B.Sc.(Sask.), M.Sc.(Wat.), Ph.D.(McM.)
N. Sancho; B.Sc., Ph.D.(Belf.)

Assistant Professors
M. Asgharian; B.Sc.(Shahid Beheshti), M.Sc., Ph.D.(McG)
M.J. Gander; M.S.(E.T.H.), M.S., Ph.D.(Stanford)
E.Z. Goren; B.A., M.S., Ph.D.(Hebrew)
D. Jakobson; B.Sc.(M.I.T.), Ph.D.(Princeton)
D. Leisen; B.Sc.(Mainz), M.Sc., Ph.D.(Bonn) *(joint appt. with Management)*
J.A. Toth; B.Sc., M.Sc.(McM.) Ph.D.(M.I.T.)
A. Vandal; B.Sc., M.Sc.(McG), Ph.D.(Auckland)

Adjunct Professors
D.A. Dawson; B.Sc, M.Sc.(McG), Ph.D.(M.I.T.)
T. Fox; B.A.(Oakland), M.Sc., Ph.D.(McG.)
V.P. Havin; M.Sc., Ph.D.(Leningrad)
R. Murty; B.Sc.(Car.), Ph.D.(M.I.T.), F.R.S.C.
B. Rowley; B.Sc.(Wat.), M.Sc., Ph.D.(McG.)
R.A. Seely; B.Sc.(McG.), Ph.D.(Cantab.)

Associate Members
L.P. Devroye *(Computer Science);* P.R.L. Dutilleul *(Plant Science);* L. Glass *(Physiology);* J.-L. Goffin *(Management);* J. Hanley *(Epidemiology & Biostatistics)*; L. Joseph *(Epidemiology & Biostatistics);* M. Mackey *(Physiology);* L.A. Mysak *(AOS);* P. Panangaden *(Computer Science);* J.O. Ramsay *(Psychology);* G.A. hitmore *(Management)*

45.2 Programs Offered

The brochure "Information for Graduate Students in Mathematics and Statistics", available on the Department website, supplements the information contained in this Calendar.

The Department offers both a Master's degree (in the form of an M.A. or an M.Sc.) and a Ph.D. degree.

By the choice of courses and thesis (or project topic) these degrees can be focussed in applied mathematics, pure mathematics or statistics.

The Institut des Sciences Mathématiques (ISM), among other activities, coordinates intermediate and advanced level graduate courses among the following universities: Concordia University, Université Laval, McGill, Université de Montréal, UQAM, Université de Sherbrooke. A list of courses available under the ISM auspices at the other universities can be obtained by consulting the ISM website (http://www.math.uqam.ca/ISM/). The ISM also offers fellowships and promotes a variety of joint academic activities greatly enhancing the mathematical environment in Montreal and indeed in the province of Quebec.

45.3 Admission Requirements

In addition to the general Graduate Faculty requirements the Department requirements are as follows:

Master's Degree

The normal entrance requirement for the Master's programs is a Canadian Honours degree or its equivalent, with high standing, in mathematics, or a closely related discipline in the case of applicants intending to concentrate in statistics or applied mathematics. For applicants intending to continue in a doctoral program, an Honours degree or its equivalent is the preferred background.

Applicants wishing to concentrate in pure mathematics should have a strong background in linear algebra, abstract algebra, and real and complex analysis.

Applicants wishing to concentrate in an applied area of statistics should have a strong background in matrix algebra, advanced calculus and undergraduate statistics; some knowledge of computer programming and numerical analysis is also desirable.

Applicants wishing to concentrate in applied mathematics should have a strong background in linear algebra, real and complex analysis, ordinary differential equations and numerical analysis. Some knowledge of computer programming is also desirable.

Students whose preparation in mathematics is insufficient may have to register for a Qualifying Year.

Ph.D. Degree

Students normally enter the Ph.D. program after completing a Master's degree program with high standing.

45.4 Application Procedures

Applications will be considered upon receipt of:
1. application form;
2. transcripts;
3. two letters of reference;
4. $60 application fee;
5. TOEFL test results (if applicable).

All information is to be submitted directly to the Graduate Secretary in the Department of Mathematics and Statistics.

Deadline: Applicants are urged to submit complete applications by March 1 for September admission, or by August 1 for January admission.

45.5 Program Requirements

Master's Degrees

Students must choose between the thesis option, which requires a thesis (24 credits) and 6 approved courses for a total of at least 22 credits, and the project option, which requires a project (15 credits) and 8 approved courses for at least 30 credits. Normally students must declare which option they choose to follow after one semester. It is expected that the degree be completed in at most four semesters.

The choice of courses must be approved by the advisor or thesis supervisor as well as by the Chair of the Committee on Graduate Affairs.

Some suggestions for the choice of courses in the Master's programs are:

- For students in applied mathematics: at least two of the following course sequences: 189-487 and 189-560; 189-578 and 189-579; 189-586 and 189-585.
- For students in pure mathematics: at least two of the following course sequences: 189-564, 189-565 and 189-566; 189-570 and 189-571; 189-576 and 189-577.
- Students in statistics are required to take 189-556 and 189-557 and, if they intend to continue in a doctoral program, they should also take 189-587 and 189-589.

Master's students who wish to keep open the possibility of continuing in a doctoral program should adhere closely to these suggestions since they will provide the background necessary for the comprehensive examination which all doctoral students are required to pass.

Further courses can be chosen from the departmental list of course offerings. A comprehensive list of courses, from which annual offerings are selected, is given below.

Ph.D. Degree

To complete a Ph.D. program students must:

a) pass twelve approved courses beyond the Bachelor's level ;
b) pass a Comprehensive Examination consisting of a written Part A, which is concerned with their general mathematical background, and an oral Part B concerned with two topics at an advanced graduate level;
c) demonstrate a reading knowledge of French;
d) submit a thesis judged to be an original contribution to knowledge.

45.6 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.

This Calendar is prepared long before it is known precisely which courses will be offered. In 2001-02 most 500-level and approximately 15 of the 600- and 700-level courses will be given. Students should consult the Departmental website for an updated list of offerings.

NOTE: With the permission of the instructor, prerequisites and corequisites for courses may be waived in individual cases.

189-523B GENERALIZED LINEAR MODELS. (4) (Prerequisite: 189-423 or 513-697) (Not open to students who have taken 189-426.) Modern discrete data analysis. Exponential families, orthogonality, link functions. Inference and model selection using analysis of deviance. Shrinkage (Bayesian, frequentist viewpoints). Smoothing. Residuals. Quasi-likelihood. Sliced inverse regression. Continency tables: logistic regression, log-linear models. Censored data. Applications to current problems in medicine, biological and physical sciences. GLIM, S, software.

189-524A NONPARAMETRIC STATISTICS. (4) (Prerequisite: 189-324 or equivalent.) (Not open to students who have taken 189-424.) Distribution free procedures for 2-sample problem: Wilcoxon rank sum, Siegel-Tukey Smirnov tests. Shift model: power and estimation. Single sample procedures: Sign, Wilcoxon signed rank tests. Nonparametric ANOVA: Kruskal-Wallis, Friedman tests. Association: Spearman's rank correlation, Kendall's tau. Goodness of fit: Pearson's chi-square, likelihood ratio, Kolmogorov-Smirnov tests. Statistical software packages used.

189-525B SAMPLING THEORY AND APPLICATIONS. (4) (Prerequisite: 189-324 or equivalent.) (Not open to students who have taken 189-425). Simple random sampling, domains, ratio and regression estimators, superpopulation models, stratified sampling, optimal stratification, cluster sampling, sampling with unequal probabilities, multistage sampling, complex surveys, nonresponse.

189-555 FLUID DYNAMICS. (4) Kinematics. Dynamics of general fluids. Inviscid fluids, Navier-Stokes equations. Exact solutions of Navier-Stokes equations. Low and high Reynolds number flow.

189-556A MATHEMATICAL STATISTICS I. (4) (Prerequisite: 189-357) Probability and distribution theory (univariate and multivariate). Exponential families. Laws of large numbers and central limit theorem.

189-557B MATHEMATICAL STATISTICS II. (4) (Prerequisite: 189-556) Sampling theory (including large-sample theory). Likelihood functions and information matrices. Hypothesis testing, estimation theory, and decision theory. Regression and correlation theory.

189-560 OPTIMIZATION. (4) (Prerequisites: undergraduate background in analysis and linear algebra, with instructor's approval.) Classical optimization in n variables. Convex sets and functions. Optimality conditions for single-objective and multi-objective nonlinear optimization problems with and without constraints. Duality theories and their economic interpretations. Optimization with functionals. Connections with calculus of variations and optimal control. Stability of mathematical models. Selected numerical methods.

189-561 ANALYTICAL MECHANICS. (4) (Prerequisites: 189-354 and 189-380 or instructor's approval.) Basic differential geometry. Lagrangian formulation: Euler-Lagrange equations, Noether's theorem, applications. Hamiltonian formalism: symplectic forms and Legendre transformation, symmetry and conserved quantities, completely integrable systems, Poisson brackets.

189-564A ADVANCED REAL ANALYSIS I. (4) (Prerequisites: 189-354, 189-355 or equivalents.) Review of theory of measure and integration; product measures, Fubini's theorem; L spaces; basic principles of Banach spaces; Riesz representation theorem for C(X); Hilbert spaces; part of the material of 189-565B may be covered as well.

189-565B ADVANCED REAL ANALYSIS II. (4) (Prerequisite: 189-564) Continuation of topics from 189-564. Signed measures, Hahn and Jordan decompositions. Radon-Nikodym theorems, complex measures, differentiation in R^N. Fourier series and integrals, additional topics.

189-566B ADVANCED COMPLEX ANALYSIS. (4) (Prerequisites: 189-466, 189-564) Simple connectivity, use of logarithms; argument, conservation of domain and maximum principles; analytic continuation, monodromy theorem; conformal mapping; normal families, Riemann mapping theorem; harmonic functions, Dirichlet problem; introduction to functions of several complex variables.

189-570A HIGHER ALGEBRA I. (4) (Prerequisite: 189-371 or equivalent) Review of group theory; free groups and free products of groups, Sylow theorems. The category of R-modules; chain conditions, tensor products, flat, projective and injective modules. Basic

commutative algebra; prime ideals and localization, Hilbert Nullstellensatz, integral extensions. Dedekind domains. Part of the material of 189-571B may be covered as well.

189-571B HIGHER ALGEBRA II. (4) (Prerequisite: 189-570 or consent of instructor.) Completion of the topics of 189-570. Rudiments of algebraic number theory. A deeper study of field extensions; Galois theory, separable and regular extensions. Semi-simple rings and modules. Representations of finite groups. Cohomology of finite groups if time permits.

● **189-574 ORDINARY DIFFERENTIAL EQUATIONS.** (4) (Prerequisites: 189-325,-354)

189-575 PARTIAL DIFFERENTIAL EQUATIONS. (4) (Prerequisite: 189-375A)

189-576A GEOMETRY AND TOPOLOGY I. (4) (Prerequisite: 189-354) Basic point-set topology, including connectedness, compactness, product spaces, separation axioms, metric spaces. The fundamental group and covering spaces. Simplicial complexes. Singular and simplicial homology. Part of the material of 189-577B may be covered as well.

189-577B GEOMETRY AND TOPOLOGY II. (4) (Prerequisite: 189-576) Continuation of the Topics of 189-576. Manifolds and differential forms. De Rham's theorem. Riemannian geometry. Connections and curvature. 2-Manifolds and imbedded surfaces.

189-578A NUMERICAL ANALYSIS. (4) (Prerequisites: A first course in numerical analysis – with programming – and a background in real and complex analysis, with Instructor's approval.) Errors in computation, vector and matrix norms. Iteration methods for roots in R^n and the complex plane. Interpolation including osculating and spline interpolation. Numerical differentiation and integration including Romberg and Gaussian methods and the Peano theorem. Matrix calculations with condition numbers and error bounds. Band matrices, eigenvalue calculations and applications to boundary value problems.

189-579 NUMERICAL DIFFERENTIAL EQUATIONS. (4) (Prerequisites: a background in ordinary and partial differential equations as well as numerical analysis, with instructor's approval.) Basic error analysis. Numerical solution of initial and boundary value problems for ordinary differential equations; simple, multiple shooting methods and finite difference methods. Finite difference methods for partial differential equations: parabolic equations, hyperbolic equations and elliptical equations, consistency, convergence and stability of numerical schemes. Explicit and implicit methods, alternating direction explicit and alternating direction implicit methods.

189-585 INTEGRAL EQUATIONS AND TRANSFORMS. (4) Integral transforms. Introduction to the theory of Hilbert spaces. Fredholm and Volterra integral equations; exact and approximate solutions. Equations with Hermitian kernels. Hilbert-Schmidt theorem and consequences. Representation formulas for the solutions of initial and boundary value problems. Green's functions. Applications.

189-586 APPLIED PARTIAL DIFFERENTIAL EQUATIONS. (4) (Prerequisites: 189-316, -375 or equivalent.) Partial differential equations of applied mathematics. Dirichlet and Newmann problems; complex variable methods. Homogeneous and non-homogeneous problems; Green's functions, integral transform methods, variational techniques. Pertubation theory. Applications.

189-587A ADVANCED PROBABILITY THEORY I. (4) (Prerequisite: 189-356 or equivalent and approval of instructor.) Probability spaces. Random variables and their expectations. Convergence of random variables in probability, almost surely, and in L^P Independence and conditional expectation. Introduction to martingales. Limit theorems including Kolmogorov's Strong Law of Large Numbers.

189-589B ADVANCED PROBABILITY THEORY II. (4) (Prerequisite: 189-587 or equivalent.) Characteristic functions : elementary properties, inversion formula, uniqueness, convolution and continuity theorems. Weak convergence. Central limit theorem. Additional topic(s) chosen (at discretion of instructor) from: martingale theory, Brownian motion, stochastic calculus.

189-591B MATHEMATICAL LOGIC I. (4) (Prerequisites: 189-488 or equivalent or consent of instructor.) Propositional logic and first order logic, completeness, compactness and Löwenheim-Skolem theorems. Introduction to axiomatic set theory. In the remaining time, a selection from the following topics: introduction to model theory, Herbrand's and Gentzen's theories, Lindström's characterization of first order logic.

189-592B MATHEMATICAL LOGIC II. (4) (Prerequisites: 189-488 or equivalent or consent of instructor.) Introduction to recursion theory; recursively enumerable sets, relative recursiveness. Incompleteness, undecidability and undefinability theorems of Gödel, Church, Rosser and Tarski. In the remaining time, a selection from the following topics: Turing degrees, Friedberg-Muchnik theorem, decidable and undecidable theories.

189-600A,B,C,L,T MASTER'S THESIS RESEARCH I. l(6) (Not open to students who have taken or are taking 189-640.) Thesis research under supervision.

189-601A,B,C,L,T MASTER'S THESIS RESEARCH II. (6) Thesis research under supervision.

189-604A,B,C,L,T MASTER'S THESIS RESEARCH III. (6) Thesis research under supervision.

189-605A,B,C,L,T MASTER'S THESIS RESEARCH IV. (6) Thesis research under supervision.

189-606 ALGEBRAIC TOPOLOGY. (4) (Prerequisite: 189-577B) Homology and Cohomology theories. Duality theorems. Higher homotopy groups.

189-608 LIE GROUPS AND LIE ALGEBRAS I. (4) Representation of linear groups and their Lie algebras. Commutative, nilpotent and solvable ideals of Lie algebras. Classification of classical simple Lie groups by means of Cartan's sub-algebras. Weights of irreducible representation and structure of semi-simple Lie algebras.

189-609 LIE GROUPS AND LIE ALGEBRAS II. (4) A continuation of the topics listed in the description of 189-608.

189-612 ALGEBRAIC CURVES. (4) A concrete introduction to algebraic geometry. Topics may vary from year to year and will include: plane algebraic curves, function fields in one variable, linear series and the theory of Riemann-Roch, elliptic curves.

189-614 THEORY OF RINGS. (4) Rings and modules. Prime and maximal ideals. Radicals. Semi-simple Artinian rings, semiperfect rings, semiprime Noetherian rings. Projective, injective and flat modules. Morita theory. Rings of quotients, localization and completion. Grouprings.

189-615 COMMUTATIVE ALGEBRA. (4) Localization and completion. Primary decomposition. Dimension theory. Homological theory of Noetherian rings. Regular sequences Kähler differentials. Unramified, smooth and étale extensions. The spectrum of a commutative ring and other applications to algebraic geometry.

189-616 HOMOLOGICAL ALGEBRA. (4) Modules. Diagrams. Free, injective, projective and flat modules. Tensor product and Hom. Derived functors. Dimension theory. Local rings. Cohomology of groups.

189-622 CATEGORIES I. (4) Categories, functors, natural transformations. Adjoint functors and limits. Embeddings and completions. Algebraic categories and standard constructions. Abelian and homological categories. Categories and the foundations of mathematics.

189-623 CATEGORIES II. (4) A continuation of the topics listed in the description of 189-622.

189-624 APPLIED CATEGORY THEORY I. (4) Review of adjoint functors, triples and their algebras. Localization with applications to modules, topological spaces and sheaves. Duality theory with applications to Morita theory and the duality theorems of Pontrjagin, Stone, Gelfand and Kaplansky. Categories and deductive systems. Introduction to toposes. Applications to computer science and linguistics.

189-625 APPLIED CATEGORY THEORY II. (4) A continuation of the topics listed in the description of 189-624.

189-626 ADVANCED GROUP THEORY I. (4) The structure of groups. Special classes of groups. Representation theory. Additional topics to suit the class.

189-627 ADVANCED GROUP THEORY II. (4) A continuation of the topics listed in the description of 189-626.

189-628 MATHEMATICAL LINGUISTICS. (4) (Given in collaboration with the Department of Linguistics. Prerequisites: 189-328 or 104-360A, or equivalent.) Phrase structure, production, categorial and transformational grammars, with applications to fragments of English and French and to kinship systems. Machines for generating and recognizing sentences; parsers. Introduction to lambda calculus and type theory; logical form and Montague semantics.

189-631 COMPLEX FUNCTION THEORY I. (4) (Prerequisite 189-564, -565, and -566 or equivalent.) Advanced topics in one complex variable, and some topics in several complex variables.

189-632 COMPLEX FUNCTION THEORY II. (4) (Prerequisite 189-631) Topics in the theory of functions of several complex variables.

189-633 HARMONIC ANALYSIS I. (4) (Prerequisite 189-564, -565, and -566) Classical harmonic analysis on the circle (Fourier series) and on the line (Fourier integrals). A brief introduction to harmonic analysis on locally compact groups.

189-634 HARMONIC ANALYSIS II. (4) (Prerequisites: 189-633 and -635.) The contents of this course will consist of further topics in classical harmonic analysis and a more detailed study of abstract harmonic analysis on locally compact groups.

189-635 FUNCTIONAL ANALYSIS I. (4) (Prerequisite 189-564, -565, and -566) Banach spaces. Hilbert spaces and linear operators on these. Spectral theory. Banach algebras. A brief introduction to locally convex spaces.

189-636 FUNCTIONAL ANALYSIS II. (4) (Prerequisites: 189-564, 189-565, 189-635.) A continuation of the topics listed in the description of 189-635.

189-637 PARTIAL DIFFERENTIAL EQUATIONS. (4) A modern introduction to the theory of linear differential equations, using the theory of distributions and Fourier transforms.

189-639 INTRODUCTION TO POTENTIAL THEORY. (4) Classical potential theory. Dirichlet problem. Harmonic and superharmonic functions. Introduction to modern axiomatic potential theory.

189-640A,B,C,L,T PROJECT I. (6) (Not open to students who have taken or are taking 189-600) Project research under supervision.

189-641A,B,C,L,T PROJECT II. (9) Project research under supervision.

189-651 ASYMPTOTIC EXPANSION AND PERTURBATION METHODS. (4) Asymptotic series. Summation. Asymptotic estimation of integrals. Regular and singular perturbation problems and asymptotic solution of differential equations.

189-670 STOCHASTIC PROCESSES. (4) Basic concepts. Stationary and nonstationary processes. Correlation function. Power spectra. Linear systems. Mean square periodicity and Fourier series. Sampling theorems. Series expansions. Linear mean square estimation.

189-671 APPLIED STOCHASTIC PROCESSES. (4) Discrete parameter Markov chains, including branching processes and random walks. Limit theorems and ergodic properties of Markov chains. Continuous parameter Markov chains, including birth and death process. Topics selected from the following areas: renewal processes, Brownian motion, statistical inference for stochastic processes.

189-674 EXPERIMENTAL DESIGN. (4) Review of one-way and two-way analyses of variance; randomized block, Latin square and incomplete block designs; factorial designs, confounding, fractional replications; random and mixed models; split-plot designs; nested and hierarchical designs; response surface analysis. Weighted least squares. Analysis of variance with equal and unequal numbers in cells. Latin squares, complete factorial designs. Prediction and confidence bands, multiple comparisons. Random effects models.

189-676 MULTIVARIATE ANALYSIS. (4) Properties of the multivariate normal distribution. Central and noncentral Wishart distribution. Statistical inference for multivariate normal populations. Hotelling's T^2. The product-moment correlation coefficient. Canonical correlations. Multivariate linear models. Principal components. Factor analysis.

189-677 DECISION THEORY. (4) Formulation of the statistical decision problem. Bayes and minimax solutions. Hypothesis testing and estimation from the point of view of decision theory. Sequential analysis.

189-678 APPLIED STATISTICAL METHODS AND DATA ANALYSIS I. (4) Statistical data analysis, with special reference to applications of the main statistical methods to problems in medicine, biology, chemistry, etc. Extensive use of computer methods, especially subroutine packages for statistical data description, display and analysis.

189-679 APPLIED STATISTICAL METHODS AND DATA ANALYSIS II. (4) Same emphasis as 189-678 but with a different selection of statistical methods.

189-680 COMPUTATION INTENSIVE STATISTICS. (4) (Prerequisites: 189-556, 189-557 or permission of instructor) (Not open to students who have taken or are taking 513-680.) Introduction to a statistical computing language, such as S-PLUS; random number generation and simulations; EM algorithm; bootstrap, cross-validation and other resampling schemes; Gibbs sampler. Other topics: numerical methods ; importance sampling; permutation tests.

189-681 TIME SERIES ANALYSIS. (4) Stationary stochastic processes. Autocovariance and autocovariance generating functions. The periodogram. Model estimation. Likelihood function. Estimation for autoregressive moving average and mixed processes. Computer simulation; diagnostic checking, tests with residuals. Estimation of spectral density; Bartlett, Daniell, Blackman-Tukey spectral windows. Asymptotic moments of spectral estimates.

189-682 MATRIX THEORY WITH STATISTICAL AND OTHER APPLICATIONS: (4) Inequalities for trace and rank. Generalized inverses; idempotent matrices. Schur complement. Factorizations into triangular and diagonal form; singular values. Normal matrices. Algebraic and geometric multiplicity. Computational procedures; Householder transformations, condition number. Applications to least squares. Courant-Fisher min-max theorem; related inequalities. Quadratic forms in normal variables: distribution, Characteristic function, cumulants and independance.

189-683 LINEAR MODELS. (4) General univariate linear models with full rank and with less than full rank. Best linear unbiased estimators. General linear hypothesis. Computational procedures.

189-684 APPLIED SAMPLING TECHNIQUES. (4) Sampling and subsampling of clusters (one-stage, two-stage, and multi-stage). Unequal probability sampling with and without replacement. Double-sampling procedures. Repetitive surveys. Non-sampling errors (analytical and practical treatment). Analytical surveys. Optimization problems in sampling. Topics in the foundations of sample surveys. Other recent developments.

189-685D STATISTICAL CONSULTING. (4) (Prerequisites: 189-423, 189-523, 189-556, 189-557. Equivalents may be substituted at instructor's discretion.) Statistical consultation skills; overview of widely used statistical techniques; understanding the client's problem; suggesting designs and statistical analyses; perfomring statistical analyses; communicating with clients orally and in writing. Format: Simulated and real consultations with clients. Password required.

189-686 SURVIVAL ANALYSIS. (4) (Prerequisites: 189-556, 189-557 or permission of instructor.) (Not open to students who have taken or are taking 513-686.) Parametric survival models. Nonparametric analysis: Kaplan-Meier estimator and its properties. Covariates with emphasis on Cox's proportional hazards model. Marginal and partial likelihood. Logrank tests. Residual analysis. Homework assignments a mixture of theory and applications. In-class discussion of data tests.

189-687 READING COURSE IN MATHEMATICAL LOGIC I. (4) A highly specialized study.

189-688 READING COURSE IN MATHEMATICAL LOGIC II. (4) A highly specialized study.

189-689 READING COURSE IN ALGEBRA I. (4) A highly specialized study.

189-690 READING COURSE IN ALGEBRA II. (4) A highly specialized study.

189-691 READING COURSE IN GEOMETRY AND TOPOLOGY I. (4) A highly specialized study.

189-692 READING COURSE IN GEOMETRY AND TOPOLOGY II. (4) A highly specialized study.

189-693 READING COURSE IN ANALYSIS I. (4) A highly specialized study.

189-694 READING COURSE IN ANALYSIS II. (4) A highly specialized study.

189-695 READING COURSE IN APPLIED MATHEMATICS I. (4) A highly specialized study.

189-696 READING COURSE IN APPLIED MATHEMATICS II. (4) A highly specialized study.

189-697 READING COURSE IN STATISTICS AND PROBABILITY I. (4) A highly specialized study.

189-698 READING COURSE IN STATISTICS AND PROBABILITY II. (4) A highly specialized study.

189-699 READING COURSE IN OPTIMIZATION. (4) A highly specialized study.

189-700A,B COMPREHENSIVE EXAMINATION: PART A. – WRITTEN

189-701A,B COMPREHENSIVE EXAMINATION: PART B. – ORAL

189-704 TOPICS IN MATHEMATICAL LOGIC I. (4)

189-705 TOPICS IN MATHEMATICAL LOGIC II. (4)

189-706 TOPICS IN GEOMETRY AND TOPOLOGY I.
189-707 TOPICS IN GEOMETRY AND TOPOLOGY II.
189-708 TOPICS IN GEOMETRY AND TOPOLOGY III.
189-709 TOPICS IN GEOMETRY AND TOPOLOGY IV.
(4 credits each)

189-720 TOPICS IN ALGEBRA I.
189-721 TOPICS IN ALGEBRA II.
189-722 TOPICS IN ALGEBRA III.
189-723 TOPICS IN ALGEBRA IV.
189-724 TOPICS IN ALGEBRA V.
189-725 TOPICS IN ALGEBRA VI.
(4 credits each) Each of these courses covers an advanced topic in some branch of algebra.

189-726 TOPICS IN NUMBER THEORY I.
189-727 TOPICS IN NUMBER THEORY II.
189-728 TOPICS IN NUMBER THEORY III.
189-729 TOPICS IN NUMBER THEORY IV.
(4 credits each) Each of these courses covers an advanced topic in number theory.

189-740 TOPICS IN ANALYSIS I.
189-741 TOPICS IN ANALYSIS II.
189-742 TOPICS IN ANALYSIS III.
189-743 TOPICS IN ANALYSIS IV.
189-744 TOPICS IN ANALYSIS V.
189-745 TOPICS IN ANALYSIS VI.
(4 credits each) Each of these courses covers an advanced topic in some branch of analysis.

189-756 TOPICS IN OPTIMIZATION I.
189-757 TOPICS IN OPTIMIZATION II.
189-758 TOPICS IN OPTIMIZATION III.
189-759 TOPICS IN OPTIMIZATION IV.
(4 credits each) Each of these courses covers an advanced topic in Optimization.

189-761 TOPICS IN APPLIED MATHEMATICS I.
189-762 TOPICS IN APPLIED MATHEMATICS II.
189-763 TOPICS IN APPLIED MATHEMATICS III.
189-764 TOPICS IN APPLIED MATHEMATICS IV.
189-765 TOPICS IN APPLIED MATHEMATICS V.
189-766 TOPICS IN APPLIED MATHEMATICS VI.
189-767 TOPICS IN APPLIED MATHEMATICS VII.

189-768 TOPICS IN APPLIED MATHEMATICS VIII. (4 credits each) Each of these courses covers an advanced topic in applied mathematics.

189-771 TOPICS IN STOCHASTIC PROCESSES I.
189-772 TOPICS IN STOCHASTIC PROCESSES II.
(4) Each of these courses covers an advanced topic in stochastic processes.

189-782 TOPICS IN STATISTICS AND PROBABILITY I.
189-783 TOPICS IN STATISTICS AND PROBABILITY II.
189-784 TOPICS IN STATISTICS AND PROBABILITY III.
189-785 TOPICS IN STATISTICS AND PROBABILITY IV.
(4 credits each) Each of these courses covers an advanced topic.

189-790D PH.D. LANGUAGE REQUIREMENTS.

189-791D SEMINARS IN MATHEMATICAL LOGIC. (6)

189-792D SEMINARS IN ALGEBRA. (6)

189-794D SEMINARS IN GEOMETRY AND TOPOLOGY. (6)

189-796D SEMINARS IN ANALYSIS. (6)

189-797D SEMINARS IN APPLIED MATHEMATICS. (6)

189-798D SEMINARS IN STATISTICS AND PROBABILITY. (6)

46 Mechanical Engineering

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Chair — A.K. Misra

Chair of Graduate Program — J.A. Nemes

46.1 Staff

Emeritus Professors
W. Bruce; B.A.Sc., M.A.Sc.(Tor.), Eng.
J. Cherna; Dipl.Eng.(Swiss Fed. Inst.), Eng., F.E.I.C.
R. Knystautas; B.Eng., M.Eng., Ph.D.(McG.), Eng.
M.P. Paidoussis; B.Eng.(McG.), Ph.D.(Cantab.), F.A.A.M., F.I.Mech.E., F.A.S.M.E., F.C.S.M.E., F.R.S.C., Eng.

Professors
A.M. Ahmed; B.Sc.(Dhaka), Ph.D.(McG.), Eng. *(Thomas Workman Professor of Mechanical Engineering)*
J. Angeles; B.Sc., M.Sc.(Unam Mexico), Ph.D.(Stan.), Eng. F.A.S.M.E., F.C.S.M.E.
B.R. Baliga; B.Tech.(I.I.T. Kanpur), M.Sc.(Case), Ph.D.(Minn.)
W.G. Habashi; B.Eng., M.Eng.(McG.), Ph.D.(C'nell)
J.H.S. Lee; B.Eng.(McG.), M.Sc.(M.I.T.), Ph.D.(McG.), Eng.
A.K. Misra; B.Tech.(I.I.T., Kgp.), Ph.D.(Br.Col.), P.Eng.
S.J. Price; B.Sc., Ph.D.(Brist.), P.Eng.

Associate Professors
M. Buehler; M.Sc., Ph.D.(Yale)
L. Cortelezzi; M.Sc., Ph.D.(Caltech)

D.L. Frost; B.A.Sc.(Br.Col.), M.S., Ph.D.(Caltech.), P.Eng.
L. Lessard; B.Eng.(McG.), M.Sc., Ph.D.(Stan.), P.Eng.
D.F. Mateescu; M.Eng.(Poli. Univ. Buch.), Ph.D.(Rom. Acad. Sci.), Doctor Honoris Causa (Poli. Univ. Buch.), AFAIAA, ACASI
J.A. Nemes; B.Sc.(Maryland), M.Sc., D.Sc.(GWU)
P. Radziszewski; B.Sc.(U.B.C.), M.Sc., Ph.D.(Laval)
V. Thomson; B.Sc.(Windsor), Ph.D.(McM.)
P.J. Zsombor-Murray; B.Eng., M.Eng., Ph.D.(McG.), Eng., F.C.S.M.E.

Assistant Professors
B. Epureanu; Ph.D.(Duke)
A.J. Higgins; B.Sc.(Illinois), M.S., Ph.D.(Washington)
V.N. Krovi; B.Tech.(I.I.T. Madras), Ph.D.(Pennsylvania)
T. Lee; M.S.(Portland St.), Ph.D.(Idaho)
R. Mongrain; B.Sc., M.Sc.(Montr.), Ph.D.(Ecole Polytechnique), Eng.
L. Mydlarski; B.Sc.(Wat.), Ph.D.(C'nell)

Adjunct Professors
E. Abramovicj, M. Asselin, G.G. Bach, R. Edwards,
G. Guèvremont, S. Kalaycioglu, L. Kops, K. MacKenzie,
W.D. May, H. Moustapha, M.P. Robichaud, R. Sumner,
G.A. Wagner, T. Yee, D. Zorbas

Associate Members
R.E. Kearney; B.Eng, Ph.D.(McG.), Biomedical Engineering Unit
B.H.K. Lee; B.Eng, M.Eng, Ph.D.(McG.)
M. Tanzer; M.D., Orthopaedic Surgery

46.2 Programs Offered

M.Eng., M.Sc. and Ph.D. degrees in Mechanical Engineering.

Advanced courses and laboratory facilities are available for graduate study leading to the M.Eng. and Ph.D. degrees in Mechanical Engineering. Some of the specific areas of research are as follows:

Aerodynamics: experimental and computational studies in subsonic, transonic and supersonic, steady and unsteady flows.

Bioengineering: mechanics of the human musculoskeletal system and design of joint prostheses.

Combustion, shock wave physics and vapour explosions: dust combustion, solid and liquid propellants, explosion hazard, and nuclear reactor safety.

Computational fluid dynamics and heat transfer: turbulent, reacting and multiphase flows in engineering equipment and in the environment.

Fluid-structure interactions and dynamics: vibrations and instabilities of cylindrical bodies, fluidelasticity, aeroelasticity, dynamics of shells containing axial and annular flows.

Manufacturing and Industrial engineering: thermoelastic effects in machine tools, functional behaviour of machined surfaces, optimization in production systems.

Robotics and automation: artificial intelligence based simulation of industrial processes, design optimization of manipulators, finite automata, geometric modeling and control systems.

Solid mechanics: composite materials, structural analysis, composite manufacturing, fracture, fatigue and reliability, microscopic and macroscopic approaches.

Space dynamics: orbital analysis, large space structures, space manipulators and tethered satellites.

46.3 Admission Requirements

The general rules of the Faculty of Graduate Studies apply. Candidates who come from other institutions are expected to have an academic background equivalent to the undergraduate curriculum in mechanical engineering at McGill or to make up any deficiencies in a qualifying year. Applicants are requested to state in as much detail as possible their particular field of interest for graduate study.

46.4 Application Procedures

Applications will be considered upon receipt of:
1. application form;
2. transcripts;
3. letters of reference;
4. $60 application fee;
5. test results (TOEFL).

All information is to be submitted directly to the Graduate Program Secretary in the Mechanical Engineering Department

Deadlines:
February 1st for Fall admission;
May 15th for Winter admission.

46.5 Program Requirements

The minimum residence requirement for the M.Eng. degree is three terms of full-time study, one of which may be a summer term. In the case of M.Eng. (Project) a part-time program is available.

M.Eng. (Thesis) Degree (minimum 45 credits)

Thesis Component – Required (29 credits)

305-609	(1)	Seminar
305-691	(3)	M.Eng. Thesis Literature Review
305-692	(4)	M.Eng. Thesis Research Proposal
305-693	(3)	M.Eng. Thesis Progress Report I
305-694	(6)	M.Eng. Thesis Progress Report II
305-695	(12)	M.Eng. Thesis

305-691 is to be completed in the first semester of the student's program.

Complementary Courses (16 credits)
A minimum of 16 credits at the graduate level (500 or above), at least eight of which must be from within the Faculty of Engineering. In special cases (e.g., interdisciplinary research), one undergraduate course from outside the Department may be used to fulfill the requirement, provided there is no overlap in the content of the course with that of any offered in the Department.

Students who do not hold an undergraduate engineering (or equivalent) degree and who are accepted into this option will register for the M.Sc. degree in Mechanical Engineering. This applies particularly to students engaged in interdisciplinary research. A thesis describing the candidate's research is to be submitted in accordance with the rules of the Faculty and is the major requirement for the degree.

M.Eng. (Project) Degree (minimum 45 credits)

This is a course-type Master's degree which requires 12 graduate courses for completion. All candidates are required to take the following courses:

Required Courses (29 credits)

305-605A	(4)	Applied Mathematics I
305-610B	(4)	Fundamentals of Fluid Mechanics
305-632A	(4)	Stress Analysis
305-642B	(4)	Advanced Dynamics
305-603*	(6)	Design Project I
305-604*	(6)	Design Project II
305-609*	(1)	Seminar

* these three courses are taken near the end of the program. In these courses, industrial liaison is encouraged.

Complementary Courses (16 credits)
The remaining courses (minimum 16 credits) may be selected individually by the student (based on interest and the choice of the area of specialization) from the following groups of courses, although it is not necessary that students confine their choice to one of these groups
Thermo-fluids
Solid Mechanics and Stress Analysis
System Dynamics and Control
Industrial and Production Engineering

M.Eng. Aerospace Degree (minimum 45 credits)

The M.Eng. Aerospace Degree is offered to the students who wish to specialize in the general area of aerospace engineering. This degree is given in conjunction with Concordia University, Ecole Polytechnique, Université Laval and Université de Sherbrooke. Students registered at McGill are required to take two courses from two other institutions.

Students holding an undergraduate degree in engineering other than Mechanical Engineering are also eligible to apply for this degree. Depending on their background, students would specialize in one of the three areas:

1. Aeronautics and Space Engineering;
2. Avionics;
3. Aerospace Materials and Structures.

Required Courses (9 credits)
305-687 (3) Aerospace Case Studies
305-688 (6) Industrial Stage

Complementary Courses (36 credits)
The other courses, depending on the area of concentration, will be chosen in consultation with an Aerospace Engineering Advisor.

Master in Management (Manufacturing) (56 credits)
The Master in Manufacturing Management program (MMM) is offered to students who wish to have a career as manufacturing managers. The curriculum is a balance between manufacturing and management subjects and provides exposure to industry through case studies, seminars, tours and a paid industry internship. The MMM program is a 12-month academic program starting in September followed by a 4-month industrial internship. The program is a collaboration between the Faculties of Engineering and Management, which jointly grant the Master of Management (Manufacturing) degree.

Students should hold an undergraduate degree in engineering or science. Two or more years of industrial experience is preferred, but not mandatory. Students with other academic backgrounds and appropriate industrial experience will be considered, but may have to take one or two qualifying courses. The program is intended for full time as well as part time students. Enrolment is limited.

The M.M.M. program is a self-funded program. Tuition is $25,000.

Management Segment – Required Courses (14 credits)
277-608 (3) Data, Decisions and Models
279-603 (3) Industrial Relations
280-611 (2) Financial Accounting
280-612 (2) Organizational Behaviour
280-616 (2) Marketing
280-641 (2) Elements of Modern Finance I

Management Segment – Complementary Courses (3 credits)
one of the following two courses:
272-632 (3) Group Dynamics and Interpersonal Behaviour
272-640 (2) Leadership, Power and Influence

A background in statistics is a prerequisite for the program; otherwise 277-671 Statistics for Business Decisions is required.

Manufacturing Segment – Required Courses (15 credits)
277-603 (3) Logistics Management
277-605 (3) Total Quality Management
277-631 (3) Analysis of Manufacturing Systems
305-524 (3) Computer Integrated Manufacturing
305-526 (3) Manufacturing and the Environment

Manufacturing Segment – Complementary Courses (12 credits)
one of the following courses:
277-601 (3) Management of Technology in Manufacturing
277-602 (3) Manufacturing Strategies
277-615 (3) The Internet and Manufacturing
MET 6.904 (3) Strategic Planning and Technological Forecasting
and one of the following 6-credit options:

Discrete Manufacturing Option
305-528 (3) Product Design
305-529 (3) Discrete Manufacturing Systems

Process Manufacturing Option
302-572 (3) Process Dynamics and Control
302-653 (3) Advanced Process Design

Industrial Segment – Required Courses (12 credits)
305-627 (9) Manufacturing Industrial Stage
305-628 (2) Manufacturing Case Studies
305-629 (1) Manufacturing Industrial Seminar

For more information, students should contact the Program Coordinator, Mechanical Engineering, at (514) 398-7201, mmm@mecheng.mcgill.ca, or the Masters Program Office, Faculty of Management, at (514) 398-4648.
Website: http://www.mecheng.mcgill.ca/mmm

Ph.D. Degree

Candidates normally register for the M.Eng. degree in the first instance. However, in exceptional cases where the research work is proceeding very satisfactorily, or where the equivalent of the M.Eng. degree has been completed at another university, candidates may be permitted to proceed directly to the Ph.D. degree without submitting a master's thesis as long as they have satisfied the course requirements for the M.Eng. degree.

Courses of study selected for a Ph.D. program will depend upon the existing academic qualifications of the candidate and those needed for effective research.

Candidates are required to pass a preliminary oral examination within twelve months of their initial registration for the Ph.D. degree.

The residence requirement for Ph.D. candidates is outlined in the General Calendar of the Faculty.

46.6 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.

▭ Denotes limited enrolment.

Undergraduate Courses Approved for Higher Degrees
The following courses, available in the undergraduate curriculum of the Mechanical Engineering Department, may be selected for graduate credit provided that both of the following conditions are met: the course is recommended by the candidate's supervisor, and no equivalent course was taken during the candidate's undergraduate program.

305-413A CONTROL SYSTEMS. (3)

305-432A AIRCRAFT STRUCTURES. (3)

Courses open to Graduate and to Qualified Undergraduate Students

305-500A,B SELECTED TOPICS IN MECHANICAL ENGINEERING. (3) A course to allow the introduction of new topics in Mechanical Engineering as needs arise, by regular and visiting staff.

305-501A,B SELECTED TOPICS IN MECHANICAL ENGINEERING. (3) A course to allow the introduction of new topics in Mechanical Engineering as needs arise, by regular and visiting staff.

305-522B PRODUCTION SYSTEMS. (3) Characteristics of production systems. System boundaries, input-output, feedback time-lag effects, dynamics of production systems. Design for manufacturability. Process planning, process/machine tool selection, break-even analysis, CAPP. Production planning, scheduling and control of operations; quality management. Competitive strategies; FMS, CIM. Hands-on experience production modeling and industrial simulation software.

▭ **305-524B COMPUTER INTEGRATED MANUFACTURING.** (3) A study of the present impact of computers and automation on man-

ufacturing. Computer aided systems. Information modelling. Information system structures. Study of several types of production systems. Integration issues: inter-and intra-enterprise. Laboratory experience with manufacturing software systems.

▭ **305-526C MANUFACTURING AND THE ENVIRONMENT.** (3) Course topics include: clean manufacturing, product and process design for minimizing materials and energy use, the product life cycle, impact of technology on the environment, environmental impact assessment, regulatory process, and managing the "political" process.

▭ **305-528A PRODUCT DESIGN.** (3) A study of the design issues present in product life cycle demands. Computer aided systems. Rapid prototyping. Design for manufacturability. Integration of mechanics, electronics and software in products. Effect on design of product cost, maintainability, recycling, marketability.

▭ **305-529C DISCRETE MANUFACTURING SYSTEMS.** (3) An overview of present day production machines and systems with special emphasis on automation, computer control and integration techniques. Material handling, automatic inspection, process monitoring, maintenance. Socio-economic and environmental issues. Laboratory experience with factory simulation.

305-530A MECHANICS OF COMPOSITE MATERIALS. (3) (Instructor's permission) Fiber reinforced composites. Stress, strain, and strength of composite laminates and honeycomb structures. Failure modes and failure criteria. Environmental effects. Manufacturing processes. Design of composite structures. Computer modeling of composites. Computer techniques are utilized throughout the course.

● **305-531B AEROELASTICITY.** (3) (Prerequisite: 305-533A)

305-532B AIRCRAFT PERFORMANCE, STABILITY AND CONTROL. (3) (Prerequisite: 305-533A) Aircraft performance criteria such as range, endurance, rate of climb, maximum ceiling for steady and accelerated flight. Landing and take-off distances. Static and dynamic stability in the longitudinal (stick-fixed and stick-free) and coupled lateral and directional modes. Control response for all three modes.

305-533A SUBSONIC AERODYNAMICS 3. (3) Kinematics; equations of motion; vorticity and circulation; conformal mapping and flow around simple bodies. Two dimensional flow around aerofoils. Three dimensional flows; high and low aspect-ratio wings; airscrews. Wind tunnel interference. Similarity rules for subsonic irrotational flow.

305-534B AIR POLLUTION ENGINEERING. (3) (Consent of instructor) Pollutants from power production and their effects on the environment. Mechanisms of pollutant formation in combustion. Photochemical pollutants and smog, atmospheric dispersion. Pollutant generation from internal combustion engines and stationary power plants. Methods of pollution control (exhaust gas treatment, absorption, filtration, scrubbers, etc.).

305-537A HIGH SPEED AERODYNAMICS. (3) Equations of compressible flows. Planar and conical shock waves. Expansion and shock wave interference; shock tubes. Method of characteristics. Supersonic nozzle design. Aerofoil theory in high subsonic, supersonic and hypersonic flows. Conical flows. Yawed, delta and polygonal wings; rolling and pitching rotations. Wing-body systems. Elements of transonic flows.

● **305-538B UNSTEADY AERODYNAMICS.** (3) (Prerequisite: 305-533A)

305-539B COMPUTATIONAL AERODYNAMICS. (3) (Pre-or Co-requisite: 305-533A or equivalent.) Fundamental equations. Basic flow singularities. Boundary element methods. Source, doublet and vortex panel methods for 2D and 3D incompressible and compressible flows. Method of characteristics. Euler equations for inviscid rotational flows. Finite-difference and finite-volume methods. Explicit and implicit time-integration methods. Quasi 1D solutions. Nozzle and confined aerofoil applications.

305-540B DESIGN: MODELLING AND DECISION. (3) 3-D geometric modelling for design; principles and practice. Selected topics/case studies requiring use of: 3-D CAD; component selection and integration; use of machine element design analysis software; practice in developing simple directions. Use of modern software for design decision making. Introduction to mechanism animation. Introduction to design for NC production.

● **305-541B KINEMATIC SYNTHESIS.** (3)

305-542B SPACECRAFT DYNAMICS. (3) Review of central force motion; Hohmann and other coplanar transfers, rotation of the orbital plane, patched conic methods. Orbital perturbations due to the earth's oblateness, solar-lunar attraction, solar radiation pressure and atmospheric drag. Attitude dynamics of a rigid spacecraft; attitude stabilization and control; attitude manoeuvres.

305-543B DESIGN WITH COMPOSITE MATERIALS. (3) (Prerequisite: 305-530) Material systems/selection process. Cost vs performance. Laminate layup procedures. Theory and application of filament winding of composite cylinders. Regular oven and autoclave oven curing, analysis of resulting material performance. Practical design considerations and tooling. Analysis of environmental considerations. Joining techniques. Analysis of test methods. Theory of repair techniques.

305-545A ADVANCED STRESS ANALYSIS. (3) Tensor Analysis: Review of continuum mechanics. Equilibrium and constitutive equations in tensor form. Finite elements methods. Torsion of non-circular cross-sections; spherical problems; advanced airy stress function problems. Introduction to plates and shells. Thermal deformations and stresses. Introduction to plasticity and viscoelasticity.

305-552B ADVANCED APPLIED MATHEMATICS. (3) (Permission of instructor.) Solutions of ordinary differential equations using integral methods; asymptotic series, Stirling's approximation. Bessel and Laguerre functions. Green's functions. Laplace, Helmholtz, diffusion, wave, telegraph partial differential equations. Variational methods. Numerical solutions to partial differential equations.

305-554A MICROPROCESSORS OF MECHANICAL SYSTEMS. (3) Digital logic and circuits – asynchronous and synchronous design. Microcontroller architectures, organization and programming – assembly and high-level. Analog/Digital conversions. Analog/Digital/Hybrid Sensors and Actuators. Sensing and conditioning subsystems. Interfacing issues. Real time issues. Operator interfaces. Lab exercises on digital logic design, interfacing and control of peripherals with a final team project.

● **305-555B APPLIED PROCESS CONTROL.** (3) (Prerequisite: 305-554)

305-557B MECHATRONIC DESIGN. (3) Team project course on the design, modeling, model validation, and control of complete mechatronic systems, constructed with modern sensors, actuators, real time operating systems, embedded controllers, and intelligent control.

305-561B BIOMECHANICS OF MUSCULO-SKELETAL SYSTEMS. (3) The musculoskeletal system; general characteristics and classification of tissues and joints. Biomechanics and clinical problems in orthopaedics. Modelling and force analysis of musculoskeletal systems. Passive and active kinematics. Load-deformation properties of passive connective tissue, passive and stimilated muscle response. Experimental approaches, case studies.

305-562A ADVANCED FLUID MECHANICS. (3) Conservation laws, control volume analysis, Navier Stokes equations, dimensional analysis and limiting forms of N-S equation, laminar viscous flows, boundary layer theory, inviscid potential flows, lift and drag, introduction to turbulence.

305-565B FLUID FLOW AND HEAT TRANSFER EQUIP. (3) Pipes and piping systems, pumps, and valves. Fans and building air distribution systems. Basic thermal design methods for fins and heat exchanges. Thermal design of shell-and-tube and compact heat exchanges.

305-572A INTRODUCTION TO ROBOTICS. (3) (Prerequisite: Permission of the instructor. Not open to students who have taken 305-573.) Manipulator hardware structure, kinematics, statics, dynamics planning and control. Rigid-body, three-dimensional

statics, kinematics and dynamics. Direct and inverse kinematics and dynamics. Trajectory planning subject to constraints. Manipulator control. In depth study of serial manipulators with extension to more complex robotic devices.

305-573B MECHANICS OF ROBOTIC SYSTEMS. (3) (Prerequisite: Consent of the instructor.) Numerical methods for the kinematic inversion of serial manipulators. The handling of redundancies and singularities. Kinematics and dynamics of parallel manipulators, manipulator performance evaluation and optimization, multifingered hand grasping and manipulation, robot compliant and constrained motion. Obstacle avoidance.

305-576A COMPUTER GRAPHICS AND GEOMETRIC MODELLING. (3) Review of pertinent linear algebra. Explicit, implicit and parametric polynomial forms. Splines: curves and surfaces. Properties: curvature, twist, continuity. Ruled surfaces and other quad patches. Constructive solid models; Octree/Voxel, sweep wire frame, Boolean, boundary representation. Mechanical Engineering applications.

305-577A OPTIMUM DESIGN. (3) The role of optimization within the design process: Design methodology and philosophy. Constrained optimization: The Kuhn-Tucker conditions. Techniques of linear and nonlinear programming. The simplex and the complex methods. Sensitivity of the design to manufacturing errors. Robustness of the design to manufacturing and operation errors.

- **305-578B ADVANCED THERMODYNAMICS.** (3)
- **305-581A NONLINEAR DYNAMICS AND CHAOS.** (3)

Courses for Graduate Students Only

305-602A,B SPECIAL TOPICS IN MECHANICAL ENGINEERING. (3) New developments related to Mechanical Engineering will be presented either by staff or by visiting professors.

305-603A,B OR C DESIGN PROJECT I. (6) A design project undertaken under the direct supervision of at least one staff member. Examination entails the writing of a report which is examined internally by the supervisor and another staff member appointed by the Mechanical Engineering Department.

305-604A,B OR C DESIGN PROJECT II. (6) A continuation of 305-603A,B or C.

305-605A APPLIED MATHEMATICS I. (4) A brief treatment of tensor analysis. A review of complex variables. Analytical methods of solution for partial differential equations occurring with great frequency in engineering. Perturbation methods, integral methods, asymptotic methods and variational techniques. Numerical methods of solution.

- **305-606B APPLIED MATHEMATICS II.** (4) (Prerequisite: 305-605A)
- **305-608B NUMERICAL ANALYSIS FOR COMPUTER USERS II.** (4)

305-609A,B,C SEMINAR. (1) All candidates for a Master's degree (except those in the Aerospace Program) are required to participate and to deliver one paper dealing with their particular area of research or interest.

305-610B FUNDAMENTALS OF FLUID DYNAMICS. (4) (Prerequisite: 305-605 or permission of instructor) Conservation laws control volume analysis, Navier Stokes Equations and some exact solutions, dimensional analysis and limiting forms of Navier Stokes Equations. Vorticity, Potential flow and lift, boundary layer theory, drag, turbulence.

305-615A,B GASDYNAMICS I. (4) Kinetic theory and conservation equations, shock detonation, deflagration wave structure, Hugoniot properties, shock interactions, acoustic theory, method of linearization, waves of finite amplitudes, wave interactions, non-similar techniques of Sakurai and Oshima, integral methods in shock dynamics, snowplow model, asymmetrical shock propagation, similarity methods in gasdynamics, blast wave theory, blast scaling.

- **305-617A,B GASDYNAMICS II.** (4)
- **305-620A,B ADVANCED COMPUTATIONAL AERODYNAMICS.** (4) (Evening course)
- **305-626B ADVANCED CONCEPTS OF ENGINEERING DESIGN.** (4) (Evening course)

305-627A,B MANUFACTURING INDUSTRIAL STAGE. (9) (Restricted to students in the M.M.M. Program) An industrial work term is an integral component of the M.M.M. program which is to be completed under the supervision of an experienced engineer in the facilities of a sponsoring company.

305-628A,B,C MANUFACTURING CASE STUDIES. (2) (Restricted to students in the M.M.M. Program) Case studies on a variety of manufacturing topics are given by industry experts. To be attended by all students in the M.M.M. program.

305-629A,B,C MANUFACTURING INDUSTRIAL SEMINAR. (1) (Restricted to students in the M.M.M. Program) A series of presentations by industry experts and manufacturing managers. To be attended by all students in the M.M.M. program.

305-632A THEORY OF ELASTICITY. (4) (Evening course) The continuum concepts of stress, stress boundary conditions, principal stresses and the equations of equilibrium. Small strain theory and principal strains. The elastic constitutive relations. The extension, torsion and flexure of mechanical components. Plane stress and plane strain. Variational principals and the finite element method. Computer techniques are utilized.

- **305-634B NONLINEAR CONTINUUM MECHANICS.** (4)
- **305-635B FRACTURE AND FATIGUE.** (4) (Evening course) (Prerequisite: 305-632A)

305-642B ADVANCED DYNAMICS. (4) (Evening course) Variational methods. Hamilton's principle and equations of motion of engineering systems. Lagrangian formulations for discrete systems. Methods of discretizing continuous systems. Rigid body dynamics. Dynamic behaviour of linear and nonlinear systems. Response of engineering systems to deterministic inputs by classical methods. Stability of linear and nonlinear systems.

- **305-643B VIBRATIONS IN ENGINEERING SYSTEMS.** (4) (Evening course) (Prerequisite: 305-642B)
- **305-645B FINITE ELEMENTS IN DYNAMIC SYSTEMS.** (4) (Evening course) (Prerequisite: 305-642B)
- **305-650A,B HEAT TRANSFER.** (4) (Evening course)
- **305-652A DYNAMICS OF COMBUSTION.** (4)

305-654B COMPUTATIONAL FLUID DYNAMICS AND HEAT TRANSFER. (4) (Evening course) A study of numerical methods for solving complex problems involving fluid flow and heat transfer. Finite volume methods, and overview of control-volume finite element methods. Methods for solving large systems of coupled nonlinear algebraic discretized equations. Mathematical models for turbulence.

305-681 A,B,C AERONAUTICS PROJECT I. (3) (Open to students in the Aeronautical Option only.) The project is undertaken under the direct supervision of at least one staff member. Examination entails the writing of a report which is examined internally within the Mechanical Engineering Department.

305-682 A,B,C AERONAUTICS PROJECT II. (3) (Open to students in the Aeronautical Option only.) A continuation of 305-681.

305-683 A,B,C AERONAUTICS PROJECT III. (3) (Open to students in the Aeronautical Option only.) A continuation of 305-682.

305-687A,B,C AEROSPACE CASE STUDIES. (3) (Restricted to students in the Aerospace Engineering Option/Programs at McGill, Concordia or Ecole Polytechnique.) This course covers topical case studies drawn from aerospace industrial experience. It is conducted in a modular form by experienced engineers from industry. It is given in collaboration with the other two institutions participating in this joint option/program, and may be conducted at any of the three locations in the language of convenience to the instructors.

305-688A,B,C INDUSTRIAL STAGE. (6) (Restricted to students in the Aerospace Engineering Option/Program) An integral component of the program that is to be completed under the supervision of an experienced engineer in the facilities of a participating com-

pany. The topic is to be decided by a mutual agreement between the candidate, the participating company and the Liaison Committee on Aerospace Engineering. An evaluation of the candidate's performance during the work period becomes a part of the student's record.

305-691A,B,C M.ENG. THESIS LITERATURE REVIEW. (3) A comprehensive literature review in the general area of the thesis topic, to be completed in the first semester.

305-692A,B,C M.ENG. THESIS RESEARCH PROPOSAL. (4) Initiation of research with particular emphasis on the definition of the thesis topic.

305-693A,B,C M.ENG. THESIS PROGRESS REPORT I. (3) A first status report on the progress in the thesis research.

305-694A,B,C M.ENG. THESIS PROGRESS REPORT II. (6) A second status report on the progress in the thesis research.

305-695A,B,C M.ENG. THESIS. (12) Submission of the M.Eng. thesis for examination.

305-701A,B,C PH.D. PRELIMINARY ORAL EXAM. Presentation of the Ph.D. thesis proposal by the student and oral examination of the student's background in related areas.

47 Medical Physics

Medical Physics Unit
Montreal General Hospital
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Canada

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Website: http://www.medphys.mcgill.ca

Director — E.B. Podgorsak

47.1 Staff

Professors
S.M. Lehnert; B.Sc.(Nott.), M.Sc., Ph.D.(Lond.)
E.B. Podgorsak; Dipl. Ing.(Ljubljana), M.Sc., Ph.D.(Wis.), F.C.C.P.M.
C.J. Thompson; B.Sc., M.Sc., D.Sc.(Otago), F.C.C.P.M.

Associate Professors
G.W. Dean; B.Sc.(Salf.), M.Sc.(Man.), Ph.D.(E. Anglia), F.C.C.P.M.
G.B. Pike; B.Eng.(St.John's), M.Eng., Ph.D.(McG.)
J.P.F. Seuntjens; M.Sc., Ph.D.(Ghent)

Assistant Professors
M.D.C. Evans; B.A.(Queen's), M.Sc.(McG.), F.C.C.P.M.
D.H. Hristov; B.Sc.(Sofia), Ph.D.(McG.)
M. Olivares; B.Sc.(Madrid), M.Sc.(Sask.), F.C.C.P.M.

Lecturers
R.A. Corns; B.Sc., M.Sc., Ph.D.(Man.), M.Sc.(McG.)
G. Durante; B.Eng.(McG.)
P. Léger; B.Eng.(École Poly.) O.I.Q.
W.A. Parker; B.Sc.(C'dia), M.Sc.(McG.), M.C.C.P.M.
H.J. Patrocinio; B.Sc.(C'dia), M.Sc.(McG.), M.C.C.P.M.
N. Sharoubirn; B.Eng.(Ain Shams)

Associate Members
A.C. Evans; B.Sc.(Liv.), M.Sc.(Sur.), Ph.D.(Leeds)
C.J. Henri; B.Sc.(New Orleans), M.Sc., Ph.D.(McG.)
T.M. Peters; B.Eng., Ph.D.(Cant.), F.C.C.P.M.
R.B. Richardson; B.Sc.(Lond.), M.Sc.(Aberdeen), Ph.D.(Bristol)

47.2 Programs Offered

The Medical Physics Unit offers an M.Sc. in Medical Radiation Physics. Facilities are available for students to undertake a Ph.D. in Medical Physics through the Department of Physics.

The Unit is a teaching and research unit concerned with the application of physics and related sciences in medicine, especially (but not exclusively) in radiation medicine, i.e. radiation oncology, medical imaging and nuclear medicine.

The research interests of members of the Unit include various aspects of medical imaging, including 3D imaging, the development of new imaging modalities and applications of imaging in radiation therapy; radiation dosimetry, especially solid state, electret and NMR systems; nuclear cardiology; and applications of radiation biology to therapy.

The M.Sc. and Ph.D. programs in Medical Physics are accredited by the Commission on Accreditation of Medical Physics Education Programs, Inc., sponsored by The American Association of Physicists in Medicine (AAPM), The American College of Medical Physics (ACMP), and The American College of Radiology (ACR).

47.3 Admission Requirements

Candidates applying to the M.Sc. program must normally hold a B.Sc. degree (Honours or Major) in Physics or Engineering, with a minimum overall GPA of 3.0/4.0 (minimum of 70%).

47.4 Application Procedures

Students are admitted to the M.Sc. program only at the start of the Fall semester in September of a given academic year. Applications for consideration for the Fall semester of 2002 should be submitted between September 1, 2001 and March 15, 2002.

Only complete applications will be considered. Interested candidates should (a) ask their university(ies) to send two originals of each transcript, and (b) request that original confidential letters of recommendation be sent by professors familiar with their work. The application fee of $60 Cdn should be remitted in Canadian funds in negotiable form, such as a bank draft, money order, etc. payable to McGill University.

Non-Canadian applicants whose mother tongue is not English and who have not completed a degree using the English language must submit documented proof of competency in English by a TOEFL or IELTS. The original test report must be sent by the testing center, i.e. a photocopy sent by the applicant is not acceptable.

All application materials should be sent directly to the Graduate Secretary, Medical Physics Unit.

47.5 Program Requirements

M.Sc. in Medical Radiation Physics

This two-year program provides a comprehensive introduction to the academic, research and practical aspects of physics applied to radiation medicine. In addition to the thesis requirement (32 credits) there are 12 mandatory courses (28 credits). The practical and laboratory sections of the program are conducted in various McGill teaching hospitals.

The program comprises:

1) didactic courses in radiation physics, radiation dosimetry, the physics of nuclear medicine and diagnostic radiology, medical imaging, medical electronics and computing, radiation biology and radiation hazards and protection;
2) seminars in radiation oncology, diagnostic radiology and miscellaneous aspects of medical physics, e.g. lasers;
3) laboratory courses in radiation dosimetry and medical imaging;
4) an individual research thesis.

47.6 Graduate Level 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.

563-601A RADIATION PHYSICS. (3) The production and properties of directly and indirectly ionizing radiations and their interactions with matter; basic theoretical and experimental aspects of radiation dosimetry.

563-602B APPLIED DOSIMETRY. (3) (Prerequisite: 563-601A) Theoretical and practical dosimetry of radiation sources, both external and internal with respect to the human body. Equipment used for external beam radiotherapy and brachytherapy.

563-603B LABORATORY PRACTICUM. (2) (Prerequisite: 563-601A. Corequisite: 563-602B) This laboratory course gives some experience in practical/clinical aspects as applied to radiation therapy and to the techniques for the measurement of different physical parameters which characterize radiation beams. The student is exposed to the operation of various therapy units, dose measuring devices, 3D treatment planning, virtual simulator units, brachytherapy, quality assurance, calibration and thermoluminescent dosimetry.

563-607A INTRODUCTION TO MEDICAL IMAGING. (3) (Corequisite: 563-615A) 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.

563-608B LABORATORY IN DIAGNOSTIC RADIOLOGY AND NUCLEAR MEDICINE. (2) (Prerequisite: 563-615A. Corequisite: 563-614B.) This laboratory course takes place in hospital departments of medical diagnostic imaging and is designed to give the student a working knowledge of the performance parameters of the diagnostic imaging equipment. Laboratory classes will offer the student the practical experience of image quality control, on selected imaging equipment currently used in diagnostic medicine together with practical applications of the concepts studied in 563-614B and 563-615A.

563-609A RADIATION BIOLOGY. (2) Deals with the effects and mode of action of ionizing radiation on biological material from molecular interactions, through sub-cellular and cellular levels of organization, to the response of tissues, organs and the whole body. Includes the application of radiation biology to oncology and the biological aspects of environmental radiation exposure.

563-611A MEDICAL ELECTRONICS. (2) An introductory course on electronics, with emphasis on digital electronics, data acquisition and microprocessors applied to instrumentation. A basic knowledge of electronics is assumed, but the detailed course contents may vary from year to year, depending on the background of the students.

563-612B COMPUTERS IN MEDICAL IMAGING. (2) (Prerequisites: 563-607A, 563-611A or equivalent, 563-615A. Corequisite: 563-614B.) The role of computers in the acquisition and storage of data in medical imaging systems, with special reference to computed tomography, gamma cameras, positron emission tomography. Special attention is paid to the interfacing requirements of each device and to image display systems. Demonstrations of some of these systems are included.

563-613B HEALTH PHYSICS. (2) (Prerequisites: 563-601A, 563-609A) The hazards of ionizing radiations and the safe handling of radiation sources. Topics covered include basic principles; safety codes, laws and regulations; organization of radiation safety; and practical safety measures and procedures.

563-614B PHYSICS OF DIAGNOSTIC RADIOLOGY. (3) (Prerequisite: 563-607A) A rigorous treatment of the physical principles and the instrumentation of radiology, computed tomography and ultrasound medical imaging systems. Special attention is paid to the analysis of the relations between imaging system design, image quality, and safety. Measurement techniques for the evaluation of medical imaging systems are reviewed.

563-615A PHYSICS OF NUCLEAR MEDICINE. (3) (Corequisite: 563-601A) The physics of radioactivity and the applications of radioisotopes and radiopharmaceuticals in medical diagnosis. Topics covered include fundamental nuclear physics, radioactivity, radiation spectrometry, the scintillation camera, image analysis and data processing in nuclear medicine, single photon emission tomography, and positron emission tomography.

563-616D SELECTED TOPICS IN MEDICAL PHYSICS. (1) This course deals with anatomy and physiology, etiology and treatment of cancer and introductory medical statistics, three topics not covered by other courses in the program. Also clinical aspects of radiation oncology physics.

563-625D M.SC. THESIS RESEARCH. (32)

48 Medicine, Experimental

Division of Experimental Medicine
Department of Medicine
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Website: http://www.medcor.mcgill.ca/EXPMED/expmed.htm

Chair, Department of Medicine — D. Goltzman

Director, Division of Experimental Medicine — G. Price

48.1 Staff

Professors

G. Batist; B.Sc.(Col.), M.D., C.M.(McG.), F.R.C.P.(C)
H. Bennett; B.A.(York, U.K.), Ph.D.(Brun.)
R. Blostein; M.Sc., Ph.D.(McG.)
T.M.S. Chang; B.Sc., M.D., C.M., Ph.D.(McG.), F.R.C.P.(C)
M. Cosio; B.Sc.(Oviedo), M.D.(Madrid)
F. Doualla-Bell; B.Sc., M.S., Ph.D.(Paris XI)
A. Fuks; B.Sc., M.D., C.M.(McG.)
J. Genest, Jr.; M.D.(McG.), F.R.C.P.(C)
H.L. Goldsmith; B.A., B.Sc., M.A.(Oxon.), Ph.D.(McG.)
D. Goltzman; B.Sc., M.D., C.M.(McG.), F.R.C.P.(C)
A. Grassino; M.D.(Rosario, Argen.)
S.A. Grover; B.A.(Roch.), M.D., C.M.(McG.), M.P.A.(Harv.), F.R.C.P.(C)
G. Hendy; B.Sc.(Sheff.), Ph.D.(Lond.)
A. Herscovics; B.Sc., Ph.D.(McG.)
J. Hiscott; B.Sc., M.Sc.(W.Ont.), Ph.D.(N.Y.)
M. Levy; B.Sc., M.D., C.M.(McG.), F.R.C.P.(C)
B. Leyland-Jones; B.Sc., M.B., B.S.(Lond.), F.R.C.P.(C), F.A.C.P.
P.T. Macklem; B.A.(Queen's), M.D., C.M.(McG.), F.R.C.P.(C)
S. Magder; M.D.(Tor.), F.R.C.P.(C)
O.A. Mamer; B.Sc., Ph.D.(Windsor)
E. Marliss; M.D.(Alta.), F.R.C.P.(C)
J. Martin; B.Sc., M.B., B.Ch., M.D.(Cork), F.R.C.P.(C)
J. Milic-Emili; M.D.(Milan), F.R.S.C.
B.E.P. Murphy; B.A., M.D.(Tor.), M.Sc., Ph.D.(McG.), F.A.C.P.(C)
C.K. Osterland; M.D.(Man.)
L. Panasci; B.Sc., M.D.(Georgetown)
Y.C. Patel; M.D.(Otago), Ph.D.(Monash), F.R.A.C.P., F.R.C.P.(C)
M.N. Pollak; M.D.(McG.), F.R.C.P.(C)
P. Ponka; M.D., Ph.D.(Prague)
B. Posner; M.D.(Man.), F.R.C.P.(C)
W.S. Powell; B.A.(Sask.), Ph.D.(Dal.)
G.B. Price; B.A.(Kansas St.), Ph.D.(Tenn.)
M. Rasminsky; B.A.(Tor.), M.D.(Harv.), Ph.D.(Lond.)
E. Silva; M.D.(Chile), F.A.C.P.
E. Skamene; M.D., (Charles U., Czech.), Ph.D.(Czech. Acad. of Sci.), F.R.C.P.(C), F.A.C.P.
A.D. Sniderman; M.D.(Tor.)
C.P. Stanners; B.Sc.(McM.), M.A., Ph.D.(Tor.)
M. Stevenson; B.A.(Hood), M.Sc., Ph.D.(Catholic U. of Amer.)
S.L. Tan; M.B.B.S., M.Med.(Sing.)
D.M.P. Thomson; M.D., (W. Ont.), Ph.D.(Lond.), F.R.C.P.(C)

C. Tsoukas; B.Sc.(McG.), M.Sc.(Hawaii), M.D.(Athens), F.R.C.P.(C)
M. Wainberg; B.Sc.(McG.), Ph.D.(Col.)
M. Zannis-Hadjopoulos; B.Sc., M.Sc., Ph.D.(McG.)
H. Zingg; M.D.(Basel), Ph.D.(McG.)

Associate Professors
A. Bateman; B.Sc., Ph.D.(Lond.)
N. Beauchemin; B.A., B.Sc., M.Sc., Ph.D.(Montr.)
L.F. Congote; B.Sc.(Z[u:r.), Ph.D.(Marburg)
D. Cournoyer; M.D.(Sher.), F.R.C.P.(C)
A. Cybulsky; M.D.(Tor.), F.R.C.P.(C)
D. Eidelman; M.D., C.M.(McG.), F.R.C.P.(C)
E.A. Faust; B.Sc., Ph.D.(McG.)
M.S. Featherstone; B.Sc., M.Sc.(Ott.), Ph.D.(McG.)
R. Gagnon; B.Sc.(Montr.), M.D.(Laval), D.Phil.(Oxon.)
R. Germinario; B.A., M.Sc.(Seton Hall U., N.J.), Ph.D.(Dakota)
V. Giguere; B.Sc., Ph.D.(Laval)
S.B. Gottfried; M.D.(Penn.)
Q.A. Hamid; M.D.(Mosul, Iraq.), Ph.D.(Lond.)
L.J. Hoffer; B.Sc., M.D., C.M.(McG.), Ph.D.(M.I.T.)
L. Kleiman; B.Sc.(Ill.), Ph.D.(Johns H.)
R. Kremer; M.D., Ph.D.(Paris)
G.A. Kuchel; M.D.(McG.)
P. Laneuville; B.Sc.(McM.), M.D.(Ott.), F.R.C.P.(C)
M. Laughrea; B.Sc.(Laval), M.Sc., M.Phil., Ph.D.(Yale)
R. Loertscher; M.D.(Basel)
M.S. Ludwig; M.D.(Man.), F.R.C.P.(C)
W.H. Miller; A.B.(Prin.), Ph.D.(Rock.), M.D.(C'nell)
S. Mulay; M.Sc., Ph.D.(McG.)
J. Nalbantoglu; B.Sc., Ph.D.(McG.)
A. Nepveu; B.Sc., M.Sc.(Montr.), Ph.D.(Sher.)
M. Newkirk; B.Sc., M.Sc.(Queen's), Ph.D.(Tor.)
T. Owens; B.Sc., M.Sc.(McG.), Ph.D.(Ott.)
R. Palfree; B.Sc., M.Sc.(Lond.), Ph.D.(McG.)
K. Pantopoulos; B.Sc., Ph.D.(Aristotelian, Greece)
M. Parniak; B.Sc., Ph.D.(Wat.)
A.C. Peterson; B.Sc.(Vic.,B.C.), Ph.D.(Br.Col.)
S. Rabbani; M.B.B.S.(King Edward Med. Coll., Lahore)
D. Radzioch; M.Sc., Ph.D.(Jagiellonian, Cracow)
J. Rauch; B.Sc., Ph.D.(McG.)
C.P. Rose; B.Sc.(Queen's), M.D., C.M., Ph.D.(McG.)
E. Schurr; Diplom., Ph.D.(Al. Ludwigs U., Freiburg)
G. Spurll; B.Sc.(Med.), M.D.(Man.)
C. Srikant; M.Sc., Ph.D.(Madr.)
M. Trifiro; B.Sc., M.D.(McG.)
B. Turcotte; B.Sc., Ph.D.(Laval)
B.J. Ward; M.D.(McG.), M.Sc.(Oxon.), F.R.C.P.(C)

Assistant Professors
M. Alaoui-Jamali; D.V.M.(Rabat, Morocco), Ph.D.(René-Descartes, Paris)
S. Ali; B.Sc.(C'dia), Ph.D.(McG.)
D. Baran; M.D.C.M.(McG.), F.R.C.P.(C)
M. Behr; B.Sc.(Tor.), M.D.(Queen's), M.Sc.(McG.)
N. Bernard; B.Sc.(McG.), Ph.D.(Duke)
M. Blostein; M.D., C.M.(McG.)
L. Chalifour; B.Sc., Ph.D.(Man.), M.A.(Harv.)
K. Cianflone; B.Sc., Ph.D.(C'dia)
A.E. Clarke; M.D.(Nfld.), M.S.(Stan.), F.R.C.P.(C)
C. Couture; B.Sc., M.Sc.(Laval), Ph.D.(McG.)
W. Cupples; B.Sc.(Vic,B.C.), M.Sc.(Calg.), Ph.D.(Tor.)
S. Daly; B.Sc.(C'dia), Ph.D.(W. Ont.)
J. Falutz; B.Sc., M.D., C.M.(McG.), F.R.C.P.(C)
E. Fixman; B.Sc.(Col.), Ph.D.(Johns H.)
J. Galipeau; M.D.(Montr.)
B. Gilfix; B.Sc.(Man.), Ph.D.(W. Ont.), M.D.C.M.(McG.), F.R.C.P.(C)
M. Götte; B.Sc., Ph.D.(Max-Planck)
M. Greenwood; B.Sc., M.Sc.(C'dia), Ph.D.(McG.)
J. Henderson; B.Sc., Ph.D.(McG.)
A.C. Karaplis; B.Sc., M.D., Ph.D.(McG.)
A.E. Koromilas; B.Sc., Ph.D.(Aristotelian U., Greece)
L. Larose; B.Sc., Ph.D.(Montr.)
D. Lasko; B.S.(Yale), Ph.D.(M.I.T.)
J.-J. Lebrun; B.Sc., M.Sc., Ph.D.(Rennes, France)
C. Liang; B.Sc., Ph.D.(Nankai)
R. Lin; B.Sc., M.Sc.(PRC), Ph.D.(C'dia)
M. Lipman; M.D.(McG.), F.R.C.P.(C)
J.-L. Liu; B.Sc., M.Sc.(Beijing), Ph.D.(McG.)
D. Malo; D.V.M., M.Sc.(Montr.), Ph.D.(McG.)
B. Mazer; B.Sc.(Columbia, NY); M.D.(McG.), F.R.C.P.(C)
M. Park; B.Sc., Ph.D.(Glas.)
B.J. Petrof; M.D.(Laval)
P. Renzi; M.D.(Montr.), F.R.C.P.(C)
S. Richard; B.Sc., Ph.D.(McG.)
A. Sherker; M.D.(Queen's), F.R.C.P.(C)
T. Takano; M.D., Ph.D.(Tokyo)
J.P.H. Th'gn; B.Sc., M.Sc.(W.Ont.)
P. Tonin; B.Sc., M.Sc., Ph.D.(Tor.)
S. Wing; B.Sc., M.Sc.(McG.)
X.-J. Yang; B.Sc.(Zhejiang), Ph.D.(Shanghai)

Associate Members, McGill
C. Autexier, D. Boivin, P. Brodt; K. Brown; M.N. Burnier; D.H. Burns; S.Chevalier; M. Chevrette; T. Chow; H. Clarke; E. Colle; D. Dufort; R. Farookhi; M.M. Frojmovic; C. Gagnon; A. Giaid; C. Goodyer; P. Goodyer; R. Gosden; B. Gour; I .Gupta; B.J. Jean-Claude; W. Lapp; S. Lehnert; B. Massie; M. MIller; E. Mills; C. Polychronakos; R. Poole; R.D. Rajan; G. Rouleau; S.-H. Shen; G. Tannenbaum; H Tenenhouse; I. Wainer; K. Watkin; J. White; S.N. Young

Associate Members, Université de Montréal
T. Bradley; R. Butterworth; P. Chartrand; J. Davignon; C. Deal; A Deng; C.F. Deschepper; J. Drouin; J. Gutkowska; P. Hamet; T. Hoang; P. Hugo; P. Jolicoeur; C. Lazure; D Lohnes; S. Mader; M. Nemer; M. Raymond; T. Reudelhuber; M. Sairam; G. Sauvageau; E. Schiffrin; N. Seidah; R.-P. Sekaly; D. Skup; M. Trudel; J. Vacher

Associate Members, Institut Armand Frappier, Université du Québec
S. Lemieux; E. Potworowski; L. Zamir

48.2 Programs Offered

Ph.D. in Experimental Medicine.
M.Sc. – Specialization in Bioethics.
Graduate Diploma in Clinical Research.

48.3 Admission Requirements

For all three programs, candidates educated outside of Canada and the United States must submit GRE (General Examination) scores.

Ph.D.

Admission to graduate studies and research in Experimental Medicine is restricted to students who wish to register for the Ph.D. degree. Candidates must hold a Major or Honours B.Sc. degree, or an M.D. degree.

Admission is based on an evaluation by the Admissions Committee, which looks for evidence of high academic achievement, and on acceptance by a research director. It is the policy of the Division that all students must be financially supported either by their supervisor or through studentships or fellowships.

In addition to the documentation currently required by the Faculty of Graduate Studies, a letter from the candidate's research director outlining the Ph.D. project is necessary.

M.Sc. (Specialization in Bioethics)

Admission to the Master's program in Bioethics, from the base discipline Medicine, shall be limited to students having degrees in Medicine, Nursing, Physical and Occupational Therapy, as well as any other professional health training degree.

For further information regarding this program, please refer to the Bioethics entry.

Graduate Diploma in Clinical Research

The diploma program is open to health care and research professionals, medical residents, pharmacists, nurses, and those with an undergraduate degree in the medical and allied sciences.

48.4 Application Procedures

Applications will be considered upon receipt of:

1. application form;
2. transcripts;
3. letters of reference;
4. $60 application fee;
5. test results (TOEFL and GRE).

All information is to be submitted to the Departmental Office.

48.5 Program Requirements

PH.D.

Comprehensive Examination

All students must take and pass the Comprehensive Oral Examination, listed as course 516-701D in the second year of the Ph.D. Students shall give a 30-minute presentation of their Ph.D. project and then answer questions from the Oral Committee. This examination will test: (i) If the student's work is progressing satisfactorily and is of sufficiently high calibre to warrant continuation in the program, and (ii) If the student has a broad knowledge, not only of his/her own field of research, but also of related areas in her/his discipline.

Course Work

A minimum of 18 course credits is required for students entering the program with a Bachelor's or M.D. degree. Depending on their background, students with a Masters degree may be required to take only 12 course credits. The following courses are highly recommended: 516-604D Recent Advances in Cellular and Molecular Biology; 516-610B Biochemical Methods in Medical Research.

After consultation with their research supervisor and the Director of the Division, students may choose their courses from those offered by Experimental Medicine, Physiology, Biochemistry as well as other graduate and advanced undergraduate courses in the medical and allied sciences. Where necessary, students may enroll for credit in courses offered in the physical and mathematical sciences.

Students in the third year of the Ph.D. must give a 20-minute oral presentation of their work at the Annual Research Seminar.

M.Sc. (Specialization in Bioethics)

The curriculum is composed of required courses (for 6 credits) offered in the Biomedical Ethics Unit, bioethics courses (3 credit minimum) offered by the base department and any graduate courses required or accepted by the base department 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.

For further information please contact the Chair, Master's Specialization in Bioethics, Biomedical Ethics Unit, 3690 Peel Street, Montreal, QC, H3A 1W9. Telephone: (514) 398-6980; Fax: (514) 398-8349; email: Glass_K@falaw.lan.mcgill.ca.

Graduate Diploma in Clinical Research

The Diploma consists of 30 credits, 24 of which include specific courses. The additional supplemental 6 credits are electives and may be chosen from course work available through the Division of Experimental Medicine, Department of Pharmacology and Therapeutics and Department of Epidemiology and Biostatistics.

The core element of the diploma is the Practicum in Clinical Research (18 credits). It is a six-step program with active 'clerkship' or 'intern-resident-type' participation in each component that is essential to the successful development and evaluation of a clinical trial.

Six 1-credit workshops will be provided by experts in the academic, industrial and government sectors, and cover wide-ranging issues pertinent to the conduct of clinical research.

48.6 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/.

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

● Denotes courses not offered in 2001-02.

★ Denotes courses offered in alternate years.

▭ Denotes limited enrolment.

516-502A ADVANCED ENDOCRINOLOGY – PART I. (3) A multidisciplinary approach will be used to teach biosynthesis and processing of hormones, their regulation, function and mechanism of action. The material will cover hypothalamic, pituitary, thyroid, atrial and adrenal hormones as well as prostaglandins and related substances.

516-503B ADVANCED ENDOCRINOLOGY – PART II. (3)The topics covered are the parathyroids, gut and pancreatic hormones and growth factors. In addition, the role of hormones and growth factors in reproduction and fetal maturation will be discussed.

▭ **516-504A BIOLOGY OF CANCER.** (3) An introduction to the biology of malignancy. A multidisciplinary approach dealing with the etiology of cancer, the biological properties of malignant cells, the host response to tumor cell growth and the principles of cancer therapy.

516-506B ADVANCED CARDIOVASCULAR PHYSIOLOGY. (3) Current topics, methods and techniques for studying the cardiovascular system. Basic and applied cardiac electrophysiology, mechanisms of pacemaker activity, arrhythmias, the effects of drugs on cardiac functions, fetal circulation, coronary circulation, mechanics of blood flow, cardiovascular diseases, renal and neural control of the circulation, and cardiac assist devices.

516-507A ADVANCED APPLIED RESPIRATORY PHYSIOLOGY. (3) (Prerequisite:552-313B) Offered in conjunction with the Department of Physiology. In depth coverage of respiratory biology including: functional anatomy of the respiratory system, pulmonary statics and dynamics, chest wall and respiratory muscles, ventilation and perfusion, control of breathing, and defense mechanisms. To provide a solid grounding in pulmonary biology and its research applications.

516-508B ADVANCED TOPICS IN RESPIRATION. (3) (Prerequisite: 516-507A)Offered in conjunction with the Department of Physiology. In depth coverage of developmental physiology,pulmonary vascular physiology, biology of airway smooth muscle, respiratory epithelium and molecular biology of respiratory muscles. Dyspnea, mechanical ventilationj and respiratory failure also covered. Emphasis on application of respiratory biology to basic and applied research and touches on pulmonary pathophysiology.

516-509B GASTROINTESTINAL PHYSIOLOGY AND PATHOPHYSIOLOGY. (3) (Prerequisite: Graduate students, U3 undergraduates) Course deals with various aspects of gastrointestinal and hepatic function in health and inaltered physiological states. The principal focus is on the recent literature pertaining to cell and molecular mechanisms underlying the motility secretory process, absorption and secretion. The molecular biology of the hepatic viruses and various aspects of colonic neoplasia will also be considered.

516-510A BIOANALYTICAL SEPARATION METHODS. (3) The student will be taught the capabilities and limitations of modern separation methods (gas and high-performance liquid chromatography, capillary electrophoresis, hyphenated techniques). Application of these techniques to solve analytical problems relevant to biomedical research will be emphasized, with special attention being paid to the processing of biological samples.

▭ **516-511B JOINT VENTURING WITH INDUSTRY.** (3) Presentation skills; preparing a business plan; the planning and control process;

and legal, financial and human resource issues as they apply to the researcher. Given in conjunction with the Centre for Continuing Education.

516-602B ADVANCED TECHNIQUES IN MOLECULAR GENETICS. (3) (Admission by permission of instructor.) Offered in conjunction with the Department of Human Genetics. Precise description of available methods in molecular genetics, and rationales for choosing particular techniques to answer questions posed in research proposals for targeting genes in the mammalian genome. Emphasis placed on analysis of regulation of gene expression and mapping, strategies for gene cloning. Course divided between lectures and student seminars.

516-603B SEMINARS IN ENDOCRINOLOGY. (3) For graduate students to develop skills in critical reading of current literature, interpretation of research date, and seminar oganization and presentation. Staff suggest topics. Each student presents two seminars on topics of their choice, supervised by professors responsible for those topics, and one mini-symposium style presentation on any topic.

516-604D RECENT ADVANCES IN CELLULAR AND MOLECULAR BIOLOGY. (6) Offered in conjunction with the Universitè de Montrèal: given Thursdays 16:00-18:00 at Institut de Recherches Cliniques de Montrèal, 110 Pine West. The course is bilingual with abstracts in the other language supplied; more than half the lectures are in French. Aimed at bringing students up to date on recent aspects of cell and molecular biology including cellular organelle structure and function, molecular genetics, signal transduction, cell growth and development, and immunology.

▭ **516-607B MOLECULAR CONTROL OF CELL GROWTH.** (3) A course for graduate students in Experimental Medicine, Biology, Biochemistry, Microbiology and Physiology, dealing with molecular control in normal and malignant cell growth, including cell cycle and physiologcal controls (nutritional and hormonal), mammalian DNA replication, viral effects on host cell growth for DNA and RNA-tumor viruses and oncogenes, and tissue and organ growth-renewal mechanisms.

● ▭ ★**516-608A MOLECULAR EMBRYOLOGY.** (3) (Offered in conjunction with the Department of Oncology.)

516-610B BIOCHEMICAL METHODS IN MEDICAL RESEARCH. (3) A course intended to introduce students to a variety of basic techniques used in medicalresearch. Lectures and demonstrations given on the purification of biologically active substances by chromatography, analysis of compounds by spectrophotometry and mass spectrometry, immunological techniques, centrifugation, cell culture, binding of hormones to receptors, molecular biology, tumor biology and electron microscopy.

▭ ★ **516-611D SEMINARS IN ONCOLOGY.** (6) A course in cancer and allied fields aimed at familiarizing students with the current literature relevant to the biology of cancer, developing their critical abilities and providing an opportunity for presenting seminars to their peers.

516-614B ENVIRONMENTAL CARCINOGENESIS. (3) Methods for identification of carcinogens, including epidemiological studies, animal modelling and molecular biomarkers, and characteristics of known environmental carcinogens (viruses, chemical and physical agents and diet). Environmental factors will be placed in the context of overall cancer risk, which involves interaction of genetics, host and environment.

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

▭ **516-616A MOLECULAR & CELL BIOLOGY TOPICS.** (3) Structured and instructor-directed student presentations and discussions of recent advances in molecular and cellular biology. The course will reinforce the students' knowledge of currently major areas of investigation, with a focus on human disease and medical applications. Important recent publications will extend material from textbook and review articles.

516-617A,B,C,T WORKSHOP IN CLINICAL TRIALS I. (1) Intensive day-long workshop discussing Industrial/Academic/Governmental interactions in the design, testing and approval of drugs.

516-618A,B,C,T WORKSHOP IN CLINICAL TRIALS II. (1) Intensive day-long workshop discussing the role of the physician in drug testing.

516-619A,B,C,T WORKSHOP IN CLINICAL TRIALS III. (1) Intensive day-long workshop discussing the pharmacoeconomics of drug design and testing.

516-620A,B,C,T CLINICAL TRIALS AND RESEARCH I. (1) Intensive day-long workshop discussing a topical subject or recent advance relevant to clinical research and the conduct of clinical trials.

516-625A,B,C,T CLINICAL TRIALS AND RESEARCH II. (1) Intensive day-long workshop discussing a topical subject or recent advance relevant to clinical research and the conduct of clinical trials.

516-626A,B,C,T CLINICAL TRIALS AND RESEARCH III. (1) Intensive day-long workshop discussing a topical subject or recent advance relevant to clinical research and the conduct of clinical trials.

516-627A,B,C,T PRACTICUM IN CLINICAL RESEARCH. (18) Six-step program: 1. Identification of the problem; 2. Experimental design; 3. Protocol development; 4. Execution of the protocol; 5. Data analysis; 6. Generation of final report with active "clerkship" participation in each component with team leaders and experts designated for each stage.

● **516-630A ECON. EVAL. OF MED. TECHNOLOGIES.** (3) (Offered in conjunction with the Department of Epidemiology and Biostatistics.)

● **516-631L ADVANCED TOPICS IN ECONOMIC EVALUATION.** (3)

516-635D EXPERIMENTAL/CLINICAL ONCOLOGY. (6) The course will deal, on a site by site basis, with the incidence of cancer, present treatment, treatment outcome, underlying causes, current research and directions for development of new treatments. Chemotherapy, surgery, radiation therapy and nutrition as therapy and treatment of cancer will be included.

516-640A,B,C EXPERIMENTAL TOPICS I. (3) Study, through guided reading, visits, practicals, assignements, of an elected and approved topic of importance in medical science.

516-641A,B,C, EXPERIMENTAL TOPICS II. (3) Study, through guided reading, visits, practicals, assignments, of an elected and approved topic of importance in medical science.

516-642A,B,C EXPERIMENTAL TOPICS III. (3) Study, through guided reading, visits, practicals, assignments, of an elected and approved topic of importance in medical science.

516-701D COMPREHENSIVE EXAMINATION.

Department of Physiology

552-508A ADVANCED RENAL PHYSIOLOGY. (3)

552-513A CELLULAR IMMUNOLOGY. (3)

552-515A PHYSIOLOGY OF BLOOD I: HEMOSTASIS AND THROMBOSIS. (3)

552-516B PHYSIOLOGY OF BLOOD II: ERYTHROCYTES AND BONE MARROW. (3)

552-517B ARTIFICIAL INTERNAL ORGANS. (3)

552-518A ARTIFICIAL CELLS: IMMOBILIZED ENZYMES AND BIOMATERIALS. (3)

519-604B SELECTED TOPICS IN HUMAN IMMUNOLOGY. (3)

Department of Microbiology & Immunology

528-510B SEMINARS ON THE INFLAMMATORY PROCESS. (3)

Scheduled Graduate Seminars

The Royal Victoria Hospital (1 hour per week):
- Respiratory Research
- Immunopathology
- Endocrinology and Metabolism
- Haematology Research

Renal and Electrolyte Seminar
Transplantation Conference
Gastroenterology Conference
Diabetes Conference
Chest-Cardiac Disease Conference
Clinical Endocrinology Conference
Steroid Biochemistry Research
Haematology Clinical Conference
Endocrinology and Metabolism Research Conference
Clinical Immunology Conference
Arthritis Conference
Internal Medicine
Dermatology Research
University Clinic Seminar
Cardiology Research

The Montreal General Hospital (1 hour per week, or in some cases alternate week):
Gastroenterology Conference
Respiratory Diseases
Dermatology
Internal Medicine
Allergy and Immunology
Infectious Diseases
Combined Staff Conference
Haematology
Arthritis
Metabolic Diseases
Cardiac Disease
Neurology – Neurosurgery
University Medical Clinic Seminar

49 Microbiology and Immunology

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Chair — G.J. Matlashewski

49.1 Staff

Emeritus Professor
E.C.S. Chan; M.A.(Texas), Ph.D.(Maryland)

Professors
N.H. Acheson; A.B.(Harv.), Ph.D.(Rockefeller)
Z. Ali-Khan; B.Sc.(Bilar), M.Sc.(Karachi), Ph.D.(Tulane)
M.G. Baines; B.Sc., M.Sc., Ph.D.(Queen's)
J.W. Coulton; B.Sc.(Tor.), M.Sc.(Calg.), Ph.D.(W. Ont.)
M.S. Dubow; B.Sc.(S.U.N.Y.), M.A., Ph.D.(Ind.)
J. Hiscott; B.Sc., M.Sc., Ph.D.(W. Ont.)
J. Mendelson; M.Sc.(Rock), M.D., C.M.(McG.), F.R.C.P.(C.)
R.A. Murgita; B.Sc.(Maine), M.S.(Vt.), Ph.D.(McG.)
M.J.H. Ratcliffe; B.A.(Glas.), Ph.D.(Coll. Lond.)
H.G. Robson; B.Sc., M.D., C.M.(McG.), F.R.C.P.(C.)
M.A. Wainberg; B.Sc.(McG.), Ph.D.(Col.)

Associate Professors
D.J. Briedis; B.A., M.D.(Johns H.)
A. Dascal; D.C.S.(McG.), M.D.,(Montr.)
G.J. Matlashewski; B.Sc(C'dia), Ph.D.(OH.)
T. Owens; B.Sc., M.Sc.(McG.), Ph.D.(Ont.)

Assistant Professors
S. Fournier; Ph.D.(Montr.)
H. Le Moual; Ph.D.(Montr.)
G.J. Marczynski; B.S., Ph.D.(Ill.)
D. Portnoy; B.Sc.(Sir G.Wms.), M.D.(Liege)
J. Portnoy; B.Sc., M.D.C.M., M.Sc.(McG.)
P. René; B.A., M.D.(Sher.)

Associate Members
J. Antel, Neurology and Neurosurgery;
A. Bar-Or, Neuroimmunology; M. Behr, Medicine;
N.V. Christou, Surgery; C. Couture, Medicine (Div. Exp. Med.);
G. Faubert, Institute of Parasitology; A. Jardim, Parasitology;
L. Kleiman, Microbiology and Immunology;
A.E. Koromilas, Oncology; V. Loo, Medicine;
J.D. MacLean, Medicine; M.A. Miller, Medicine;
M. Newkirk, Medicine; R.G.E. Palfree, Medicine;
A.R. Poole, Surgery; G. Prud'homme, Pathology;
J. Rauch, Medicine; P. Ribeiro, Institute of Parasitology;
S. Richard, Oncology; B. Turcotte, Medicine; B.J. Ward, Medicine.

Adjunct Professors
A. Descoteaux; B.Sc., M.Sc.(Montr.), Ph.D.(McG.)
P. Hugo; B.Sc., M.Sc., Ph.D.(McG.)
G. Kukolj; B.Sc., Ph.D.(McG.)
P. Lau; Ph.D.(Ottawa)
C. Rioux; B.Sc., M.Sc.(Laval), Ph.D.(Guelph)
R.-P. Sekaly; B.A.(Stanislas), B.Sc., M.Sc.(Montr.), Ph.D.(Lausanne)

49.2 Programs Offered

The Department offers graduate programs leading to the degrees of M.Sc., M.Sc. Applied and Ph.D. Each program is tailored to fit the needs and backgrounds of individual students.

The Department concentrates on four key areas of research: cellular and molecular immunology, microbial physiology and genetics, molecular biology of viruses, and medical microbiology.

49.3 Admission Requirements

Master's and Master's Applied

Candidates are required to hold a B.Sc. degree in microbiology and immunology, biology, biochemistry or another related discipline; those with the M.D., D.D.S. or D.V.M. degrees are also eligible to apply. The minimum grade point average for acceptance into the program is 3.2 (out of 4.0) B+. All international applicants whose language of instruction is not English must have a TOEFL score of 550 on the paper-based test (213 on the computer-based test).

Ph.D

Students who have satisfactorily completed a M.Sc. degree in microbiology and immunology, a biological science, or biochemistry, or highly qualified students enrolled in the departmental M.Sc. program, may be accepted into the Ph.D. program provided they meet its standards.

49.4 Application Procedures

Applications will be considered upon receipt of:
1. application form;
2. two official transcripts;
3. two letters of reference;
4. $60 application fee;
5. TOEFL test (GRE not required but recommended).

All information is to be submitted directly to the Student Affairs Officer in the Department of Microbiology and Immunology.

All applicants are encouraged to approach academic staff members during or before the application process since no applicants are accepted without a supervisor.

Deadline(s)
All applications and documents must be submitted by the following dates:

Canadian Applicants

October 15	for the Winter term (January)
February 15	for the Summer term (May)
May 15	for the Fall term (September)

International Applicants
August 1 for the Winter Term (January)
December 1 for the Summer term (May)
February 15 for the Fall term (September)

49.5 Program Requirements

M.Sc. Degree (45 credits)
The following requirements must be satisfied:
1. Students must register for and satisfactorily complete the requirements of courses 528-611, 528-612, 528-613, 528-614, 528-615 and two of the following courses: 528-616, 528-617, 528-618 and 528-619 (see list below).
2. Other courses may be required to strengthen the student's background.
3. A satisfactory M.Sc. thesis (24 credits) must be presented.

M.Sc.A. Degree (non-thesis degree) (45 credits)
The principal aim is to provide specialized training in Applied Medical Microbiology and Immunology.

Candidates must satisfy requirements (1) and (2) above. In addition, applied laboratory research projects must be pursued as a major part of the overall program. The results of each project form the basis of a formal report which is reviewed by the Department staff.

Ph.D
Candidates will be judged principally on their research ability and on the presentation of a satisfactory thesis.

Students must also register for and satisfactorily complete the requirements of courses 528-701D, 528-711, 528-712, 528-713, 528-714, 528-715 and 528-716 and three or the following courses: 528-704A, 528-705B, 528-706A, 528-707B (see list below). Other courses may be required to strengthen the student's background.

Each Ph.D. student has an advisory committee (three professors including research advisor) that meets yearly to consider the student's progress.

49.6 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.

528-603H PRACTICAL DIAGNOSTIC MICROBIOLOGY. (12) (offered to M.Sc.A. students only)

528-604D INDEPENDENT RESEARCH PROJECT. (6) (offered to M.Sc.A. students only)

528-605D ADVANCED INDEPENDENT RESEARCH PROJECT IN APPLIED MICROBIOLOGY AND IMMUNOLOGY. (12) (offered to M.Sc.A. students only)

528-611A,B GRADUATE SEMINAR. (3)

528-612A,B GRADUATE SEMINAR. (3) (M.Sc. students - presentation of two seminar topics throughout the course of their degree program).

528-613A,B CURRENT TOPICS IN MICROBIOLOGY & IMMUNOLOGY. (3)

528-614A,B CURRENT TOPICS IN MICROBIOLOGY & IMMUNOLOGY. (3)

528-615A,B CURRENT TOPICS IN MICROBIOLOGY & IMMUNOLOGY. (3) M.Sc. Students (discussion groups with guest speakers).

528-616A,B READING AND CONFERENCE. (3)

528-617A,B READING AND CONFERENCE. (3)

528-618A,B READING AND CONFERENCE. (3)

528-619A,B READING AND CONFERENCE. (3) (M.Sc. students - two of these courses required throughout the course of their degree program.) Student presentations, taken from current literature, are concerned with aspects of a central topic. Presentations are designed to be informal and to generate student discussions. Topic will change from term to term.

528-697A,B,C MASTER'S RESEARCH I. (8)

528-698A,B,C MASTER'S RESEARCH II. (8)

528-699A,B,C MASTER'S RESEARCH III. (8) (M.Sc. students) Independent work under the direction of a supervisor on a research problem in the student's designated area of research.

528-701D COMPREHENSIVE EXAMINATION.

528-704A READING AND CONFERENCE. (3)

528-705B READING AND CONFERENCE. (3)

528-706A READING AND CONFERENCE. (3)

528-707B READING AND CONFERENCE. (3) (Ph.D. students - three of these courses required throughout the course of their degree program.) Description as for M.Sc. students.

528-711A,B GRADUATE SEMINAR. (3)

528-712B GRADUATE SEMINAR. (3)

528-713A,B GRADUATE SEMINAR. (3) (Ph.D. students) Presentation of a maximum of three seminars topics throughout the course of their degree program.

528-714A,B CURRENT TOPICS IN MICROBIOLOGY & IMMUNOLOGY. (3)

528-715A,B CURRENT TOPICS IN MICROBIOLOGY & IMMUNOLOGY. (3)

528-716A,B CURRENT TOPICS IN MICROBIOLOGY & IMMUNOLOGY. (3) (Ph.D. students) Discussion groups with guest speakers.

528-721D PH.D. RESEARCH PROGRESS REPORT. (1)

528-722D PH.D. RESEARCH PROGRESS REPORT. (1)

528-723D PH.D. RESEARCH PROGRESS REPORT. (1)

528-724D PH.D. RESEARCH PROGRESS REPORT. (1) Each Ph.D. student has an advisory committee (3 professors including research advisor) that meets yearly to consider student's progress. Students submit a 6-page progress report to the committee and give a 20-minute oral presentation, discussing data obtained and future research plans. Committee gives advice on progress and fine-tuning the research project.

50 Mining and Metallurgical Engineering

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Chair — R.A.L. Drew

Director, Mining Engineering — F.P. Hassani

Chair, Graduate Program — H.S. Mitri

Co-Chair, Graduate Program — M. Hasan

Graduate Program Secretary — N. Procyshyn

50.1 Staff

Emeritus Professor
W.M. Williams; B.Sc., M.Sc.(Brist.), Ph.D.(Tor.), Eng.

Professors
G.P. Demopoulos; Dipl.Eng.(NTU Athens), M.Sc., Ph.D.(McG.), Eng.
R.A.L. Drew; B.Tech.(Brad.), Ph.D.(N'cle)
J.A. Finch; B.Sc.(Birm.), M.Eng., Ph.D.(McG.), Eng., F.C.I.M.

J.E. Gruzleski; B.Sc., M.Sc.(Queen's), Ph.D.(Tor.), Eng., F.C.I.M., F.A.S.M.
R.I.L. Guthrie; B.Sc., Ph.D.(Lond.), D.I.C., A.R.S.M., Eng., F.C.I.M.
F.P. Hassani; B.Sc., Ph.D.(Nott.), C.Eng.(U.K. Reg.)
J.J. Jonas; B.Eng.(McG.), Ph.D.(Cantab.), F.A.S.M., F.R.S.C., Eng.
J. Szpunar; B.Sc., M.Sc., Ph.D., D.Sc.(Krakow)

Associate Professors
M.L. Bilodeau; B.Eng.(Montr.), M.Sc.A., Ph.D.(McG.), Eng.
R. Harris; B.Sc.(Q'ld), M.Eng., Ph.D.(McG.)
M. Hasan; B.Eng.(Dhaka), M.Eng.(Dhahran), Ph.D.(McG.)
J.A. Kozinski; B.A., M.Eng., D.Sc.(Krakow)
A. Laplante; B.A.Sc., M.A.Sc.(Montr.), Ph.D.(Tor.), Eng.
H.S. Mitri; B.Sc.(Cairo), M.Eng., Ph.D.(McM.), Eng.
F. Mucciardi; B.Eng., M.Eng., Ph.D.(McG.), Eng.
J. Ouellet; B.Sc.A.(Laval), M.Sc.A., Ph.D.(Ecole Poly.), Eng.
S. Yue; B.Sc., Ph.D.(Leeds)

Lecturer
J. Mossop; B.Eng.(McG.)

Adjunct Professors
W. Caley, W. Comeau, R. Dimitrakopoulos, P.A. Distin, B. Harris, A. Hemami, B. Mohanty, M. Pugh, J.H. Root, M.J. Scoble, W.T. Thompson, R. Thorn, V. Vaidya, G. Van Weert, A.E. Wraith

Liaison Officer, Mining Co-op Program — M. Vachon

50.2 Programs Offered

Graduate programs leading to M.Eng., M.Sc. and Ph.D. research degrees are available in rock mechanics, mining environments, mining automation and robotics, operations research, ground fragmentation, mineral economics, materials handling, chemical and process metallurgy, hydrometallurgy, effluent treatment, mineral processing and related surface chemistry, metal casting, materials engineering, composites, ceramics and mechanical metallurgy.

Course programs leading to the M.Eng. (Project) degree in Mining or Metallurgy/Materials and the Graduate Diploma in Mining Engineering are also available.

Special programs are available for those holding degrees in subjects other than Metallurgy, Materials or Mining (e.g. Chemistry, Physics, Engineering Geology).

50.3 Admission Requirements

The Graduate Diploma in Mining Engineering is open to graduates with suitable academic standing in any branch of engineering or science. It is designed to provide a sound technical mining engineering background to candidates intending to work in the minerals industry.

The M.Eng. (thesis) degree is open to graduates holding the B.Eng. degree or its equivalent in Metallurgical or Materials Engineering, Mining Engineering, or other related engineering fields.

The M.Sc. (thesis) degree is open to graduates holding the B.Sc. degree or its equivalent in Metallurgy, Geology or related fields. A high academic standing at the undergraduate level is required for admission to these programs.

The Master of Engineering (Project) program (Metallurgy/Materials Option) is primarily designed to train people with appropriate engineering or scientific backgrounds to allow them to work effectively in the metals or materials industries. Industrial experience is favourably viewed for entrance into the program, but is not considered a necessity.

The Master of Engineering (Project) program (Mining Option) is primarily designed for graduates from mining engineering programs who have received adequate academic training in modern mining technology, mineral economics, computer programming and probabilities and statistics. Students without this academic training must follow a qualifying semester of courses established by the Mining Program Director. Industrial experience is favourably viewed for entrance into the program, but is not considered a necessity.

Ph.D. Degree applicants may either be “directly transferred” from the M.Eng. or M.Sc. program (see below) or hold an acceptable Master's degree in Metallurgy or Materials Science, Metallurgical or Materials Engineering, Mining Engineering, or other related fields. The Ph.D. degree is awarded in the appropriate field.

50.4 Application Procedures

Applications will be considered upon receipt of:

1. application form;
2. two official copies of transcripts;
3. letters of reference;
4. $60 CDN application fee;
5. TOEFL test results.

All information is to be submitted directly to the Graduate Secretary in the Department of Mining and Metallurgical Engineering.

Deadlines:
March 1 – Fall admission
July 1 – Winter admission
November 1 – Summer admission

50.5 Program Requirements

Graduate Diploma in Mining Engineering

This program consists of 30 credits of course work, and normally requires one academic year of full-time study to complete. Candidates are required to take an integrated group of courses (including 306-673 Mining Engineering Seminar), selected in consultation with the Program Adviser and based on their academic background.

M.Eng. and M.Sc. (Thesis) Degrees

The programs consist of 45 credits of course work, seminars and research. The candidate must pass a minimum number of courses, normally equivalent to 12 credits, chosen in consultation with a supervisor and based on his/her academic background and research interests.

In addition, the candidate must participate in an appropriate Research Seminar course and submit an acceptable thesis based on a series of successfully completed research courses.

M.Eng. and M.Sc. candidates may submit to a qualifying examination and on recommendation, may be admitted to the Ph.D. program.

Direct Transfer from Master's to Ph.D. – Students enrolled in a Master's program (thesis) may transfer into the Ph.D. program without obtaining a Master's degree if they have satisfied the following:

1) they have been in the Master's program for less than 16 months;
2) they have satisfactorily passed all the required Master's courses, and given one seminar;
3) they have obtained a letter of recommendation from their supervisor;
4) they have passed a preliminary examination (as per the Ph.D. program).

M.Eng. (Project) Degree Metallurgy/Materials Option

The M.Eng. (Project) program (Metallurgy/Materials Option) consists of 45 credits of course work and projects. The package of courses undertaken will provide any necessary basic training and will be selected in consultation with the Program Advisor to satisfy the desired specialization of the candidate. The project courses may be undertaken in an industrial environment as a 4- to 8-month work term.

The program consists of a minimum of 12 credits of Departmental graduate level courses, 6 to 15 credits of M.Eng Metallurgy Project courses, the Metallurgical Engineering Seminar (306-670) and enough additional courses chosen from within or outside the Department to complete the 45 credit requirement. The external courses and project courses undertaken in an industrial environment are subject to Departmental approval. The program is established in consultation with the Program Advisor.

M.Eng. (Project) Degree Mining Option

The M.Eng. (Project) program (Mining Option) consists of 45 credits of course work and projects. It is primarily designed for graduates from mining engineering programs who have received adequate academic training in modern mining technology, Mineral Economics, Computer Programming and Probabilities and Statistics. Students without this academic training must follow a qualifying semester of courses (including 306-420 Feasibility Study) established by the Mining Program Director.

The program consists of a minimum 12 credits of Departmental graduate level courses, 6 to 15 credits of M.Eng Mining Project courses, the Mining Engineering Seminar (306-673) and enough additional courses chosen from within or outside the Department to complete the 45 credit requirement. The program is established in consultation with the Program Director. The external courses are subject to Departmental approval.

Ph.D. Degree

A candidate for this degree must pass courses assigned by the Department. These are selected on the basis of the student's previous academic training and research interests. The candidate is required to participate in an appropriate Research Seminar course and is expected to take a preliminary examination within the first year of his/her Ph.D. registration.

The candidate must submit an acceptable thesis based upon successfully completed research and must satisfy the examiners in an oral examination of the thesis and related topics.

50.6 Graduate Courses Offered by the Department

The courses in this Department have been numbered to conform with the following classification system. The first three digits (i.e., 306) represent the departmental code. The next digit represents the level of instruction. The last two digits are classified as follows:

01 to 19 technical courses
20 to 39 mining courses
40 to 49 mineral processing courses
50 to 59 extractive and process metallurgy courses
60 to 69 metallurgy and materials courses
70 to 79 seminars

Certain courses may be cancelled without notice; students should therefore consult the Department before registration. 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.

306-515A ADVANCED METALLURGICAL AND MATERIALS THERMODYNAMICS. (3) (Prerequisite: 306-212 or equivalent.) Computational thermodynamics including phase diagram estimation, Gibbs energy minimization and solution modelling are considered in view of the Facility of Chemical Thermodynamics (F*A*C*T) computer database. Students undertake projects developed in consultation with the instructor and prepare verbal and written reports.

306-520B STABILITY OF ROCK SLOPES. (3) (Prerequisite: permission of instructor.) The properties of rock masses and of structural discontinuities. Influence of geological structure on stability. Linear, non-linear, and wedge failures. Site investigations. Methods of slope stabilization.

306-521B,C,T STABILITY OF UNDERGROUND OPENINGS. (3) (Prerequisite: permission of instructor.) The properties of rock masses and stability classification systems. The influence and properties of geological structural features. Stability related to the design of underground openings and mining systems. Site investigations. Methods of stabilization.

● **306-524B MINERAL RESOURCE ECONOMICS.** (3) (Prerequisite: 306-310 or equivalent, or permission of instructor.)

306-526A,B MINERAL ECONOMICS. (3) (Prerequisite: 306-310) Mineral project evaluation techniques and applications. Topics covered include grade-tonnage relationships, capital and operating cost estimation techniques, assessment of mineral market conditions, taxation, discounted cash flow analysis, risk analysis, and optimization of project specifications with respect to capacity and cutoff grade. (Course given once per academic year.)

306-528B MINING AUTOMATION. (3) (Prerequisite: 306-426) System analysis and design in the frequency domain. Review of optimization methods. Mining system modelling applied to rock cutting, materials transport and bunkerage, and pitch, yaw and roll steering of mining machines. Control and robotics: digitization, discrete systems, sensors, actuators and real time algorithms, Data communications in mines. Simulation exercises.

306-544A MINERAL PROCESSING SYSTEMS I. (3) The course covers three main topics: principles of separation, including data presentation, properties of recovery/yield plots, technical and economic efficiency and identification of limits to separation; column flotation, hydrodynamics of collection and froth zones, mixing, scale-up and design, measurements and control; surface and electrochemistry, including adsorption, surface charge, coagulation, electron transfer reactions, electrochemistry in plant practice. Guest lectures on various specialized topics are also included.

306-545B MINERAL PROCESSING SYSTEMS II. (3) Gold recovery (as a Professional Development Seminar); methods of recovery or dissolution (gravity, flotation, cyanidation), refractory gold (roasting, pressure oxidation, bacterial leaching), dissolved gold recovery (Merrill-Crowe) and activated carbon methods. Sampling: definition of errors, sample extraction, size, and processing. Mass Balancing: basic considerations, definition of networks, software. Blending: auto-correlation functions, transfer functions, blending systems. Effect of feed variability.

● **306-551B ELECTROCHEMICAL PROCESSING.** (3) (Prerequisite: 306-352)

● **306-555A THERMAL REMEDIATION OF WASTES.** (3) (Prerequisite: 306-212)

306-560B JOINING PROCESSES. (3) (Prerequisite: 306-361 or equivalent.) Physics of joining; interfacial requirements; energy sources, chemical, mechanical and electrical; Homogeneous hot-joining, arc-, Mig-, Tig-, gas-, thermite- and Plasma-welding; Autogeneous hot-joining, forge-, pressure-, friction-, explosive-, electron beam- and laser-welding; Heterogeneous hot-joining, brazing, soldering, diffusion bonding; Heterogeneous cold joining, adhesives, mechanical fastening; Filler materials; Joint metallurgy; Heat affected zone, non-metallic systems; joint design and economics; defects and testing methods.

306-561A MATERIALS DESIGN AND SELECTION. (3) (Prerequisite: 306-362 or equivalent) Advanced topics in materials design problems. Discussion and laboratory work, supplemented by detailed technical reports. Special attention is given to selection, design and failure problems in various materials systems.

306-563A HOT DEFORMATION OF METALS. (3) (Prerequisite: 306-463 or equivalent.) A lecture and seminar course dealing with the high temperature mechanical properties of metals and alloys, with special emphasis on high strength low alloy steels. Topics covered include recovery and recrystallization; precipitation of microalloy carbonitrides; effect of alloy additions on high temperature mechanical properties, both as solutes and as precipitates; effect of multiple alloying; thermo-mechanical treatment and grain size control; examples of industrial controlled rolling schedules.

306-564B X-RAY DIFFRACTION ANALYSIS OF MATERIALS. (3) (Prerequisite: 306-317 or equivalent.) The techniques of X-ray and neutron diffraction are discussed as applied to the minerals and materials production industries. Special emphasis is placed upon automated X-ray powder diffractometry as employed for determining the structure and composition of materials. The application of X-ray techniques to studies of crystal structure, crystal orientation, residual stress, short-range order in liquid metals, phase diagram determination, order-disorder transformation and chemical analysis are presented.

● **306-565B INTRODUCTION TO CERAMIC ENGINEERING** (3)

306-566A TEXTURE, STRUCTURE AND PROPERTIES OF POLYCRYSTALLINE MATERIALS. (3) (Prerequisite: 306-317 or equivalent) Concepts and quantitative methods for the description of the structure of minerals and materials are discussed. Special emphasis is placed on experimental techniques of texture measurement. Procedures are demonstrated for the control of deformation and recrystallization textures in order to obtain the properties required of industrial products. Finally, the correlation between texture and the anisotropy of elastic, plastic and magnetic properties of engineering materials is described and analysed.

● **306-567B ALUMINUM CASTING ALLOYS.** (3) (Prerequisite: 306-361 or equivalent)

306-568B TOPICS IN ADVANCED MATERIALS. (3) (Prerequisite: 306-362 or equivalent) New and emerging materials. Composites. Coatings. Electronic materials. Current and future technologies. Specialised property requirements. Novel processing and fabrication techniques. Future developments.

306-569B ELECTRON BEAM ANALYSIS OF MATERIALS. (3) (Prerequisite: 306-317 or equivalent.) Applications of electron beam techniques in minerals and materials engineering are presented. Special emphasis is placed upon scanning and transmission electron microscopy, wavelength and energy dispersive electron probe microanalysis and quantitative image analysis techniques. Applications of electron diffraction, auger electron spectroscopy, E-beam lithography and associated techniques are also discussed. Students are encouraged to take a "hands-on" approach to instrumentation and to design a project suited to their own discipline involving the use of one or more of these techniques.

Courses at the 600 and 700 level require about 3 contact hours per week per semester or equivalent.

306-606A SELECTED TOPICS IN MINERAL/METAL PRODUCTION AND MARKETING I. (3) (Prerequisite: permission of instructor.) Introduction of new topics in Mining and Metallurgical Engineering.

306-608B SELECTED TOPICS IN MINERAL/METAL PRODUCTION AND MARKETING II. (3) (Prerequisite: permission of instructor.) Introduction of new topics in Mining and Metallurgical Engineering.

306-620A ROCK MECHANICS I. (3) A study of the effects of rock properties and ground stresses on problems in mine design.

306-621B ROCK MECHANICS II. (3) The application of the principles of strength of materials to the analysis of problems in ground control.

306-622A,B HEALTH AND SAFETY IN THE MINERAL INDUSTRY. (3) (Prerequisite: permission of instructor.) A comprehensive review of health, safety and engineering aspects of the mining environment. Radiation hazards and control; airborne contaminants and ventilation; dust control design; noise and vibration control; illumination theory and design. (Course given once per academic year.)

306-623A,B GROUND FRAGMENTATION. (3) (Prerequisite: permission of instructor.) A comprehensive review of principles and theory of explosives; rock information systems, cratering concepts and applications to mining. (Course given once per academic year.)

306-624D MATERIALS HANDLING IN MINES. (6) (Prerequisite: permission of instructor.) A comprehensive review of materials handling systems used in open pit and underground mines. Review of system selection criteria, and analysis of the impact of particular systems on mine design.

306-625A APPLIED MINERAL ECONOMICS I. (3) (Prerequisite: permission of instructor.) A study of analytical techniques employed for project evaluation and decision-making in the mineral industry.

306-627B APPLIED MINERAL ECONOMICS II. (3) (Prerequisite: permission of instructor.) A study of the techniques employed in the analysis of government policy and the financing of projects in the mineral industry.

306-628D,N,E,G MINING ENGINEERING PROJECT I. (6) A project of the student's choice, undertaken under the direct supervision of at least one staff member. The final mark is assessed on the basis of a final report which is examined internally, by the supervisor and at least one other staff member.

306-629D,N,E,G MINING ENGINEERING PROJECT II. (6) Continuation of Mining Engineering Project I.

306-633A INDUSTRIAL EXPLOSIVES. (4) (Prerequisite: 306-322 and/or Permission of instructor.) Development of industrial explosives and propellants, with particular application to mining, metallurgical and petroleum industries. Chemistry and physics of reactive materials; initiation and detonation process; commercial explosives; rock blasting and explosive energy transfer; specialized blasting techniques; explosive welding and forming; principles of shaped charges; miscellaneous industrial applications.

306-634A,B,L MINING ENGINEERING PROJECT III. (3) Continuation of Mining Engineering Project I.

306-635A THE FINITE ELEMENT METHOD IN ROCK MECHANICS. (4) (Prerequisites: 306-521 and/or permission of instructor.) Equilibrium equation solvers; elasticity theory; finite element formulative procedures; convergence and accuracy; 2-D and 3-D isoparametric elements; rock failure criteria; applications to rock/mining engineering; computer programming using available software library (FELIBS) and packages.

306-636B BOUNDARY ELEMENTS IN GEOMECHANICS. (4) (Prerequisite: 308-208 or equivalent, and 306-521 or permission of instructor.) Applications of boundary element methods in geomechanics. Elasticity relations. Coordinate transformations. Kelvin's problem, constant tractions, fictitious stress method, symmetry conditions. Displacement discontinuity method. Yield and deformation joint models. Stress and displacement analysis of underground openings in faulted rock. Initial joint deformation technique. Introduction to nonlinear analysis.

306-638A MINE WASTE MANAGEMENT. (4) Nature and generation of mine waste. Characteristics of mine waste material. Surface and underground disposal methods. Surface impoundment. Tailing embankment design and stability analysis. Seepage and containment transport. Seepage control methods. Site reclamation. Computer applications in design and monitoring. Case histories.

306-639B MANAGEMENT TECHNIQUES FOR ENGINEERING SERVICES OF MINING PROJECTS. (3) Project phases: preparation of proposals, feasibility studies, tender documents, instrumentation and monitoring during mine development. Project controls: organization charts, scheduling, quality assurance and control, site inspection. Engineering services: budget and manpower, performance analysis, maintenance and filing, policies and administrative procedures.

306-640D ADVANCED MINERAL PROCESSING. (6) Modern advances in mineral processing techniques. The student will prepare a series of reports covering developments in mineral processing.

● **306-650D TRANSPORT PHENOMENA IN PROCESS ENGINEERING METALLURGY.** (6)

306-652B AQUEOUS PROCESSING. (3) Advanced treatment of the chemical and engineering principles governing aqueous dissolution, purification and deposition operations. Topics include: ionic activities of dilute and concentrated solutions; solution and solid-liquid equilibria; analysis of complexation and redox reactions; high temperature solution thermodynamic kinetics; solvent extraction, equilibria and mass transfer kinetics; nucleation, growth and agglomeration phenomena in aqueous precipitation systems.

● **306-653A,B TRANSPORT PHENOMENA IN PROCESS METALLURGY.** (3)

306-657A ADVANCED EXTRACTIVE METALLURGY. (3) Field trips focusing on non ferrous metallurgy: energy considerations and minor elements in production and refining of aluminum, copper, gold, titania slag, zinc and other metals. Advanced technology and process design. Visits will reflect instructor's and students' interests.

306-670D RESEARCH SEMINAR. (6) For students registered for a Master's degree in Metallurgy.

306-672D ROCK MECHANICS AND GEOPHYSICS SEMINAR. (6) Theoretical and practical aspects of ground control practice using the case study method.

306-673D,N,E,G MINING ENGINEERING SEMINAR. (6) For students registered in the Graduate Diploma or Master's programs in Mining.

306-680D,E,G METALLURGICAL/MATERIALS ENGINEERING PROJECT I. (6)

306-681D,E,G METALLURGICAL/MATERIALS ENGINEERING PROJECT II. (6)

306-682A,B,C METALLURGICAL/MATERIALS ENGINEERING PROJECT III. (3)

306-690D,N,E,G,B THESIS RESEARCH I. (6)

306-691A,B,L THESIS RESEARCH II. (3)

306-692D,N,E,G,B THESIS RESEARCH III. (6)

306-693A,B,L THESIS RESEARCH IV. (3)

306-694D,N,E,G,B THESIS RESEARCH V. (6)

306-695A,B,L THESIS RESEARCH VI. (3)

306-701A,B,C,T PH.D. THESIS RESEARCH PROPOSAL (0) For students registered in a Ph.D. program in Metallurgy. Student submits a document and takes an oral examination to demonstrate familiarity with relevant literature, define a methodology and describe a work plan.

306-771D RESEARCH SEMINAR. (6) For students registered in a Ph.D. program in Metallurgy.

306-776D MINING RESEARCH SEMINAR. (6) For students registered in a Ph.D. program in Mining.

Undergraduate Courses

The following undergraduate courses are available to graduate students who have not taken an equivalent course. Please consult the Undergraduate Programs Calendar for descriptions.

306-200A MINING TECHNOLOGY.

306-320B EXTRACTION OF ENERGY RESOURCES.

306-322B ROCK FRAGMENTATION.

306-323B ROCK AND SOIL MASS CHARACTERIZATION.

306-419C OR T SURFACE MINING.

306-420B FEASIBILITY STUDY.

306-426C OR T DEVELOPMENT AND SERVICES.

306-341B INTRODUCTION TO MINERAL PROCESSING.

51 Music

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Website: http://www.music.mcgill.ca

Dean, Faculty of Music — Don McLean

Associate Dean (Academic) and Chair, Committee on Graduate Studies — TBA

Chair, Department of Theory — Wieslaw Woszczyk

Chair, Department of Performance — Gordon Foote

Associate Dean (Information Systems and Technology) — Bruce Minorgan

51.1 Staff

Emeritus Professors
Kelsey Jones; L.Mus., B.Mus.(Mt.All.), B.Mus., Mus.Dc.(Tor.)
Dorothy Morton; Graduate, Conservatoire de Musique de Québec

Professors
Brian Cherney; Mus.Bac., Mus.M., Ph.D.(Tor.)
Robert Gibson; B.S., M.F.A., Ph.D.(Minn.)
John Grew; L.T.C.L.(Lond.), B.Mus.(Mt. All.), M.Mus.(Mich.) D.D.(U.T.C.); LL.D.(Mt.All.); University Organist
Alcides Lanza ; Graduate, Instituto Torcuato Di Tella(Buenos Aires)
John Rea; B.Mus.(Wayne St.), M.Mus.(Tor.), M.F.A., Ph.D.(Prin.)
Charles Reiner; Graduate, Conservatoire de Genève
Wieslaw Woszczyk; M.A., Ph.D.(F. Chopin Academy of Music, Warsaw)

Associate Professors
Dale Bartlett; A.R.A.M.(Lond.), LL.D.(Leth.)
Pierre Béluse; Graduate, Conservatoire de Musique de Québec
Yehonatan Berick; B.Mus., Artist Dip.(Cinn.)
William Caplin; B.M.(S.Calif.), M.A., Ph.D.(Chic.)
Eugenia Costa-Giomi; Profesora Superior de Musica (National Cons., Buenos Aires), Ph.D.(Ohio)
Julie Cumming; B.A.(Col.), M.A., Ph.D.(Calif.)
Kevin Dean; B.M.E.(Iowa), M.Mus.(Miami)
Philippe Depalle; B.Sc.(Paris XI and ENS Cachan), D.E.A.(Le Mans and ENS Cachan), Ph.D.(Le Mans & IRCAM)
Iwan Edwards; B.Mus.(U.Coll. of Wales)
Lucile Evans; Dip.(Vincent d'Indy)
Gordon Foote; B.Sc., M.A.(Minn.)
Paul Helmer; B.A.(Tor.), M.A., Ph.D.(Col.)
Steven Huebner; B.A., B.Mus., L.Mus.(McG.), M.F.A., Ph.D.(Prin.)
Timothy Hutchins; Dip. L.G.S.M.(Guildhall), B.A.Hons.Mus.(Dal.), Principal Flute, Montreal Symphony
Jan Jarczyk; B.A., M.A.(Academy of Music, Cracow), Dip.(Berklee)
Abe Kestenberg
Hank Knox; B.Mus., M.Mus.(McG.)
Richard Lawton; B.Mus.(McG.), M.Mus.(Ind.)
Tamara Levitz; B.Mus.(McG.), M.A.(Technische Universität, Berlin), Ph.D.(Eastman)
Antonio Lysy; P.P.(Royal Northern Coll.), Dip.(Menuhin Academy, Gstaad), Performer's Dip.(Maast. Cons., Nether.)
Don McLean; Mus.Bac., M.A., Ph.D.(Tor.)
Michael McMahon; B.Mus.(McG.), Graduate, Hochschule für Musik(Vienna)
Douglas McNabney; B.Mus.(Tor.), M.M.(W.Ont.), Mus.Doc.(Montr.)
Marina Mdivani; Post-graduate Dip.(Moscow Cons.)
Bruce Minorgan; B.Mus.(Br.Col.), M.A.(Tor.)
William Neill; B.Mus., M.Mus.(Texas at Austin)
Louis-Philippe Pelletier; Premier Prix (Conservatoire de Musique de Québec)
Tom Plaunt; B.A.(Tor.), Graduate, Nordwestdeutsche Musikakademie (Detmold, Germany)
Marcel Saint-Cyr; B.A.(Laval), Premier Prix(Cons.de Mus. de Qué.), Concert Dip.(Hochschule für Musik, Karlsruhe)
Peter Schubert; B.A., M.A., Ph.D.(Col.)
Thérèse Sevadjian; B.Mus., M.Mus.(Montr.)
Jan Simons
Eleanor Stubley; B.Mus.(Tor.), M.Mus.(Bran.), Ph.D.(Illinois)
Joel Wapnick; B.A.(N.Y.), M.A.(S.U.N.Y.), M.F.A.(Sarah L.), Ed.D.(Syr.)
Thomas Williams; B.Mus.(Bran.)
John Zirbel; B.Mus.(Wis.), Principal Horn, Montreal Symphony
Luba Zuk; L.Mus.(McG.), Graduate, Conservatoire de Musique de Québec

Assistant Professors
Denys Bouliane; B.Mus., M.Mus.(Laval)
Jean Gaudreault; LL.L.(Montr.), Graduate, Conservatoire de Musique de Québec, Montreal Symphony.

Valerie Kinslow; B.A.(McG.)
John Klepko; B.F.A.(C'dia.), M.Mus., Ph.D.(McG.)
Denise Lupien; B.M., M.M.(Juilliard)
Chris McCann
Dennis Miller; Principal Tuba, Montreal Symphony
Richard Roberts; B.Mus.(Ind.); Concertmaster, Montreal Symphony
Dixie Ross-Neill; B.Mus.(N. Carolina), M.Mus.(Texas)
André Roy; Montreal Symphony
Joe Sullivan; B.A.(Ott.), M.M.(New England Cons.)
André White; B.A.(C'dia.), M.Mus.(McG.)

Adjunct Professor
Kenneth Gilbert; D.Mus.honoris causa(McG.), O.C., F.R.S.C., Hon RAM

51.2 Programs Offered

The Master of Arts degree (M.A.) is available as a thesis option in Music Education, Music Technology, Musicology, and Theory and as a non-thesis option in Music Education, Musicology, and Theory.

The Master of Music degree (M. Mus.) is available in Composition, Performance, and Sound Recording. Within the Performance option are offered specializations in: piano, guitar, orchestral instruments, organ, conducting, chamber music, orchestral training, piano accompaniment, vocal, opera, vocal pedagogy, early music, church music - organ, and jazz.

The Doctor of Music degree (D.Mus.) is offered in Composition and Performance Studies while the Doctor of Philosophy degree (Ph.D.) is available in Music Education, Musicology, Music Technology, Sound Recording and Theory. Interdisciplinary studies involving Musicology or Theory are encouraged.

There are opportunities for graduate students to obtain funding by being hired as assistants through the Faculty of Music. Positions are available as: teaching assistants, apprentice writers for program notes and Music McGill, sound recording technicians, dubbing technicians, correctors, and invigilators. Inquiries should be directed to the Chair of the Department of Theory or the Chair of the Department of Performance, as appropriate.

51.3 Admission Requirements

Masters' Degrees

Applicants for the Master's degree must hold a B.Mus. or a B.A. degree with a Major or Honours in Music including considerable work done in the area of specialization.

All applicants (except those for performance and sound recording) will be required to take placement examinations. Applicants found to be deficient in their background preparation may be required to take certain additional undergraduate courses.

Applicants to the Composition, Music Education, Music Technology, Musicology, Sound Recording, and Theory programs are requested to submit samples of work done in their special area.

Applicants to the Music Education program should normally have had two years of teaching experience.

All applicants to the Performance program will be required to pass an entrance audition. Only those applicants who clearly demonstrate the potential to become professional performers on their instruments will be admitted.

Applicants to the Vocal Pedagogy option should have a minimum of three to four years experience in studio teaching.

A reading knowledge of German is strongly recommended as a prerequisite for graduate work in Music Education, Musicology, and Theory.

Prerequisite Undergraduate Courses for M.Mus. – Sound Recording
In order to be considered for admission to the Master of Music in Sound Recording, students must attain a minimum grade of B in all of the courses listed below and must have a B.Mus. degree with a minimum CGPA of 3.00

Faculty of Music
213-260A Instruments of the Orchestra
216-202A Fundamentals of New Media
216-203B Introduction to Digital Audio
216-232A or B Introduction to Electronics
216-300D Introduction to Music Recording
216-339A or B Introduction to Electroacoustics

One of (Complementary):
216-302A New Music Production I
216-306A Music & Audio Computing I

Faculty of Science
198-224A Physics and Psychophysics of Music
198-225B Musical Acoustics

Prerequisite Undergraduate Courses for M.Mus. – Performance

Piano Accompaniment
An undergraduate major in Piano.
214-570 Research Methods in Music
One of:
214-372A or B Solo Song outside Germany & Austria
214-390A or B The German Lied
Two of:
242-210A Italian Diction (or equivalent)
242-211B French Diction (or equivalent)
242-212A English Diction (or equivalent)
242-213B German Diction (or equivalent)

Orchestral Conducting
213-260A Instruments of the Orchestra
213-261B Elementary Orchestration
213-460D Orchestration
214-389A or B Orchestral Literature
214-570 Research Methods in Music
223-201A String Techniques
223-202A Woodwind Techniques
223-203A or B Brass Techniques
223-204A or B Percussion Techniques
242-315D Introduction to Orchestral Conducting (or equivalent)

Choral Conducting
129-202D German
213-260A Instruments of the Orchestra
213-261B Elementary Orchestration
214-397A or B Choral Literature after 1750
214-570 Research Methods in Music
221-415B Choral Conducting II (or equivalent)
253-130A or B Voice Concentration

Wind Band Conducting
An undergraduate major in Wind or Percussion instruments
213-260A Instruments of the Orchestra
213-261B Elementary Orchestration
214-398A or B Wind Ensemble Literature after 1750
214-570 Research Methods in Music
223-202A Woodwind Techniques
223-203A or B Brass Techniques
223-204A or B Percussion Techniques
223-415B Instrumental Conducting II (or equivalent)

Early Music (Voice students only)
214-570 Research Methods in Music
Two of:
242-210A Italian Diction (or equivalent)
242-211B French Diction (or equivalent)
242-212A English Diction (or equivalent)
242-213B German Diction (or equivalent)

Jazz Performance
214-393A or B History of Jazz
240-440D Advanced Jazz Composition
240-461D Advanced Jazz Arranging
240-493A or B Jazz Performance Practice

D.Mus. Degree

Applicants for the D.Mus. degree in Composition must hold an M.Mus. degree in Composition, or its equivalent, and must submit scores and/or tapes of their compositions at the time of application. Applicants for the D.Mus. degree in Performance Studies must hold an M.Mus. degree in Performance, or its equivalent, and will be required to pass an entrance audition.

Ph.D. Degree

Applicants for the Ph.D. degree must hold an M.A., or a Bachelor's degree equivalent to a McGill Honours degree, in Music Education, Music History, or Theory. Applicants with a Bachelor's degree will normally be admitted to the M.A. program for the first year and may apply for admittance to the Ph.D. program after the completion of one full year of graduate course work. Qualified applicants who have already completed an appropriate Master's degree will be admitted to the second year of the program.

51.4 Application Procedures

Applications will be considered upon receipt of:

1. application form;
2. transcripts;
3. letters of reference;
4. $60 application fee;
5. $50 audition fee;
6. submissions appropriate to area of specialization;
7. TOEFL test results.

All information is to be submitted to Veronica Slobodian, Admissions Officer, Faculty of Music.

Deadline date for submission of application and accompanying documentation is January 15.

All applicants are requested to submit samples of their work completed during their previous studies. Those applying for the first time will be required to take placement examinations.

51.5 Program Requirements

Masters' Degrees

The minimum residence requirement for Masters' programs is 1½ years (3 full-time terms); for Sound Recording, 2 years (4 full-time terms). In all programs a minimum number of formal courses are prescribed. The student's major work is expected to be thesis, research, composition or performance which will be done under the supervision of an adviser. This work, as well as any additional courses and/or individual study which the Department considers necessary, constitutes the central part of each program.

Applicants who hold the equivalent of a McGill B.Mus. with Honours in the area of specialization may be able to complete the Master's degree in less than two years.

Master of Music – Composition (thesis) (48 credits)
213-622D Composition Tutorial.
Two of 213-631A, 213-632B, 213-633A, 213-634B, 213-635A, 213-636B Seminar in 20th-Century Music.
Two approved 3-credit electives or the equivalent.
Language reading examination in one of: French, German, or Italian. Students whose mother tongue is French are exempt from the French Language Reading examination.
Thesis (30 credits). The thesis is a composition, accompanied by an analytical essay of approximately 20 to 30 pages.

M.A. in Music – Music Education (thesis) (48 credits)
Five 3-credit courses approved by the Department, normally three of these will be Seminars in Music Education.
Thesis (33 credits). The candidate will undertake supervised research leading to a thesis which will be an in-depth investigation in some specialized field of music education.

M.A. in Music – Music Technology (thesis) (48 credits)
216-605A or B Digital Sound Synthesis & Audio Processing.
Two of 216-610A, 216-611B, 216-612A, 216-613B, 216-614A, 216-615B Computer Music Seminar.
Two 3-credit electives, approved by the Department.
Thesis (33 credits). The candidate will undertake supervised research leading to a thesis which will utilize or investigate computer applications in one of the following areas of music study and practice: performance, jazz, sound recording, theory, composition, music education, musicology.

M.A. in Music – Musicology (thesis) (48 credits)
Four 3-credit courses approved by the Department, normally at least two of these will be Seminars in Musicology.
214-529 Proseminar in Musicology.
Thesis (33 credits). The candidate will undertake supervised research leading to a thesis which will be an in-depth investigation in some specialized field of musicology.

Master of Music – Sound Recording (non-thesis) (60 credits)
Required Courses (51 credits)

216-629D	(4)	Technical Ear Training
216-667A or B	(3)	Digital Studio Technology
216-668A or B	(3)	Digital/Analog Audio Editing
216-669A or B	(3)	Topics - Classical Music Recording
216-670D	(10)	Recording Theory & Practice I
216-671D	(10)	Recording Theory & Practice II
216-672D	(6)	Analysis of Recordings
216-674A or B	(3)	Electronic and Electroacoustic Meas.
216-677D	(6)	Audio for Video Post-Production
216-678B	(3)	Advanced Digital Editing and Post-Production

Elective Courses (9 credits)
three 3-credit graduate electives

Note: A reorganization of the program under the designation "Music, Media and Technology" is currently under consideration.

M.A. in Music – Theory (thesis) (48 credits)
Five 3-credit courses approved by the Department, normally three will be Seminars in Music Theory and either 211-658 History of Music Theory I or 211-659 History of Music Theory II
Thesis (33 credits). The candidate will undertake supervised research leading to a thesis which will be an in-depth investigation in some specialized field of music theory.

Non-thesis M.A. in Music (options in Music Education, Musicology, and Theory) (45 credits)

Seven 3-credit courses approved by the appropriate Area, four of which must be in the Area itself.
- For students in the Musicology Area, one of the courses must be 214-529 Proseminar in Musicology.
- For students in the Theory Area, one of the courses must be 211-658 History of Music Theory I or 211-659 History of Music Theory II.
- For students in Music Education, and with the approval of the Music Education Area, two of the seven 3-credit courses may be taken in the Faculty of Education.

219-614 Reading Course I and 219-615 Reading Course II.
219-635 Research Paper I and 219-636 Research Paper II.

Master of Music – Performance
Solo – Piano, Guitar, Orchestral Instruments, Organ, Conducting (45 credits)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance Practice Seminar.
Electives:
- One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
- One additional graduate 3-credit seminar.

Recitals:
- 242-660 Solo Recital I and 242-667 Solo Recital II (one of these could optionally include some chamber music).

(Wind Band Conducting – not available 1999-2000)

Master of Music – Performance
Chamber Music (48 credits)
(All instruments except Early Music Instruments, Organ, Harp and Double Bass.)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance Practice Seminar.
Electives:
One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar.
Recitals:
242-661 Chamber Music Recital I and 242-668 Chamber Music Recital II (one of these could optionally include some solo music).
Ensembles:
Three terms of 243-660 Chamber Music Ensemble.

Master of Music – Performance
Orchestral Training (45 credits)
(all orchestral instruments except Harp.)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance
Practice Seminar.
Electives:
One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar.
Recital/Exam:
242-660 Solo Recital I and 242-664 Repertoire Examination.
Ensembles:
Three terms of 243-697 Orchestra.

Master of Music – Performance
Piano Accompaniment (45 credits)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance
Practice Seminar **or** 253-690A or B Vocal Styles & Conventions.
Electives:
One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar.
Recital/Exam:
242-665 Accompanying Recital I and 242-663 Quick Study (to be successfully completed before the first recital is performed).
Ensembles:
Two terms of 243-679 Song Interpretation and 243-684 Studio Accompanying
or **three terms** of 243-596 Opera Repetiteur.

Master of Music – Performance
Vocal Performance (49 credits)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance Practice Seminar **or** 253-690A or B Vocal Styles & Conventions.
Electives:
One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar (this must have the prefix 253-).
Recitals:
242-660 Solo Recital I and 242-667 Solo Recital II.
253-600A and 253-601B Vocal Repertoire Coaching.

Master of Music – Performance
Opera Performance (45 credits)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance Practice Seminar **or** 253-690A or B Vocal Styles & Conventions.
Electives:
One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar (this must have the prefix 253-).
Recital:
242-660 Solo Recital I and 242-658 Opera Performance Examination.
Ensembles:
Three terms of 243-696 Opera Theatre.

Master of Music – Performance
Vocal Pedagogy (47 credits)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance Practice Seminar **or** 253-690A or B Vocal Styles & Conventions.

Electives:
One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar (this must have the prefix 253-).
Recital:
242-660 Solo Recital I.
242-611A, 242-612B, 242-613A Directed Teaching
242-650D Pedagogy Workshop.
253-600A or 253-601B Vocal Repertoire Coaching.

Master of Music – Performance
Early Music (48 credits)
(Voice, baroque flute, recorder, baroque oboe, baroque violin, baroque viola, baroque cello, viola da gamba, harpsichord)

242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance Practice Seminar.
Electives:
One graduate 3-credit seminar with the prefix 211-, 213-, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar.
Recitals:
242-660 Solo Recital I and 242-662 Solo and Chamber Music Recital.
Ensembles:
Three terms of 243-661 Early Chamber Music Ensemble.

Master of Music – Performance
Church Music - Organ (45 credits)
242-620A, 242-621B, 242-622A Performance Tutorials.
One of 215-690A, 215-691B, 215-692A, 215-693B, 215-694A or 215-695B Performance Practice Seminar.
Electives:
One graduate 3-credit seminar with the prefix 211-, 213, 214-, 215-, 219-, 222-.
One additional graduate 3-credit seminar.
Recital:
242-660D Solo Recital I.
Courses:
242-676D Special Project in Performance II
Ensembles:
Three terms of 243-693 Choral Ensemble.

Master of Music – Performance
Jazz Performance (47 credits)
(Saxophone, Trumpet, Trombone, Drums, Piano, Guitar, Bass, Voice)

242-620A, 242-621B, 242-622A (1 hour/week)
Recital:
242-660 Solo Recital I

242-659D Performance in Recording Media
Ensemble:
243-695A and B Jazz Ensemble.
Courses:
240-601A or B Jazz Pedagogy
240-640D Jazz Composition & Arranging

Courses approved as electives for M.Mus. students in Performance:
211-652A Seminar in Music Theory I
211-653B Seminar in Music Theory II
211-654A Seminar in Music Theory III
211-655B Seminar in Music Theory IV
211-656A Seminar in Music Theory V
211-657B Seminar in Music Theory VI
211-658A History of Music Theory I
211-659B History of Music Theory II
213-552A Computer Applications in Music
213-623A Electronic Music Seminar I
213-624B Electronic Music Seminar II
213-631A Seminar in 20th-Century Music I
213-632B Seminar in 20th-Century Music II
213-633A Seminar in 20th-Century Music III
213-634B Seminar in 20th-Century Music IV
213-635A Seminar in 20th-Century Music V
213-636B Seminar in 20th-Century Music VI
214-591D Paleography
214-653B Music Aesthetics and Criticism
214-680A Seminar in Musicology I
214-681B Seminar in Musicology II
214-682A Seminar in Musicology III
214-683B Seminar in Musicology IV
214-684A Seminar in Musicology V
214-685B Seminar in Musicology VI
214-692A Seminar in Music Literature I
214-693B Seminar in Music Literature II
214-694A Seminar in Music Literature III
214-695B Seminar in Music Literature IV
214-696A Seminar in Music Literature V
214-697B Seminar in Music Literature VI
215-690A Performance Practice Seminar I
215-691B Performance Practice Seminar II
215-692A Performance Practice Seminar III
215-693B Performance Practice Seminar IV
215-694A Performance Practice Seminar V
215-695B Performance Practice Seminar VI
222-610A Seminar in Music Education I
222-611B Seminar in Music Education II
222-612A Seminar in Music Education III
222-613B Seminar in Music Education IV

Doctor of Music (D.Mus.) Degree Requirements - Composition

A minimum of two years' residence is required beyond the M.Mus. in Composition, or its equivalent.
213-722D Doctoral Composition Tutorial (for two years).
Four approved 3-credit electives or the equivalent.
219-701D Doctoral Oral Comprehensive Examination and 219-702D Doctoral Written Comprehensive Examination.
Composition Performance. The candidate must present a concert of his/her compositions. With the permission of the Committee on Graduate Studies, the compositions may be presented as parts of two or three concerts.
Thesis. A musical composition of major dimensions together with a written analysis of the work. The thesis must be defended in an oral examination.

Details concerning the comprehensive examinations, composition performance, thesis and academic regulations are available from the Admissions Officer, Faculty of Music or the Secretary for Graduate Studies, Faculty of Music.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of three years of full-time resident study (6 full-time terms) beyond a Bachelor's degree. A candidate who holds a Master's degree in the area of specialization may, on the recommendation of the Department, be permitted to count the work done for the Master's degree as the first year of resident study.

Ten 3-credit courses approved by the Department (the Doctoral Tutorial will be considered a course for purposes of this requirement). Applicants who have completed an M.A. degree before entering the Ph.D. program will be required to complete at least five approved 3-credit courses beyond the M.A. requirements.
Language reading examinations in two foreign languages (one foreign language for students in music education; none required for students in music technologies). Normally, one of these will be German and the other related to the candidate's field of research. A third language may be required if considered necessary for the candidate's research. Students whose mother tongue is French are exempt from the French Language Reading examination.
Comprehensive examinations, both written and oral. The language reading examinations must be passed before a candidate will be permitted to sit the Comprehensive Examinations.
Participation in 219-705D Colloquium.
Doctoral Dissertation. All courses and language requirements and the comprehensive examinations must be successfully completed before the dissertation is submitted.

51.6 Graduate Courses

SEMINARS
Topics for graduate seminars vary from year to year and are normally chosen according to the individual instructor's areas of research expertise. A list of detailed seminar descriptions can be obtained from the Secretary for Graduate Studies prior to fall registration. The following sampling of seminars given in recent years (though not necessarily to be offered in the upcoming year) indicate the scope of course offerings. (Enrolment in seminars will normally be limited to 10.)

Seminar in Music Literature: The Music of Bela Bartok; The Symphonies of Beethoven; The Nineteenth-century French Symphony; The Choral Music of Johannes Brahms; French opera from Carmen to Pelléas

Seminar in Music Theory: Theory and Analysis of Classical Form; Mathematical Set and Group Theory Models; Theories of Musical Rhythm and Meter

Seminar in Musicology: Beethoven Style Periods; The "Roman de Fauvel"; The German Lied; Problems in Verdi Studies

Seminar in Performance Practice: Late Renaissance Performance Practice; Baroque Performance Practice; Performance Practice of the Beethoven Piano Sonatas

Seminar in Music Education: Music Criticism and Music Education; Musical Ability; Aesthetics, Music, and Music Education

Seminar in Twentieth Century Music: Music After 1945; The Symphony in the Twentieth Century; The Music of Olivier Messiaen

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.

Not all courses listed below will be offered in 2001-02; for an up-to-date listing, please consult the final Music Graduate Course Timetable for 2001-02.

- **211-641A ADVANCED COUNTERPOINT I.** (3) (2 hours)
- **211-642B ADVANCED COUNTERPOINT II.** (3) (2 hours)

211-648A THEORY TUTORIAL. (3)

211-649B THEORY TUTORIAL. (3)

211-652A SEMINAR IN MUSIC THEORY I. (3) (3 hours)

211-653B SEMINAR IN MUSIC THEORY II. (3) (3 hours)

211-654A SEMINAR IN MUSIC THEORY III. (3) (3 hours)

211-655B SEMINAR IN MUSIC THEORY IV. (3) (3 hours)

211-656A SEMINAR IN MUSIC THEORY V. (3) (3 hours)

211-657B SEMINAR IN MUSIC THEORY VI. (3) (3 hours)

211-658A HISTORY OF MUSIC THEORY I. (3) (3 hours) Selected topics in the history of music theory from Greek antiquity to 1700 through readings of primary and secondary literature.

211-659B HISTORY OF MUSIC THEORY II. (3) (3 hours) Selected topics in the history of music theory from 1700 to the present through readings of primary and secondary literature.

213-552A COMPUTER APPLICATIONS IN MUSIC. (3) (3 hours)

213-622D COMPOSITION TUTORIAL. (6)

- **213-623A ELECTRONIC MUSIC SEMINAR I.** (3) (3 hours seminar, 6 hours studio time)
- **213-624B ELECTRONIC MUSIC SEMINAR II.** (3) (3 hours seminar, 6 hours studio time)
- **213-625D MUSIC NOTATION SEMINAR.** (6) (3 hours)

213-631A SEMINAR IN 20TH-CENTURY MUSIC I. (3) (3 hours)

213-632B SEMINAR IN 20TH-CENTURY MUSIC II. (3) (3 hours)

213-633A SEMINAR IN 20TH-CENTURY MUSIC III. (3) (3 hours)

213-634B SEMINAR IN 20TH-CENTURY MUSIC IV. (3) (3 hours)

213-635A SEMINAR IN 20TH-CENTURY MUSIC V. (3) (3 hours)

213-636B SEMINAR IN 20TH-CENTURY MUSIC VI. (3) (3 hours)

213-722D DOCTORAL COMPOSITION TUTORIAL.

- **214-653B MUSIC AESTHETICS AND CRITICISM.** (3) (3 hours)

214-678A MUSICOLOGY TUTORIAL. (3)

214-679B MUSICOLOGY TUTORIAL. (3)

214-680A SEMINAR IN MUSICOLOGY I. (3) (3 hours)

214-681B SEMINAR IN MUSICOLOGY II. (3) (3 hours)

214-682A SEMINAR IN MUSICOLOGY III. (3) (3 hours)

214-683B SEMINAR IN MUSICOLOGY IV. (3) (3 hours)

214-684A SEMINAR IN MUSICOLOGY V. (3) (3 hours)

214-685B SEMINAR IN MUSICOLOGY VI. (3) (3 hours)

214-692A SEMINAR IN MUSIC LITERATURE I. (3) (3 hours)

214-693B SEMINAR IN MUSIC LITERATURE II. (3) (3 hours)

214-694A SEMINAR IN MUSIC LITERATURE III. (3) (3 hours)

214-695B SEMINAR IN MUSIC LITERATURE IV. (3) (3 hours)

214-696A SEMINAR IN MUSIC LITERATURE V. (3) (3 hours)

214-697B SEMINAR IN MUSIC LITERATURE VI. (3) (3 hours)

215-690A PERFORMANCE PRACTICE SEMINAR I. (3) (3 hours)

215-691B PERFORMANCE PRACTICE SEMINAR II. (3) (3 hours)

215-692A PERFORMANCE PRACTICE SEMINAR III. (3) (3 hours)

215-693B PERFORMANCE PRACTICE SEMINAR IV. (3) (3 hours)

215-694A PERFORMANCE PRACTICE SEMINAR V. (3) (3 hours)

215-695B PERFORMANCE PRACTICE SEMINAR VI. (3) (3 hours)

216-605A OR B DIGIT (SOUND) SYNTH & AUDIO PROCESS. (3) (3 hours) Basic principles of digital sound synthesis including techniques such as additive synthesis, frequency modulation, tuned resonators, waveshaping and digital audio processing techniques including simple delay systems, filters, reverberators, spatial controllers, etc. will be explored.

216-609A OR B MUSIC, MEDIA & TECHNOLOGY PROJECT. (3) (3 research/project hours) Independent music technology project. Students will prepare a statement of objectives, a comprehensive project design and a schedule of work, and will undertake the project on appropriate music technology platforms.

216-610A COMPUTER MUSIC SEMINAR I. (3) (3 hours) Advanced topics in computer applications in music will be examined. Students will be expected to 1) present critical analyses of current research and 2) develop and implement software demonstrations.

216-611B COMPUTER MUSIC SEMINAR II. (3) (3 hours)

216-612A COMPUTER MUSIC SEMINAR III. (3) (3 hours)

216-613B COMPUTER MUSIC SEMINAR IV. (3) (3 hours)

216-614A COMPUTER MUSIC SEMINAR V. (3) (3 hours)

216-615B COMPUTER MUSIC SEMINAR VI. (3) (3 hours)

216-629D TECHNICAL EAR TRAINING. (4) (1 hour tutorial, 2 hours laboratory) This course will, through a sequence of specific auditory exercises, develop and improve students' aural sensitivity to small changes in sound quality. Students train to identify spectral variables in sound, develop stable reference of sound quality and learn about spectral characteristics of musical instruments.

216-631D ADVANCED TECHNICAL EAR TRAINING. (4) (1 hour tutorial, 2 hours laboratory) (Prerequisite: 216-629D) Included in this course are exercises for developing some of the following aural skills: identification and quantification of spatial parameters of sound image, nonlinear and transient distortion audibility, identification of coherent and incoherent noise, sound source identification in complex textures, sound enhancement and reconstruction.

216-667A OR B DIGITAL STUDIO TECHNOLOGY. (3) (3 hours lecture) Technical and operational characteristics of different digital recording systems currently employed by the recording industry.

216-668A OR B DIGITAL/ANALOG AUDIO EDITING. (3) (1 hour tutorial, 3 hours studio time) Using analog and digital record/playback equipment, students learn, through practice, the art of replacing, patching, rebalancing, reconstructing, or generally speaking, improving recorded music through editing. Teaching will include cut and splice editing, disk-based editing, and editing by transfer and mixing.

216-669A,B,D TOPICS – CLASSICAL MUSIC RECORDING. (3) (3 hours lecture) Issues involving classical music recording. Topics may include: analysis of performance styles, acoustics of concert halls, production of music videos, seminars with recording producers, tonmeisters, classical music in multimedia, and others.

216-670D RECORDING THEORY & PRACTICE I. (10) (3 hours seminar, 6 hours studio time) (Prerequisite: 216-300D) Theoretical and practice study of recording equipment, procedures and techniques. Recording sessions and live stereo recording, using the recording studio, concert hall and portable equipment for on-location recording. Also included will be an introduction to the areas of radio drama, broadcast recording and radio commercials.

216-671D RECORDING THEORY & PRACTICE II. (10) (3 hours seminar, 6 hours studio time) (Prerequisite: 216-670D) Emphasis on multi-track recording theory and practice. The course will also concentrate on expanded multi-track procedures: signal processing, overdubbing, mixing, editing, and producing.

216-672D ANALYSIS OF RECORDINGS. (6) (3 hours) The analysis of recording engineering, production, performance, aesthetics and technical quality of selected recordings.

216-674A OR B ELECTRONIC & ELECTROACOUSTIC MEAS. (3) (1½ hours lecture, 1½ hours laboratory) This course demonstrates the instruments, measurement procedures, and techniques used in a recording studio to determine the acoustical properties of a room and the transfer functions of devices used in a studio. Theoretical lectures on electronic test instrumentation and measurement methods are combined with practical application.

216-676A,B,D AUDIO INDUSTRY EXPERIENCE. (3)

216-677D AUDIO FOR VIDEO POST-PRODUCTION. (6) (3 hours seminar, 4 hours studio time) Theoretical study includes historical analysis of sound for image, audio post-production process for film and video, aesthetic and technical considerations in sound design, time code and synchronization, and final mix formats. Practical skills include field recording, sound library management, sound design, dialog, effects and music editing, and final mix process.

216-678B ADV. DIGITAL EDIT. & POST-PRODUCT. (3) (3 hours) (Prerequisite: 216-668) This course covers advanced concepts and techniques of audio post-production using digital worksta-

tions. Students practise the assembly of raw material into a complete final product through editing, signal processing, mixing, sound restoration and pre-mastering.

216-690A MEDIA THEORY & PRACTICE SEMINAR I. (3) (3 hours) Topics vary from year to year and are normally chosen according to the individual instructor's area of expertise. Topics to be covered may include the following: Media Technology, Digital Restoration of Archival Recordings, Communications Systems and Standards, Audio Aesthetics of Video Musicals, Classical Music and the Television Medium, etc.

216-691B MEDIA THEORY & PRACTICE SEMINAR II. (3) (3 hours)

216-692A MEDIA THEORY & PRACTICE SEMINAR III. (3) (3 hours)

216-693B MEDIA THEORY & PRACTICE SEMINAR IV. (3) (3 hours)

216-694A MEDIA THEORY & PRACTICE SEMINAR V. (3) (3 hours)

216-695B MEDIA THEORY & PRACTICE SEMINAR VI. (3) (3 hours)

219-614A OR B READING COURSE I. (3) Independent study of an approved topic or topics under the guidance of a supervisor. Topics will be chosen to suit individual needs and interests. The extent of reading, synthesis, and reporting will be agreed upon by the supervisor and the student at the beginning of the course.

219-615A OR B READING COURSE II. (3)

219-635A,B,D RESEARCH PAPER I. (9)

219-636A,B,D, RESEARCH PAPER II. (9)

219-675A,B,D SPECIAL PROJECT. (3)

219-676A,B,D SPECIAL PROJECT. (6)

219-694A,B SPECIAL TOPIC SEMINAR. (3) (3 hours)

219-695A,B SPECIAL TOPIC SEMINAR. (3) (3 hours)

219-701A,B,C,D DOCTORAL ORAL COMP. EXAM.

219-702A,B,C,D DOCTORAL WRITTEN COMP. EXAM.

219-705D COLLOQUIUM.

219-749A DOCTORAL TUTORIAL.

219-750B DOCTORAL TUTORIAL.

221-602A SEMINAR IN CHORAL TECHNIQUES. (3) (3 hours)

221-603B SEMINAR IN CHORAL TECHNIQUES. (3) (3 hours)

222-610A SEMINAR IN MUSIC EDUCATION I. (3) (3 hours)

222-611B SEMINAR IN MUSIC EDUCATION II. (3) (3 hours)

222-612A SEMINAR IN MUSIC EDUCATION III. (3) (3 hours)

222-613B SEMINAR IN MUSIC EDUCATION IV. (3) (3 hours)

222-618A MUSIC EDUCATION TUTORIAL I. (3)

222-619B MUSIC EDUCATION TUTORIAL II. (3)

- **223-606A SEMINAR IN ORCHESTRA/BAND TECH.** (3) (3 hours)
- **223-607B SEMINAR IN ORCHESTRA/BAND TECH.** (3) (3 hours)

240-601A OR B JAZZ PEDAGOGY. (3) (3 hours) A course designed to prepare students to teach jazz-related subjects at the university and professional level, with emphasis on ensemble direction and the instruction of improvisation, as well as course and curriculum development. Various pedagogical methods, philosophies, rehearsal techniques, and materials will be investigated.

240-640D JAZZ COMPOSITION & ARRANGING. (4) (2 hours) A course intended to guide the student towards an individual musical style. A variety of jazz compositional and arranging techniques will be explored.

242-603A,B BRASS INSTRUMENT PERF. & REPERTOIRE. (3) (3 hours) Designed for the brass performer/prospective teacher. Emphasis on a wide variety of brass literature and performance practice: solos, pedagogical materials, and chamber music for various levels of performance.

242-611A DIRECTED TEACHING I. (2) (1 hour)

242-612B DIRECTED TEACHING II. (2) (1 hour)

242-613A DIRECTED TEACHING III. (2) (1 hour)

242-614B DIRECTED TEACHING IV. (2) (1 hour)

242-615A,B MASTER CLASS – ORCHESTRAL CONDUCTING. (3) (3 hours) Advanced stick techniques, score preparation, stylistic concerns and rehearsal techniques will be discussed with reference to selected major works from the 18th, 19th, and 20th century orchestral repertoire. Emphasis will be placed on practical considerations.

242-616A,B MASTER CLASS – CHORAL CONDUCTING. (3) (3 hours) To focus on the problems of advanced choral repertoire, e.g., conducting techniques, score analysis, choral sound and textual criticism. Repertoire will include representative works from Medieval music to the present day.

242-620A PERFORMANCE TUTORIAL I. (4)

242-621B PERFORMANCE TUTORIAL II. (4)

242-622A PERFORMANCE TUTORIAL III. (4)

242-623B PERFORMANCE TUTORIAL IV. (4)

242-624A PERFORMANCE TUTORIAL V. (4)

242-630A PERFORMANCE TUTORIAL VI. (6)

242-631B PERFORMANCE TUTORIAL VII. (6)

242-632A PERFORMANCE TUTORIAL VIII. (6)

242-633B PERFORMANCE TUTORIAL IX. (6)

242-650D PEDAGOGY WORKSHOP. (6) (1½ hours) Teaching of one or more students chosen in consultation with the respective area, and a presentation on an approved topic of the candidate's choice.

242-658A,B,C,D OPERA PERFORMANCE EXAMINATION. (6) The student performs a major role in a public performance of a full-length opera. To be marked on a pass-fail basis.

242-659D PERFORMANCE IN RECORDING MEDIA. (12) The candidate must submit a 60-75 minute audio and/or video document of his or her performances, compiled from various media sources. This might include radio, television, and/or studio recordings. All of the music must be composed and arranged by the candidate.

242-660D SOLO RECITAL I. (12)

242-661D CHAMBER MUSIC RECITAL I. (12)

242-662D SOLO AND CHAMBER MUSIC RECITAL. (12)

242-663A,B,C,D QUICK STUDY. (6) (To be successfully completed before the first recital is performed.)

242-664A,B,C,D REPERTOIRE EXAMINATION. (6)

242-665D ACCOMPANYING RECITAL I. (12)

242-667D SOLO RECITAL II. (12)

242-668D CHAMBER MUSIC RECITAL II. (12)

- **242-669D ACCOMPANYING RECITAL II.** (12)

242-672D LITURGICAL IMPROVISATION. (3) (1½ hours) The study and practice of cantus firmus-based improvisation according to selected stylistic models so as to provide diversity of techniques, styles and tonalities. Free improvisation is studied in conjunction with C.F. improvisation. Modulation is taught in both C.F.-based and free improvisation; emphasis being placed on clarity and liturgical appropriateness.

242-673A,B 20TH-CENTURY ORGAN IMPROVISATION. (3) (3 hours seminar) The relationship between creative improvisation and composition will be examined. Students will develop their knowledge of timbre and dynamics as structural elements. Three different organs will be used to familiarize the students with different aspects of improvisation in different situations.

242-674A,B SEMINAR IN ORGAN REGISTRATION. (3) (3 hours) Organ registration from the late Gothic through the symphonic tradition of the 19th century will be discussed. Special attention will be given to the national building styles of German, French, Italian and Iberian organs and their evolution from the Renaissance to the 20th century.

242-675A,B,D, SPECIAL PROJECT IN PERFORMANCE I. (3)

242-676D SPECIAL PROJECT IN PERFORMANCE II. (6)

242-677A SEMINAR IN PERFORMANCE TOPICS I. (3) (3 hours)

242-678B SEMINAR IN PERFORMANCE TOPICS II. (3) (3 hours)

242-683A,B THE PIANIST AS PARTNER. (3) (3 hours) Studies in the role of the pianist in partnership with an instrumentalist or singer, with emphasis given to preparation of works for performance. These studies will include a survey of repertoire, comparison of

styles, and a basic knowledge of other instruments. Performance of work(s) studied is a requirement for the course.

242-685A,B MASTER CLASS – 20TH-CENTURY PIANO MUSIC. (3) (3 hours) Students will explore the piano repertoire of the 20th century. Repertoire will include such diverse music as that of Milhaud, Ives, Boulez, Berio, etc., as well as the recent Canadian music of Tremblay, Mather, etc. Performance of work(s) studied is a requirement for the course.

242-686A,B MASTER CLASS – STRING CHAMBER MUSIC. (3) (3 hours) Advanced studies of the chamber music repertoire, intended for graduate string players. Students will gain firsthand experience playing, reading (in rotation) and studying works both with their colleagues and occasionally with the instructor; discussion of master recordings and active listening with scores.

242-687A,B DEVELOPMENT – WOODWIND INSTRUMENTS. (3) (3 hours) This course traces the technical, mechanical, and tonal development of woodwinds from antiquity to modern times, and will include performance and discussion of alternate fingerings, addition of ringed keys, different bore designs, Bartolozzi techniques, etc., as well as changes in orchestral function and style.

242-696A,B TECHNICAL LITERATURE FOR PIANO. (3) (3 hours) Studies of published works on piano performance technique and interpretation. Students will read and discuss selected texts as well as make individual reports on particular studies on technical schools or methods.

242-698A,B 20TH-CENTURY WIND REPERTOIRE. (3) (3 hours) A study of performance problems related to small mixed wind ensembles and wind band repertoire of the late 20th century. Special emphasis will be given to score reading, performance and notational problems, interpretation, and efficient rehearsal procedures.

242-699D CHURCH SERVICE PLAYING. (4) (2 hours) The course is designed to assist organists in developing the skills necessary to accompany church services. All aspects of liturgical music will be dealt with including hymns, Psalms (both Gregorian and Anglican chant), Mass settings, anthem accompaniment, and adaptation of orchestral scores to the organ.

242-720A,B,C PERFORMANCE TUTORIAL 1. (4)

242-721A,B,C PERFORMANCE TUTORIAL 2. (4)

242-722A,B,C PERFORMANCE TUTORIAL 3. (4)

242-723A,B,C PERFORMANCE TUTORIAL 4. (4)

242-724A,B,C PERFORMANCE TUTORIAL 5. (4)

242-725A,B,C PERFORMANCE TUTORIAL 6. (4)

242-730A,B,C PERFORMANCE TUTORIAL 7. (6)

242-731A,B,C PERFORMANCE TUTORIAL 8. (6)

242-732A,B,C PERFORMANCE TUTORIAL 9. (6)

242-733A,B,C PERFORMANCE TUTORIAL 10. (6)

242-760A,B,C DOCTORAL RECITAL 1. (12)

242-767A,B,C DOCTORAL RECITAL 2. (12)

242-770A,B,C LECTURE-RECITAL PROJECT. (12)

243-660A,B CHAMBER MUSIC ENSEMBLE. (1)

243-661A,B EARLY MUSIC CHAMBER MUSIC ENSEMBLE. (1) (Prerequisite: Audition; 1 hour) Chamber music of theMedieval, Renaissance and Baroque periods.

● **243-671A,B MEDIEVAL & RENAISSANCE MUSIC WORKSHOP.** (2) (4 hours) (Prerequisite: Audition)

243-672A,B CAPPELLA ANTICA. (2) (4 hours) (Prerequisite: Audition) An ensemble of 8 to 12 voices specializing in early music.

243-673A,B COLLEGIUM MUSICUM. (2) (4 hours) (Prerequisites: Audition AND 243-480A & B AND 215-381; Additional prerequisite for keyboard players: 242-372D with a grade of A-) Open to singers and instrumentalists, this ensemble specializes in chamber music primarily of the Baroque era.

● **243-678A,B CHAMBER WINDS.** (2) (4 hours) (Prerequisite: Audition. Corequisite for wind players: 243-697A,B)

243-679A,B SONG INTERPRETATION. (1) (Prerequisite: Audition; 2 hours) Study of the standard song repertoire with emphasis on the singer and pianist as partners. The student will be assigned to work with two singers. A public recital will be given at the end of each term.

243-680A,B EARLY MUSIC ENSEMBLE. (1) (2 hours) (Prerequisite: Audition. Prerequisite or corequisite for keyboard players: 242-272D) An ensemble of 4-6 vocalists and instrumentalists which performs music of the Medieval, Renaissance and Baroque periods.

243-684A,B STUDIO ACCOMPANYING. (2) (Prerequisite: Audition; 2 hours) Students will be assigned to work as accompanists with performance teachers and their students.

243-690A,B MCGILL WINDS. (2) (4 - 6 hours) (Prerequisite: Audition)

243-693A,B CHORAL ENSEMBLE. (2) (4 hours) (Prerequisite: Audition) Students enrolling in Choral Ensembles will be assigned to one of the following groups.
Chamber Singers:
a group of approximately 24 mixed voices which explores the a capella repertoire of all periods as well as works with chamber accompaniment. Section 01

Concert Choir: an ensemble of approximately 60 voices (S.A.T.B.) which performs the repertoire from all periods appropriate to a group of this size. Section 02

University Chorus: a mixed chorus of approximately 100 which performs a variety of choral material including both traditional and popular selections. Section 03

Women's Chorale: an ensemble of approximately 40 women stressing the fundamentals of singing and ensemble participation. Works are chosen from the substantial repertoire available for women's voices. Section 04

243-694A,B CONTEMPORARY MUSIC ENSEMBLE. (2) (4 hours) (Prerequisite: Audition) An ensemble of approximately 15 performers which will explore 20th-century ensemble repertoire.

243-695A,B JAZZ ENSEMBLE. (2) (3-4 hours) (Prerequisite: Audition)

243-696A,B OPERA THEATRE. (2) (3-6 hours) (Prerequisite: open to all Graduate Performance and Artist Diploma students who have completed 243-496 or its equivalent.) Individual coaching in acting, movement and role preparation; possibility for roles in Opera McGill productions (by audition).

243-697A,B ORCHESTRA. (2) (6-7 hours) (Prerequisite: Audition. Corequisite for wind players: 243-678A,B) A full orchestra of approximately 90 which performs the symphonic repertoire. N.B. Woodwind and brass players will take one hour per week of Repertoire Class as a part of Orchestra.

253-600A VOCAL REPERTOIRE COACHING I. (2) (1 hour) A course in which the performer will have individual coaching sessions on repertoire, with emphasis on musical and linguistic nuance.

253-601B VOCAL REPERTOIRE COACHING II. (2) (1 hour)

253-690A OR B VOCAL STYLES & CONVENTIONS. (3) (3 hours) Emphasis on vocal performance practices through practical application: text, language, inflection, pronunciation and interpretation considered with individuality of each student's voice and technical development. After examining historical treatises, students will discuss and present musical selections utilizing modern performance standards yet remaining true to stylistic demands of each period.

253-691A VOCAL SEMINAR I. (3) (3 hours) (Open to singers, pianists, and conductors with permission of instructor.)

253-692B VOCAL SEMINAR II. (3) (3 hours) (Open to singers, pianists, and conductors with permission of instructor.)

● **253-693A VOCAL TREATISES & METHODS.** (3) (3 hours)

253-694B VOCAL PHYSIOLOGY FOR SINGERS. (3) (3 hours) An anatomical study of the entire vocal mechanism; how to keep it functioning in a healthy manner, the various possible dysfunctions and how to diagnose and treat them.

253-700A,B,C VOCAL REPERTOIRE COACHING 1. (2)
253-701A,B,C VOCAL REPERTOIRE COACHING 2. (2)
253-702A,B,C VOCAL REPERTOIRE COACHING 3. (2)
253-703A,B,C VOCAL REPERTOIRE COACHING 4. (2)

ADVANCED UNDERGRADUATE COURSES

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

Students deficient in their background preparation may be required to take some of the following undergraduate courses in addition to their required graduate courses.

For an up-to-date listing of upper-level music history courses that will be offered, please consult the final 2001-02 Faculty of Music timetable.

With the exception of 211-501, 211-502 and 211-503, all 500-level courses are available as elective courses to graduate students.

211-301A Modal Counterpoint I
211-302B Modal Counterpoint II
211-303A Tonal Counterpoint I
211-304B Tonal Counterpoint II
211-327D 19th-Century Analysis
211-427D 20th-Century Analysis
211-501 Theory Review I
211-502 Theory Review II
211-503 Theory Review III
211-522D Advanced Counterpoint
211-523D Advanced Harmony
211-528 Schenkerian Techniques
211-529 Proseminar in Music Theory
211-538 Mathematical Models for Musical Analysis
214-366 Era of the Fortepiano
214-372 Solo Song Outside Germany & Austria
214-377 Baroque Opera
214-379 Solo Song 1100-1700
214-380 Medieval Music
214-381 Renaissance Music
214-382 Baroque Music
214-383 Classical Music
214-384 Romantic Music
214-385 Early Twentieth-Century Music
214-386 Chamber Music Literature
214-387 Opera from Mozart to Puccini
214-388 Twentieth-Century Opera
214-389 Orchestral Literature
214-390 The German Lied
214-391 Canadian Music
214-392 Music Since 1945
214-395 Keyboard Literature before 1750
214-396 Era of the Modern Piano
214-397 Choral Literature after 1750
214-398 Wind Ensemble Literature after 1750
214-489 History of Music Theory
214-570 Research Methods in Music
214-591D Paleography
215-381 Topics in Perf. Practice before 1800
215-385 Topics in Perf. Practice after 1800
216-306 Music & Audio Computing I
216-307 Music & Audio Computing II
221-315A Choral Conducting I
221-415B Choral Conducting II
222-402D Principles and Processes of Music Ed.
222-403A,B Selected Topics in Music Ed.
222-404A,B Selected Topics in Music Ed.
223-315A Instrumental Conducting I
223-415A Instrumental Conducting II
242-372D Continuo
243-494A,B Contemporary Music Ensemble

52 Natural Resource Sciences

Department of Natural Resource Sciences
Macdonald Campus
21,111 Lakeshore Road
Sainte-Anne de Bellevue, Q CH9X 3V9
Canada

Telephone: (514) 398-7890
Fax: (514) 398-7990
Email: info@nrs.mcgill.ca
Website: http://www.nrs.mcgill.ca

Chair — W. Hendershot

Graduate Program Director — R.D. Titman

52.1 Staff

Emeritus Professors
A.C. Blackwood; B.Sc., M.Sc.(Alta.), Ph.D.(Wis.), F.R.S.C.; Microbiology
R. Knowles; B.Sc.(Birm.), Ph.D., D.Sc.(Lond.); Microbiology
A.F. MacKenzie; B.S.A., M.Sc.(Sask.), Ph.D.(C'nell); Soil Science
R.A. MacLeod; B.A., M.A.(Br.Col.), Ph.D.(Wis.), F.R.S.C.; Microbiology
P.H. Schuepp; Dipl.Sc.Nat.(Zür.), Ph.D.(Tor.); Agricultural Physics
R.K. Stewart; B.Sc.(Agr.), Ph.D.(Glas.); Entomology

Professors
D.M. Bird; B.Sc.(Guelph), M.Sc., Ph.D.(McG.); Wildlife Biology
W.H. Hendershot; B.Sc.(Tor.), M.Sc.(McG.), Ph.D.(Br.Col.); Soil Science
E.S. Idziak; B.Sc.(Agr.), M.Sc.(McG.), D.Sc.(Delft); Microbiology

Associate Professors
B. Côté; B.Sc., Ph.D.(Laval); Forest Resources
M.A. Curtis; B.Sc., M.Sc., Ph.D.(McG.); Wildlife Biology
G.B. Dunphy; B.Sc.(U.N.B.), M.Sc., Ph.D.(Mem.); Entomology
J.W. Fyles; B.Sc., M.Sc.(Vic., B.C.), Ph.D.(Alta.); Forest Resources
D.J. Lewis; B.Sc., M.Sc., Ph.D.(Mem.); Entomology
G.R. Mehuys; B.Sc., Ing.Agron.(Gembloux), Ph.D.(Calif.); Soil Science
D.F. Niven; B.Sc., Ph.D.(Aber.); Microbiology
M.E. Rau; B.Sc.(Purdue), M.Sc., Ph.D.(McG.); Entomology
R.D. Titman; B.Sc.(McG.), M.Sc.(Bishop's), Ph.D.(U.N.B.); Wildlife Biology

Assistant Professors
D. Berteaux; Bqcc.(Lycèe M. Genevoix), Dip.(Nantes), M.Sc.(Rennes), Ph.D.(Sherbrooke); Wildlife Biology
B.T. Driscoll; B.Sc., Ph.D.(McM.); Microbiology
C. Hamel; B.Sc., Ph.D.(McG.); Soil Science
J. Whalen; B.Sc.(Agr.)(Dal.), M.Sc.(McG.), Ph.D.(Ohio St.); Soil Science
T.A. Wheeler; B.Sc.(Mem.), M.Sc., Ph.D.(Guelph); Entomology

Adjunct Professors
R. Anderson, F. Archibald, G. Boiteau, G. Boivin, T. Charles, H. Chiasson, J. Cumming, C. Greer, T. Herman, P. Mineau, M. St-Arnaud, J.P. Savard, A. Scheuhammer, D. Sergeant, N. Seymour, R. Simard, T.G. Smith, I. Thompson, C .Vincent, F.G. Whoriskey

Associate Members
L. Chan *(Dietetics and Human Nutrition)*, W.D. Marshall *(Food Science and Agricultural Chemistry),* G.J. Matlashewski *(Microbiology and Immunology),* D. Smith *(Plant Science)*

Cross-Appointed Professor
P. Brown *(Geography and McGill School of Environment)*

52.2 Programs Offered

The Department of Natural Resource Sciences offers programs leading to M.Sc. and Ph.D. degrees in Entomology, Microbiology,

and Renewable Resources (includes Agrometeorology, Forest Science, Soil Science and Wildlife Biology).

The Department possesses, or has access to, excellent facilities for laboratory research and research in the field. Affiliated with the Department are the Lyman Entomological Museum and Research Laboratory, the Morgan Arboretum, the Avian Science and Conservation Centre, and the Ecomuseum of the St. Lawrence Valley Natural History Society.

52.3 Admission Requirements

General

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 (Test of English as a Foreign Language) with a minimum score of 577 on the paper-based test (233 on the computer-based test) or 7.0 overall band on IELTS.

The Graduate Record Exam (GRE) is not required, however, it is highly recommended.

M.Sc.

Candidates are required to have a Bachelor's degree with an equivalent cumulative grade point average of 3.0/4.0 and a sufficient background in the appropriate basic sciences.

Ph.D.

Candidates, normally, are required to hold an M.Sc. Degree and will be judged primarily on their ability to conduct an original and independent research study.

52.4 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 577 on the paper-based test (233 on the computer-based test) or IELTS (minimum overall band 7.0). 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.**

52.5 Program Requirements

M.Sc.

Candidates must complete a course and research program of a minimum of 45 credits elaborated in consultation with their Supervisory Committee. Course work (6 credits minimum) will include at least two, normally graduate-level, courses and in most research areas, at least one of these courses must be a graduate-level course in statistics. Students are required to register for three

1-credit seminar courses, the last of which will consist of a formal presentation of the student's final thesis research. Candidates must also register in the three M.Sc. Thesis Research courses (373-691, -692, -693; 36 credits) and present a satisfactory thesis based on their research.

Ph.D.

Course requirements are specified by the staff in the discipline but are flexible and depend largely on the student's background, immediate interests, and ultimate objectives. Students are required to register for four 1-semester seminar courses.

Also required are satisfactory performance in the Ph.D. Comprehensive Examination (373-701) and the presentation, and subsequent defence, of a satisfactory thesis based on the student's research.

52.6 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.

● Denotes courses not offered in 2001-02.

★ Denotes courses offered in alternate years.

● ★ **338-510B AGRICULTURAL MICROMETEOROLOGY.** (3) (3 lectures)

● **338-602B ISOTOPIC TRACER TECHNIQUES.** (3) (3 lectures and 1 four-hour lab) (Prerequisite: 338-303A or equivalent.)

● ★ **350-525B INSECT ECOLOGY.** (3)

★ **350-535B AQUATIC ENTOMOLOGY.** (3)

350-600A,B INSECT PATHOLOGY. (3)

350-610D ADVANCED TAXONOMY AND ZOOGEOGRAPHY. (6)

● **350-726B INSECT POPULATION DYNAMICS.** (3)

● ★ **360-612B MATHEMATICAL METHODS.** (3) (3 lectures) (Prerequisite: 360-205B or equivalent.)

362-740D INVITATION LECTURES IN MICROBIOLOGY I. (1) (1 seminar) Prominent scientists, actively engaged in research will be invited to present a series of lectures in the field of their research interest. The speakers and their topics will be chosen to complement the offerings of the permanent staff.

362-741D INVITATION LECTURES IN MICROBIOLOGY II. (1) (1 seminar) Description as for course 362-740D.

362-742D INVITATION LECTURES IN MICROBIOLOGY III. (1) (1 seminar) Description as for course 362-740D.

362-764A READING AND CONFERENCE. (3) (2 hours) Student presentations, taken from current literature, concerned with various aspects of a central topic chosen for the term. Such presentations are designed to be informal and to generate discussions. Topic will change from term to term.

362-765B READING AND CONFERENCE. (3) (2 hours) Description as for 362-764A.

● ★ **372-610D PEDOLOGY.** (3) (2 lectures per week, one term)

★ **372-630D SOIL MINERALOGY.** (3) (2 lectures per week, one term) Structure and identification of minerals, weathering, properties of clay surfaces, adsorption on clays, ion exchange.

372-631B ADVANCED SOIL PHYSICS. (3) (2 lectures per week, one term) State and fluxes of matter and energy in the soil. Applications to movement of water, salts, nutrients; diffusion of gases; heat transfer. Discussion of significant research in soil physics.

● ★ **373-515B PARASITOID BEHAVIOURAL ECOLOGY.** (3) (3 lectures and one 2-hour seminar) (Prerequisite: 373-330A or equivalent)

373-520B INSECT PHYSIOLOGY. (3) (Prerequisite: Permission of instructor.) Organismal approach to insects, emphasizing the physiology and development, and the physiological relations of insects to their environment.

★ **373-521B SOIL MICROBIOLOGY AND BIOCHEMISTRY.** (3) (Prerequisite: 372-210A) Soil environment, soil microorganisms and their function in the biogeochemical cycles of C, N, P and S. Basics of soil bioremediation.

373-550B VETERINARY AND MEDICAL ENTOMOLOGY. (3) (Prerequisite: Permission of instructor.) Environmental aspects of veterinary and medical entomology. An advanced course dealing with the biology and ecology of insects and acarines as aetiological agents and vectors of disease, and their control. Integrated approaches to problem solving.

373-643A,B GRADUATE SEMINAR I. (1) Open to students in the M.Sc. Program. Presentation on a selected topic, research proposal, or research results based on progress towards the M.Sc. degree.
Section 01 Agrometeorology, Forest Science and Soil Science students
Section 02 Entomology and Wildlife Biology students
Section 03 Microbiology students

373-644A,B GRADUATE SEMINAR II. (1) Open to students in the M.Sc. Program. Presentation on a selected topic, research proposal, or research results based on progress towards the M.Sc. degree.
Section 01 Agrometeorology, Forest Science and Soil Science students
Section 02 Entomology and Wildlife Biology students
Section 03 Microbiology students

373-651A,B GRADUATE SEMINAR III. 1) Open to students in the M.Sc. Program. Presentation of an M.Sc. student's final thesis results.
Section 01 Agrometeorology, Forest Science and Soil Science students
Section 02 Entomology and Wildlife Biology students
Section 03 Microbiology students

373-680A,B,C SPECIAL TOPICS I. (1) Students pursue topics not otherwise available in formal courses, under staff supervision.

373-681A,B,C SPECIAL TOPICS II. (1) Students pursue topics not otherwise available in formal courses, under staff supervision.

373-682A,B,C SPECIAL TOPICS III. (2) Students pursue topics not otherwise available in formal courses, under staff supervision.

373-683A,B,C SPECIAL TOPICS IV. (2) Students pursue topics not otherwise available in formal courses, under staff supervision.

373-684A,B,C SPECIAL TOPICS V. (3) Students pursue topics not otherwise available in formal courses, under staff supervision.

373-685A,B,C SPECIAL TOPICS VI. (3) Students pursue topics not otherwise available in formal courses, under staff supervision.

373-691A,B,C M.SC. THESIS RESEARCH I. (12) Independent research under the direction of a supervisor towards the completion of the M.Sc. degree.

373-692A,B,C M.SC. THESIS RESEARCH II. (12) Independent research under the direction of a supervisor towards the completion of the M.Sc. degree.

373-693A,B,C M.SC. THESIS RESEARCH III. (12) Completion of the M.Sc. thesis, its approval by reviewers and acceptance by Graduate Faculty are all required for a pass to be granted.

373-701D,N PH.D. COMPREHENSIVE EXAMINATION. (See Faculty Regulations.)

373-751A,B GRADUATE SEMINAR IV. (Open to students in the Ph.D. Program.) Presentation on a selected topic, research proposal or research results based on progress in the Ph.D. degree.
Section 01 Agrometeorology, Forest Science and Soil Science students
Section 02 Entomology and Wildlife Biology students
Section 03 Microbiology students

373-752A,B GRADUATE SEMINAR V. (Open to students in the Ph.D. Program.) Presentation on a selected topic, research proposal or research results based on progress in the Ph.D. degree.

Section 01 Agrometeorology, Forest Science and Soil Science students
Section 02 Entomology and Wildlife Biology students
Section 03 Microbiology students

373-753A,B GRADUATE SEMINAR VI. (Open to students in the Ph.D. Program.) Presentation on a selected topic, research proposal or research results based on progress in the Ph.D. degree.
Section 01 Agrometeorology, Forest Science and Soil Science students
Section 02 Entomology and Wildlife Biology students
Section 03 Microbiology students

373-754A,B GRADUATE SEMINAR VII. (Open to students in the Ph.D. Program.) Presentation on a selected topic, research proposal or research results based on progress in the Ph.D. degree.
Section 01 Agrometeorology, Forest Science and Soil Science students
Section 02 Entomology and Wildlife Biology students
Section 03 Microbiology students

373-772A ADVANCED MICROBIAL GENETICS. (3) (Prerequisite: Minimum of two undergraduate courses in genetics or permission of instructor.) Topics in bacterial archaeal, eucaryal, and bacteriophage genetics.

373-773B ADVANCED MICROBIAL PHYSIOLOGY. (3) (Prerequisite: Minimum of an undergraduate course in biochemistry and in genetics or permission of instructor.) Topics in microbial physiology and metabolism, ranging from current to classic, from biochemical to genetic aspects.

374-640A,B RECENT ADVANCES IN TREE ECOPHYSIOLOGY. (3) (3 lectures per week) Discussion of the effects of environmental factors on the physiology of trees. Both anthropogenic and natural factors will be discussed.

374-660A,B RECENT ADVANCES IN FOREST ECOLOGY. (3) (2 hours seminar) Review and discussion of current literature in forest ecology. Topics covered will depend on the research interests of students and may include population biology of forest plants, forest succession, forest nutrition and nutrient cycling, computer modelling of forest systems.

375-605B WILDLIFE ECOLOGY. (3) (2 class hours per week) Discussion of current topics in wildlife ecology with special reference to the research interests of staff and students involved.

● **375-610A ADVANCED FISH ECOLOGY.** (3) (3 class hours per week)

53 Neurology and Neurosurgery

Graduate Program in Neurological Sciences
Division of Neuroscience
Department of Neurology and Neurosurgery
Departments of Ophthalmology and Psychiatry
Montreal Neurological Institute, Room 122C
3801 University Street
Montreal, QC H3A 2B4
Canada

Telephone: (514) 398-1905/ 398-1229
Fax: (514) 398-7371
Email: Monique@MNI.Lan.McGill.ca / GPNS@mni.mcgill.ca
Website: http://www.mcgill.ca/gpns/index.html

Chair, Dept. of Neurology and Neurosurgery — R. Riopelle

Chair, Graduate Program in Neurological Sciences — H. Durham

53.1 Staff

Emeritus Professors
D.W. Baxter, G. Bertrand, P. Gloor, J.P. Robb, L. Wolfe

Professors
A. Aguayo; M.D.(Cordoba Natn.), F.R.C.P.(C)
E. Andermann; M.D., C.M., M.Sc., Ph.D.(McG.)
F. Andermann; B.A.(Paris), B.Sc., (McG.), M.D.(Montr.), F.R.C.P.(C)
J. Antel; M.D., B.Sc.(Man.), F.R.C.P.(C)
D. Arnold; B.Sc., M.D.(C'nell), F.R.C.P.(C)
M. Avoli; M.D.(Rome), Ph.D.(McG.)
A. Beaudet; B.A., M.D., Ph.D.(Mont.)
C. Bourque; B.Sc.(Ott.), Ph.D.(McG.)
G. Bray; B.Sc.(Bran.), M.D., B.Sc., (Man.), F.R.C.P.(C)
S. Carbonetto; M.Sc.(Mass.), Ph.D.(N.Carolina)
M. Diksic; B.Sc., Ph.D.(Zagreb)
P. Drapeau; B.Sc., Ph.D.(McG.)
A. Evans; M.Sc.(Sur.), Ph.D.(Leeds)
W.H. Feindel; O.C., B.A.(Acad.), M.D., C.M.(McG.), M.Sc.(Dal.), D.Sc.(Acad. and McG.), D.Phil.(Oxon.), F.R.C.S.(C), F.A.C.S., F.R.S.C.
S.G. Gauthier; B.A., M.D.(Montr.), F.R.C.P.(C)
J. Gotman; M.Eng.(Dart.), Ph.D.(McG.)
D. Guitton; Dipl. IVK(U. Libre de Brux.), B.Eng., M.Eng., Ph.D.Eng., Ph.D.Physiol.(McG.)
I. Heller;
P.C. Holland; B.A.(Lanc.), Ph.D.(N'cle)
B. Jones; B.A., M.A., Ph.D.(Delaware)
M. Jones-Gotman; B.A.(Calif.), M.A., Ph.D.(McG.)
J.-P. Julien; B.Sc.,(Que.), Ph.D.(McG.)
D. Kaplan; B.A.(Clark), Ph.D.(Harv.)
G. Karpati; M.D.(Dal.), F.R.C.P.(C)
D. Lawrence; B.Sc.(Bishop's), M.Sc., M.D., C.M.(McG.), F.R.C.P.(C)
R. Leblanc; M.Sc.(McG.), M.D.(Ott.), F.R.C.S.(C)
F. Miller; B.Sc.(Sask.), Ph.D.(Calg.)
B. Milner; B.A., Sc.D.(Cantab.), Ph.D.(McG.)
G. Mohr; M.D.(Stras.)
A. Olivier; M.D.(Montr.), Ph.D.(Laval), F.R.C.S.(C)
H. Pappius;
Y. Patel; M.B., Ch.B.(Otago), Ph.D.(Monash), F.R.A.C.P., F.R.C.P.(C)
M. Petrides; B.Sc., M.Sc.(Lond.), Ph.D.(Cantab.) *(James McGill Professor)*
M. Rasminsky; B.A.(Tor.), M.D.(Harv.), Ph.D.(Lond.), F.R.C.P.(C)
J. Richardson; B.Sc., M.D., C.M., Ph.D.(McG.), F.R.C.P.(C)
G. Rouleau; M.D.(Ott.), F.R.C.P. (C)
A. Sherwin;
J.D. Stewart; B.Sc.(Lond.), M.B., B.S.(W.I.), F.R.C.P.(C)
J.G. Stratford; M.D., C.M., M.Sc.(McG.), F.R.C.S.(C), F.A.C.S.
G. Tannenbaum; M.Sc., Ph.D.(McG.)
C. Thompson; M.Sc., D.Sc.(N.Z.)
G. Watters; B.A.(Minn.), M.D.(Man.), F.R.C.P.(C)

Associate Professors
A. Alonso; M.S.(Barcelona), Ph.D.(Madrid)
M. Aubé; B.A., M.D.(Montr.), F.R.C.P.(C)
P. Barker; Ph.D.(Alta.), B.Sc.(S. Fraser)
S. Bekhor; M.B., Ch.B.(Baghded), F.R.C.P.(C)
J. Blundell;
J. Carlton; B.S., M.D.(Johns H.), F.R.C.P.(C)
C. Chalk; B.Sc.(Queen's), M.D., C.M.(McG.) F.R.C.P. (C)
H. Chertkow; M.D.(W. Ont.), F.R.C.P.(C)
R. Cote; M.D.(Montr.), F.R.C.P.(C)
S. David; Ph.D.(Man.)
R. Del Carpio; M.D.(Lima), F.R.C.P.(C)
R. Del Maestro; M.D.(W.Ont.), Ph.D.(Uppsala.), F.R.C.S.(C), D.A.B.N.S.,F.A.C.S.
F. Dubeau; M..D.(Montr.), F.R.C.P.(C)
J.R. Dunn; B.Sc., Ph.D.(U.B.C.)
H. Durham; M.Sc.(W.Ont.), Ph.D.(Alta.)
J.P. Farmer; M.D., M.Sc.(McG.), F.R.C.P.(C)
E. Hamel; B.Sc.(Sher.), Ph.D.(Montr.)
K. Hastings; B.Sc., Ph.D.(McG.)
Y. Lapierre; B.A., M.D.(Montr.), F.R.C.P.(C)
A. Leblanc; M.Sc.(Moncton), Ph.D.(Dal.)
I. Libman; B.A., M.D., C.M.(McG.), F.R.C.P.(C)
D. Melançon; B.A., M.D.(Montr.)
C. Melmed; B.Sc., M.D.(Man.), F.R.C.P.(C)

A. Ptito; Ph.D.(Montr.)
J. Montes; B.Sc.(Inst.Pot.-Mex.), M.D.(Uoio.Auto.de San Luis Pot.-Mex)
J. Nalbantoglu; B.Sc., Ph.D.(McG.)
A. O'Gorman; M.D.(Ireland)
T. Owens; M.Sc.(McG.), Ph.D.(Ott.)
A. Peterson; B.Sc.(Vic., B.C.), Ph.D.(U.B.C.)
B. Pike; B.Eng.(Mem.), M.Eng., Ph.D. (McG.)
R. Pokrupa, R., M.D.(W.Ont.), F.R.C.S. (C)
L.F. Quesney; B.Sc., M.D.(Chile), Ph.D.(McG.)
B. Rosenblatt; B.Sc., M.D., C.M.(McG.), F.R.C.P.(C)
A. Sadikot; M.D.(McG.), Ph.D.(Laval), F.R.C.S. (C)
G. Savard; M.D.(Montr.), F.R.C.P.(C)
H. Schipper; M.D., Ph.D.(McG.)
R. Schondorf; M.Sc., Ph.D., M.D.(McG.), F.R.C.P.(C)
P. Séguéla; Ph.D.(Bord.), Ph.D.(Montr.)
M. Shevell; B.Sc., M.D.(Vanderbilt)
E. Shoubridge; M.Sc., Ph.D.(U.B.C.)
W. Sossin; S.B.(M.I.T.), Ph.D.(Stan.)
S. Stifani; Ph.D.(Rome); Ph.D.(Alta)
D. Tampieri; M.D.(Bologna)
J. Woods; M.B., B.Ch.(Dub.), M.Sc.(McG.), F.R.C.P.(C)
R.J. Zatorre; A.B.(Boston), M.Sc., Ph.D.(Brown)

Assistant Professors
M. Angle; M.D., C.M.(McG.), F.R.C.P.(C)
A. Bar-Or; M.D.(McG.); F.R.C.P(C), D.A.B.N.P.
A. Bernasconi; M.D.(Basel U.)
M.A. Castro-Alamancos; B.Sc., M.Sc., Ph.D.(U. Complutense of Madrid)
L. Collins, M.Eng., Ph.D.(McG.)
A. Dagher; M.Eng.(McG.), M.D.(Tor.), F.R.C.P.(C)
L. Durcan; M.D.(Man.), F.R.C.P.(C)
M. Ferns; B.Sc.(Otago), Ph.D.(W. Aust.)
E. Fon, M.D.(Montr.), F.R.C.P. (C)
D. Gendron; M.D.(Laval), F.R.C.P.(C)
A. Genge; B.Sc.(Dal.), B.Med.Sc., M.D.(Mem.), F.R.C.P.(C)
W. Gorczyca; M.D., Ph.D.(Poland)
L. Jacques; B.Sc.(Laval), M.Sc., M.D.(Montr.), F.R.C.P.(C)
K. Johnston; Ph.D., M.D.(Tor.), F.R.C.S.(C)
R. Joober; M.D.(Tunis U.); Ph.D.(McG.)
T. Kennedy; B.Sc.(McM.), Ph.D.(Col.)
A.L. Lafontaine; M.Sc(McG.), M.D. (McM.), F.R.C.P.(C)
M. Lechter; B.Sc.(McG.), M.D., Ph.D.(Queen's)
G. Leonard; Ph.D.(McG.)
M. Maleki, M.D.(Iran), F.R.C.S. (C)
P. McPherson; M.Sc.(Man.), Ph.D.(Iowa)
E. Meyer; M.Sc.(Montr.), Ph.D.(McG.)
J. Minuk; M.D.(Man.), F.R.C.P.(C)
M. Panisset; M.D.(Montr.)
H. Paudel; Ph.D.(Okla.), M.Sc.(Nepal)
T. Paus; M.D.(Purkyne U./Czechoslovakia), Ph.D.(Czech. Acad. of Sciences/Prague)
C. Poulin; M.D.(Laval), F.R.C.P.(C)
D. Ragsdale; B.S.(Ill.), Ph.D.(Calif.)
Y. Rao; B.Sc.(China), Ph.D.(Tor.)
J.-P. Roy; M.D.(Laval), F.R.C.P.(C)
J. Rubin; B.Sc., M.D.(McG.), D.A.M.P.& N.
F. Salevsky; M.Sc., M.D.(Alta.), F.R.C.P.(C)
C. Sirard; M.Sc.(Montr.), Ph.D.(Tor.)
D. Sirhan; M.D.(Montr.), F.R.C.S.(C)
J. Snipes; Ph.D., M.D.(Vanderbilt)
V. Soland, M.D.(Sher.)
V. Sziklas, Ph.D.(McG.)
D. Trojan; M.D.(Conn.)
G. Tureki; M.D.(Sâo Paulo); Ph.D.(McG.)
M. Veilleux; M.D.(Sher.), F.R.C.P.(C)
L. Viera, B.Sc.(Waterloo), M.D.(Ott.) F.R.C.S.(C)
F. Wein, M.D.(McG.) F.R.C.S. (C)
T. Wein; M.D.(Vermont U.), F.R.C.P.(C)

Lecturers
B. Brais; M.D.(McG.), M.Phil.(Univ. College London)
S. Chouinard; M.D.(Montr.), F.R.C.P.(C)
D. Gross; M.D.(Sask.), F.R.C.P.(C)
S. Gross; M.D.(Tor.), F.R.C.P.(C)
D. Klein; B.A., Ph.D.(U. of Witwatersrand/S. Africa)
G. Pari, M.Sc., M.D.(Ott.), F.R.C.P.(C)
W. Vanast; M.D.(Tor.), F.R.C.P.(C)

Associate Members
C. Baker, S. Beaulieu, C. Benkelfat, P. Blier, D. Boivin, P. Boksa, R. Brassard, P. Braun, C. Bushnell, D. Chartrand, B. Collier, G. Debonnel, B. Debruille, C. de Montigny, J.P.A. Gratton, R. Hess, S. Kar, F. Kingdom, P. Lachapelle, S. Lupien, A. Majnemer, M. Meaney, K. Mullen, D. Payen de la Garanderie, B. Petrof, J. Poirier, R. Quirion, J. Rochford, L. Srivastava, C.D. Walker, S. Williams, C. Wolfson, K. Worsley

Adjunct Professors
Z. Argov, S. Berkovic, F. Cendes, J. Doyon, G. Duncan, A. Gjedde, J. Hardy, P. Matthews, L. McKerracher, M. Molnar, M. Pandolfo, T. Peters, M. Ptito, Y. Robitaille, N. De Stefano, J. Teitelbaum.

53.2 Programs Offered

M.Sc. and Ph.D. in Neurological Sciences.

53.3 Admission Requirements

General

The applicant should be a university graduate and hold a Bachelor's degree in a field related to the subject selected for graduate work.

The applicant must present evidence of high academic achievement. A standing equivalent to a cumulative grade point average of 3.0 out of a possible 4.0 is required by the Faculty of Graduate Studies; however, the program prefers applicants to show a higher academic standing, and requires a minimum GPA of 3.3.

Applicants with degrees from a non-Canadian university must submit results of the GRE exam with their application.

Applicants whose undergraduate studies were carried out in a language other than English must submit results of the TOEFL exam with their application and have a score of 600 on the paper-based test (250 on the computer-based test) or higher.

M.Sc. Degree
Bachelor's degree with adequate background in basic sciences, or an M.D.

Ph.D. Degree
M.Sc. in a related field, or an M.D. with post-graduate training or enrolled in M.D.-Ph.D. program

53.4 Application Procedures

Applications will be considered upon receipt of:
1. application form;
2. transcripts;
3. letters of reference;
4. $60 application fee,;
5. TOEFL test results;
6. GRE test results.

All information is to be submitted to above address.

Deadlines:
September entrance –
May 1 (February 1 for International candidates)
January entrance –
Septermber 15 (June 1 for International candidates).

To meet the diversity of individual interests and backgrounds, the graduate program for each student is designed at the time of entry. As part of the admission process each applicant will identify, with the participation of the prospective thesis supervisor and the Graduate Studies Committee, a research thesis topic and the course work necessary to complete the training deemed necessary for the degree sought. These decisions become an integral part of the graduation requirements for the student.

53.5 Program Requirements

GENERAL

1. Students must select an Advisory Committee, in conjunction with their thesis supervisor. This committee will consist of the thesis supervisor and two other individuals who will participate in discussions with students about their research program.
2. Students are required to submit a written thesis proposal to the Graduate Studies Committee (at the end of their first year for M.Sc. students, and at least one month prior to the Candidacy Examination for Ph.D. students). This document must state the hypothesis being tested, the relevant literature, and a summary of the methods that will be used to address the research question. This proposal will then be orally presented to the student's Advisory Committee which will also review the written proposal and communicate its recommendations to the student and the Graduate Studies Committee.
3. Students will present a formal seminar on their research work prior to writing their thesis. This presentation will be attended by the student's Advisory Committee and members of the Graduate Studies Committee who will report their impressions and recommendations to the student.
4. An annual oral informal presentation of research work accomplished will be presented to the student's Advisory Committee which in turn presents its report to the Graduate Studies Committee.

M.SC. DEGREE

Course requirements:
Student with a B.Sc., B.A. or M.D. degree: A minimum of 45 credits distributed as follows:*

Principles of Neuroscience I course: 531-630A and either Principles of Neuroscience II: 531-631B or CNS course: 531-610B;
6 credits in other graduate level specialty courses relevant to program;
9 credits in Master's project Proposal: 531-697 (first term of studies)
9 credits in Master's Seminar Presentation: 531-698 (second term of studies)
12 credits in Master's Thesis Submission: 531-699 (third term of studies)

Upon recommendation, depending upon their particular background and needs, students may be requested to take additional selected courses.

Any remaining credits needed to complete the minimum 45 credits required may be chosen from the following: Master's Thesis Research I: 531-695 (3 credits); Master's Thesis Research II: 531-696 (6 credits).

** Please note that all M.Sc. level students must register for a minimum of 12 credits a term during the first three terms of their Master's program.*

Research requirements:
Presentation of a thesis in a subfield of neuroscience. The thesis must be based upon the research of the student. While not necessarily requiring an exhaustive review of work in a particular field, or a great deal of original scholarship, the thesis must show familiarity with previous work in the field and must demonstrate the ability of the candidate to carry out research and to organize results, all of which must be presented in good literary style. The Graduate Studies Committee expects the student's research should be of sufficient quality for publication in a peer-reviewed journal. A seminar on the thesis topic is given prior to writing the thesis, and each year, a report from the student's Advisory Committee is required by the graduate Studies Committee.

Residence requirements:
Three terms of full-time study.

PH.D. DEGREE

Course requirements:

Students with an M.Sc. degree continuing in this Department have no required courses. It may be recommended that they take specialty courses related to their field of study in neuroscience. Students with an M.Sc. degree from another program will be required to take 531-630 and 531-631 and/or other courses listed under the M.Sc. degree depending upon their background and field of study.

Students with an M.D. degree proceeding directly into a Ph.D. program will be required to take 531-630 and 531-631. Recently graduated M.D.s should have the equivalent of 531-610, and may be granted equivalence. They will also be required to take 6 credits of graduate level courses.

Doctoral Candidacy Examination (531-700A/B)
All students registering directly into the Ph.D. program on or after September 1998, regardless of prior degrees from McGill or any other academic institutions, must complete the Doctoral Candidacy Examination within 18 months of initial registration in the Program. This is a qualifying examination consisting of a formal presentation and oral examination of the thesis proposal. The questioning will pertain to the student's knowledge and understanding of his/her field of specialization in neuroscience as well as the research proposal. Its primary purpose is to evaluate the student's ability to carry out original scholarship.

The Candidacy Examination will be conducted in conjunction with the Transfer seminar for all students currently registered in the M.Sc. program who apply for transfer to the Ph.D.

Research requirements:
Presentation of a thesis in a subfield of neuroscience. The thesis must display original scholarship expressed in satisfactory literary style and must be a distinct contribution to knowledge. After the thesis has been submitted to, and approved by the Faculty of Graduate Studies, a final oral exam will be held on the subject of the thesis and subjects immediately related to it.

Residence requirements:
Three years of resident study of which one year may be completed in the Master's program.

53.6 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.

531-602A CURRENT TOPICS IN NEUROSCIENCE. (3) (Prerequisite: Permission of Unit Instructor) (Offered alternate years - even numbered years.) This course consists of several units, running concurrently, in which small groups of students (up to 8) will participate in discussions of present and past literature that has contributed to the present "state of the art" knowledge on various fields of neuroscience. Each unit will be led by a faculty member with expertise in the chosen area. A list of the literature to be covered will be distributed in the first lecture and updated as new articles appear on the topic. The supervising faculty will introduce the topic. The remainder of the course (12-14 weeks) will be devoted to didactic discussion of the literature and/or students presentations in a journal-club format.

531-603B FOUNDATIONS OF CELLULAR EXCITABILITY. (3) (Offered alternate years - even numbered years.) This course will focus on the neuronal excitability and synaptic communication in the central nervous system. Discussion of the molecular properties of the voltage-and-ligand-gated ion channels that are the building blocks of cellular excitability. Examination of synaptic transmission and the mechanisms that underlie the changes in synaptic strenght that are responsible for learning and memory. Discussion of the properties of neuronal networks that contribute to higher brain func-

tions and pathological conditions like epilepsy. Each week, the class will meet for two 90 minute long sessions dedicated to a particular topic. The first session will be a general presentation by the instructor and the second session will be a student presentation on a specific paper or set of papers.

531-604A SEMINAR IN CELL AND MOLECULAR BIOLOGY OF NEUROLOGICAL DISEASE. (3) (Offered alternate years - odd numbered years.) (Prerequisites: 531-630A, 531-631B or 531-610B; and permission of instructor.) (Enrolment limited to 12.) Advanced seminars in neurobiology emphasizing current concepts of the molecular and cellular mechanisms underlying disease of the nervous system and muscle and how the study of disease has contributed to our understanding of cell biology. Topics: genetic mutations responsible for diseases, mechanisms of selective vulnerability of cell populations, and environmental influences.

531-605B MOLECULAR AND CELLULAR ASPECTS OF NEURONAL DEVELOPMENT. (3) (Offered alternate years - odd numbered years.) This course focuses on neuronal development and maturation from a molecular aspect. We introduce various model organisms and systems that are used to study molecular aspects of development, explore their particular advantages and explore the cellular and molecular events that contribute to the development of the nervous system.

531-610B CENTRAL NERVOUS SYSTEM. (5) An interdisciplinary course including lectures in neuroanatomy and neurophysiology; laboratories in neuroanatomy, and clinical problems and demonstrations in neurology.

531-630A PRINCIPLES OF NEUROSCIENCE I. (3) (Prerequisites: 177-200A and 177-201B or equivalent; permission of instructor.) An overview of cellular and molecular neuroscience at the graduate level. Topics include: synthesis, processing and intracellular transport of macromolecules; development of the nervous system including neurogenesis, axonal pathfinding, synaptogenesis and myelination; neuronal survival and response to injury; generation and propagation of action potentials; neurotransmitters and synaptic transmission.

531-631B PRINCIPLES OF NEUROSCIENCE II. (3) (Prerequisite: Permission of instructor; basic knowledge of mechanisms of neurotransmission and signal transduction.) An overview of the structure, function and interaction of neuronal systems of vertebrates. Topics include basic neuroanatomy, coding and processing of sensory information (somatic sensory, visual and auditory systems), control of posture and voluntary movement, learning and memory, processing of language and speech, cerebral blood flow, the neuroendocrine system and neuroimmunology.

531-697A,B,C,T,L MASTER'S THESIS PROPOSAL. (9) (M.Sc. students only) Presentation of a written thesis proposal by the end of the first year in the program. This document stating the hypothesis being tested, relevant literature and methodology will be orally presented to the student's Advisory Committee which will also review the written proposal and communicate its recommendations to the student and the Graduate Studies Committee.

531-698A,B,C,T,L MASTER'S SEMINAR PRESENTATION. (9) Student's presentation of a thesis research seminar. In this seminar, the student shall explain the direction of his/her research and present his/her findings to date. The presentation shall take approximately 30 to 45 minutes and shall be followed by a question period. This seminar will be attended by the Graduate Studies Committee, the student's Advisory Committee, and interested observers.

531-695A,B,C,T,L MASTER'S RESEARCH I. (3) Independent work under the direction of the student's supervisor.

531-696A,B,C,T,L MASTER'S RESEARCH II. (6) Independent work under the direction of the student's supervisor.

531-699A,B,C,T,L MASTER'S THESIS SUBMISSION. (12) Submission of a Master's thesis.

531-700A/B DOCTORAL CANDIDACY EXAMINATION. A qualifying examination consisting of a formal presentation and oral examination of the thesis proposal. The questioning will pertain to the student's knowledge and understanding of his/her field of specialization in neuroscience as well as the research proposal. Its primary purpose is to evaluate the student's ability to carry out original scholarship. (The Candidacy Examination course is also conducted as part of the Transfer seminar for all students currently registered in the M.Sc. program who apply for transfer to the Ph.D.)

COURSES IN OTHER DEPARTMENTS

Biology
177-588A ADVANCES IN MOLECULAR AND CELLULAR NEUROBIOLOGY. (3)

177-532B DEVELOPMENTAL NEUROBIOLOGY SEMINAR. (3)

Dentistry
590-654B MECHANISMS AND MANAGEMENT OF PAIN. (3)

Physiology
552-520B IONIC CHANNELS. (3)

552-556B TOPICS IN SYSTEMS NEUROSCIENCE. (3)

Psychiatry
555-500B ADVANCES IN THE NEUROBIOLOGY OF MENTAL DISORDERS. (3)

555-630B STATISTICS FOR NEUROSCIENCES. (3)

Psychology
204-526A ADVANCES IN VISUAL PERCEPTION. (3)

204-710A COMPARATIVE & PHYSIOLOGICAL PSYCH. (3)

54 Nursing

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Telephone: (514) 398-4151
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Website: http://www.nursing.mcgill.ca

Associate Dean of Medicine and Director — S.E. French

Associate Director of Research — C.C. Johnston

54.1 Staff

Emeritus Professor
Elizabeth C. Logan; N., B.Sc.(Acad.), M.Sc.(Yale)

Professors
Laurie N. Gottlieb; N., B.N., M.Sc.(A.), Ph.D.(McG.)
(Shaw Professor of Nursing) (on leave Jan. - Dec. 2001)
Celeste C. Johnston; N., M.S.(Boston), B.N., D.Ed.(McG.)

Associate Professors
Hélène Ezer; N., B.Sc.(N), M.Sc.(A.)(McG.)
Nancy Frasure-Smith; B.A., Ph.D.(Johns H.) [part-time]
Susan French; N., B.N.(McG.), M.S.(Boston), Ph.D.(Tor.)
Omaima Mansi; N., B.Sc.N.(Alexandria), M.Sc.(A.)(McG.)
Carolyn J. Pepler; N., B.N.Sc.(Queen's), M.Sc.N.(Wayne St.), Ph.D.(Mich.) [part-time]

Assistant Professors
Marcia Beaulieu; N., B.Sc., M.Sc.(A.), Ph.D.(McG.)
Anita J. Gagnon; N., B.Sc.N., M.P.H., Ph.D.(McG.)
Carmen G. Loiselle; N., B.Sc.(N.)(Montr.), M.S., Ph.D.(Wis.-Madison)
Margaret Purden; N., B.Sc.(N), Ph.D.(McG.)

Lecturers
Madeleine M. Buck; N., B.Sc.(N), M.Sc.(A.)(McG.)
Kathryn Carnaghan-Sherrard; N., B.N., M.Sc.(A.)(McG.)
Cindy Dalton; N., B.Sc.(N.), M.Sc.(A.)(McG.)
Anne Gilchrist; N., B.Sc., M.Sc.(A.)(McG)
Catherine P. Gros; N., B.Sc.(Mass.), M.Sc.(A.)(McG.) [part-time]

54.2 Programs Offered

Master's Programs

Two types of Master's degrees are offered: Master of Science (Applied) and Master of Science (with thesis) (not offered 2001-02). These programs are designed to prepare clinicians and researchers for the expanding function of nursing within the health care delivery system.

Master of Science (Applied)
The objective of this program is to prepare specialists in nursing able to participate in the development, implementation and management of services in all domains of health care. Opportunity is provided for the advanced clinical study of nursing, and for incorporating research and evaluation methods in the investigation of nursing problems.

Master of Science (with thesis) (not offered 2001-02).

Doctoral Studies in Nursing

The School of Nursing of McGill University and the Faculté des Sciences Infirmières of the Université de Montréal offer a joint doctorate program leading to a Ph.D. in Nursing. This program is offered in English at McGill.

The program is designed to train researchers who will make a contribution to the advancement of knowledge in the field of nursing and assume a leadership role both in the profession and in the health care system.

54.3 Admission Requirements

Master's Programs

Non-Canadian applicants shall normally be required to submit documented proof of competency in oral and written English, e.g. TOEFL (600 minimum on the paper-based test, 250 minimum on the computer-based test) or equivalent.

GRE – may be required in individual circumstances.

Nurse applicants
Applicants for the Master's degree must have completed a bachelor's degree in nursing with a minimum GPA of 3.0 on a scale of 4.0. This preparation must be comparable to that offered in the bachelor's program at McGill. Experience in nursing is suggested. An introductory statistics course (3 credits) is strongly recommended.

Nurses with a general B.Sc. or B.A. (comparable to the McGill undergraduate degrees) may be considered on an individual basis.

All nurse applicants are expected to hold current registration in the province or country from which they come. Nurses who are not licensed in Quebec must obtain a special authorization for graduate nurse students from the Order of Nurses of Quebec.

Non-nurse applicants (generic Master's students)
Applicants holding a B.Sc. or B.A., which includes a number of prerequisite courses, may be admitted to a Qualifying Year. Upon successful completion of their studies, candidates may apply directly to the Master's program. (Persons prepared in another professional discipline or in nursing are not eligible for this program.) A GPA of 3.0 or above on a scale of 4.0 is required for entry.

Ph.D. Program

Applicants admitted to the Doctoral program through McGill University must satisfy the following conditions:

1. hold a Master of Science in Nursing or equivalent;
2. GPA of 3.3 or high B standing;
3. demonstrated research ability;
4. be accepted by a faculty member who has agreed to serve as the thesis adviser;
5. submit a 5-page outline of proposed research including literature review and abbreviated methods sections;
6. submit letters of references from two professors who are familiar with the candidate's work and research aptitude;
7. submit a curriculum vitae;
8. submit two official copies of academic transcripts of undergraduate and graduate records,
9. be eligible to hold nursing registration in Quebec;
10. submit results of the Graduate Record Examination General Test.

54.4 Application Procedures

Application for admission to any of these programs is made on application forms available from the Graduate Program Office in the School of Nursing. Applications must be completed according to the instructions that accompany the forms.

Deadline for receipt of application for September admission is March 30. All documents required for admission should be submitted by this deadline.

54.5 Program Requirements

Master's Programs

The general rules concerning higher degrees apply. (See the Faculty of Graduate Studies General Information and Faculty Regulations.) A minimum of two years of study is required for the Masters programs.

Nurse applicants to the Master's program may complete their studies on a part-time basis, i.e. minimum of 6 credits per term to a maximum of four years.

Non-nurse applicants must complete their qualifying year and the Master's program of study on a full-time basis.

M.SC. (APPLIED)
(48 credits nurse students; 52 credits non-nurse students)

First Year
(24 credits nurse students; 28 credits non-nurse students)
573-611D (6) Seminar in Nursing I
573-612A (3) Research Methods in Nursing I
573-614D (6) Clinical Laboratory in Nursing I
573-627B (3) Nursing Practicum
one 3-credit Statistics course
and
573-616C (4) Advanced Clinical Skills (Generic students only)
573-623A (3) Clinical Assessment and Therapeutics (Generic students only)
Complementary course (3 credits) (Nurse students only)

Second Year (24 credits)
573-615B (3) Health Care Evaluation
573-620A (2) Current Theories of Nursing
573-621D (6) Seminar in Nursing II
573-624A (4) Clinical Laboratory in Nursing II
573-625B (6) Clinical Laboratory in Nursing III
573-626A (3) Developments in Education & Administration

M.SC. (THESIS) (50 credits) (not offered 2001-02)

QUALIFYING YEAR
(non-nurse applicants entering with B.A. or B.Sc.)
572-222A (1) McGill Model of Nursing
572-235B (3) Health and Physical Assessment
573-511D (6) Practice and Theory in Nursing – Par tI
573-514D (10) Clinical Laboratory in Nursing
573-512C (8) Practice and Theory in Nursing – Par tII

Complementary Courses (12 credits)
12 credits from the physical sciences, social sciences and nursing, are chosen in consultation with faculty to complement the student's previous academic background.

Students must successfully complete the Qualifying Year and be recommended by the Standing and Promotions Committee for entry to the Master of Science (Applied) Program.

Ph.D. PROGRAM

Each student's program is designed with the research director and thesis supervisor, taking into account the student's previous aca-

demic preparation, needs and research interests. The requirements for the doctoral degree are:

1. A minimum of 18 credits beyond the Master's level. Courses and seminars in research design, issues of measurement, advanced nursing, development of theory in nursing, advanced statistics and complementary course(s) in the student's major field of study are compulsory. The student's program is decided in consultation with the faculty advisor.
2. Successful completion of the Ph.D. comprehensive examination.
3. Oral defense of the thesis proposal.
4. Dissertation and oral examination.
5. Two years of full-time residence. A student who has obtained a Master's degree at McGill University or at an approved institution elsewhere, and is proceeding in the same subject to a Ph.D. degree, may on the recommendation of the School, be registered in the second year of the Ph.D. program.

54.6 Courses

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

A – fall term
B – winter term
C – summer session courses starting in May
D – fall and winter term

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.

QUALIFYING PROGRAM

572-235B HEALTH AND PHYSICAL ASSESSMENT. (4) This course will develop basic knowledge and skills required to do a health history and to carry out basic physical assessment in infants, children, and adults.

573-511D PRACTICE AND THEORY IN NURSING – PART I. (6) A study of selected concepts related to the practice of nursing including health, family, normative life transitions and interpersonal interaction. The major focus is on developing an understanding of human behaviour using the process of scientific inquiry. Special emphasis is placed on the observation of people in their physical and social environments and on the analysis of clinical data as the basis for the development of innovative nursing approaches.

573-512C PRACTICE AND THEORY IN NURSING – PART II. (8) Learning to nurse patients in acute care settings, who are experiencing a variety of common illness-related problems.

573-514D CLINICAL LABORATORY IN NURSING. (10) Learning to nurse through field experiences with individuals and families in the community and in acute care settings. The focus is on the application of knowledge and theory in practice and includes the testing and analysis of nursing approaches. Students work with clients and families experiencing a variety of life events including aging, birth and parenting as well as acute illness and hospitalisation.

GRADUATE PROGRAM

573-611D SEMINAR IN NURSING I. (6) A critical study of selected concepts in nursing and health related to individuals and families. An introduction to the study of concepts and theories relevant to nursing.

573-612A RESEARCH METHODS IN NURSING I. (3) Basic knowledge and skills needed to conduct research. The philosophy and principles of scientific inquiry, research design, sampling, techniques of data collection, ethics, and incorporating research into practice are discussed with emphasis for nursing.

573-614D CLINICAL LABORATORY IN NURSING I. (6) Field experience in nursing to test and develop concepts critical to the health of individuals and families. The examination of theories relevant to nursing practice in the clinical field.

573-615B HEALTH CARE EVALUATION. (3) An evaluation of educational and health care systems with particular reference to the nursing input in problems of health, health care and health care delivery. Evaluative research includes qualitative and quantitative approaches to assessing health status and quality of care.

573-616C ADVANCED CLINICAL SKILLS. (4) Supervised clinical experiences in health care agencies are aimed at developing competence in technical and family nursing skills at an advanced level. Experience is determined on an individual basis according to learning needs and the student's area of interest.

573-620A CURRENT THEORIES OF NURSING. (2) (Prerequisites: 573-611D, 573-614D or equivalent). Current theories of nursing e.g. Orem, Roy, King, Rogers are examined along with their implications for practice, curriculum, administration, and research. The internal and external adequacy of these theories will be evaluated using selected schema. Critical analysis of issues and problems of theories in a practice discipline will be undertaken.

573-621D SEMINAR IN NURSING II. (6) An opportunity for investigation of some of the critical problems in nursing as related to the student's area of inquiry. Particular emphasis is placed on theory development in nursing.

573-623A CLINICAL ASSESSMENT AND THERAPEUTICS. (3) (Prerequisites: 546-300B; 522-201A, 522-202B or equivalent.) Development of skills in the medical-nursing assessment and management of patients and families dealing with chronic and life-threatening illnesses. Includes instruction in history-taking and physical assessment.

573-624A CLINICAL LABORATORY IN NURSING II. (4) Field experience in nursing, incorporating extensive assessment, experimentation and evaluation of differing nursing approaches.

573-625B CLINICAL LABORATORY IN NURSING III. (6) Field experience in nursing, incorporating extensive assessment, experimentation and evaluation of differing nursing approaches.

573-626A DEVELOPMENTS IN EDUCATION & ADMINISTRATION. (3) An examination of theories of learning and organizational behaviour as related to the preparation of nurses for the delivery of health care services. Implications of these theories for the assessment, development, and evaluation of nursing programs will be investigated.

573-627B NURSING PRACTICUM. (3) Research, administrative or teaching projects in nursing are defined by interested faculty and developed with students. The goal is to promote and enhance scholarly activity and productivity. At completion, there should be some final product such as a manuscript, a data collection system set-up, or the synthesis of pilot data

- **573-690B M.SC. THESIS I.** (4)
- **573-691A M.SC. THESIS II.** (8)
- **573-692B M.SC. THESIS III.** (12)

Ph.D. PROGRAM

573-701 COMPREHENSIVE EXAMINATION. (1)

573-702 RESEARCH DESIGN. (3) The logic and procedures of both qualitative and quantitative research designs are examined with particular emphasis on their appropriateness for addressing nursing and health problems. Issues specific to the design of nursing and health care studies are explored. Included in the types of designs analyzed are: experimental and quasi-experimental, ethnographic, grounded theory and evaluative.

573-703 ISSUES OF MEASUREMENT. (3) An examination of the underlying theories of measurement and techniques for assessing the validity and reliability of data collection instruments. Issues related to the development and/or utilization of instruments to measure target variables in nursing and health research are addressed.

573-730 DEVELOPMENT OF THEORY IN NURSING. (3) (Prerequisite: 573-620A or equivalent) This course surveys the history of nursing

theory development with special emphasis placed on the approaches theory development and the factors affecting these approaches. Issues such as the level of theory, where theory derives are examined in light of the needs of a practice discipline. Future directions for theory development in nursing are explored.

573-780 ADVANCED NURSING. (3) (3 hours seminar weekly) (Prerequisite: 573-621D, 573-624A, 573-625B or equivalent and permission of instructor). An in-depth analysis of selected issues and developments within nursing and health care. Included will be topics relevant to the areas of research and clinical expertise of the student and faculty.

55 Occupational Health

Department of Occupational Health
Purvis Hall
1020 Pine Avenue West
Montreal, QC H3A 1A2
Canada

Website: http://www.mcgill.ca/occh

Chair — G. Thériault

M.Sc. (Resident) and Ph.D. programs:
Telephone: (514) 398-4229
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Email: occhdept@epid.lan.mcgill.ca

Coordinator (M.Sc. Resident/Ph.D.) — S. Larivière

M.Sc. (Distance Education) program:
Telephone: (514) 398-6989
Fax: (514) 398-7153
Email: distocch@epid.lan.mcgill.ca

Coordinator (M.Sc. Distance Education) — M. Franzo

55.1 Staff

Emeritus Professor
J.C. McDonald; M.D., B.S.(Lond.), M.Sc.(Harv.), F.R.C.P.(C)

Professors
J.P. Farant; Ph.D.(Carl.), C.I.H.
C. Infante-Rivard; M.D.(Montr.), M.P.H.(UCLA), Ph.D.(McG.), F.R.C.P.(C)
G. Thériault; M.D.(Laval), M.I.H., Dr. P.H.(Harv.)

Associate Professors
A. Dufresne; B.Sc., M.Sc.(Que.), Ph.D.(McG.)
P. Héroux; B.Sc.(Laval), M.Sc., Ph.D.(I.N.R.S.)
T. Kosatsky; M.D.(Man.), M.P.H.(Emory)
M. Rossignol; B.Sc., M.D.(Sher.), M.Sc.(McG.), F.R.C.P.(C)

Lecturers
P. Dubé, J.P. Gauvin

Associate Members
M.R. Becklake, J.F. Boivin, P. Ernst, F. Liddell, A.D. McDonald *(Epidemiology and Biostatistics)*
P. Burpee *(Faculty of Education)*
B. Case *(RVH-Pathology)*

Adjunct Professors
D. Amre (Hôpital Ste-Justine); B. Armstrong (London School of Hygiene); I. Arnold (Alcan); S.Arnold (Consultant); P.Auger (Montreal Chest Hospital); M. Baillargeon (Montreal Chest Hospital); N. Cherry (U. of Manchester); L. DeGuire, L. Drouin, M. Goldberg, F. Labreche, P. Robillard, S. Stock (Direction de la santé publique); A. Dembe (U. of Massachusetts); D. Gautrin (Hôpital Sacré-Coeur); C. Martin (U. of West Virginia); B. Pant (Concordia); L. Patry; G. Perrault (IRSST); P. Sebastien (St.Gobain); J. Saari (U. of Waterloo); G. Shematek (Calgary Regional Hospitals Authority); J. Siemiatycki (Institut Armand Frappier); C. Tremblay (Santé Publique-Montérégie); M. Vézina (Centre de santé Publique de Québec); C. Viau (U. de Montréal); W. Wood (Environmental Safety Office, McGill).

55.2 Programs Offered

The Department of Occupational Health offers two graduate degree programs: a doctorate (Ph.D.) and Master (M.Sc.A) in occupational health sciences. The Master's program is available on campus or in distance education format.

M.Sc. Applied Program (Full-time) (Resident) (on campus)
The objective of this program is to train and enable competent health and hygiene professionals to work in occupational health programs by evaluating the work environment and work hazards and by proposing appropriate methods of prevention and control.

M.Sc. Applied Program (Distance Education)
A three and one-half year program leading to the degree of Master of Science Applied in Occupational Health Sciences – M.Sc.(A). This program is also offered for professional interest, for details please contact the Coordinator.

Ph.D. Program
The objective of this program is to train independent researchers in the field of work environment and health.

55.3 Admission Requirements

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 (Test of English as a Foreign Language) with a minimum score of 600, or 250 on the computerized test.

M.Sc. Applied Program (Full-time) (Resident) (on campus)

Candidates should have completed, with high academic standing, a bachelor of science degree or its equivalent in a discipline relevant to occupational health or hygiene such as: chemistry, engineering, environmental sciences, physics; medicine, nursing and other health sciences with a standing equivalent to a minimum Cumulative Grade Point Average (CGPA) of 3.0 out of 4. High grades are expected in courses considered by the Department to be preparatory to the graduate program.

M.Sc. Applied Program (Distance Education)

Candidates must hold an M.D., a bachelor's degree in nursing, or a B.Sc. (any major). They must have maintained at least a 3.0 on 4.0 grade point average.

Those who hold a B.Sc. must be Industrial Hygienists with at least three years of experience in industrial hygiene and/or safety. In the case of medical doctors and nurses, priority will be given to candidates with two or more years of experience in occupational health.

Ph.D. Program

Candidates must hold a M.Sc. degree or its equivalent in occupational health sciences, or in a relevant discipline, such as: community health, environmental health, epidemiology, chemistry, engineering, physics, or health sciences (medicine, nursing, etc.).

55.4 Application Procedures

M.Sc. Applied Program (Full-time) (Resident) (on campus)

Candidates must submit with their application two official copies of their university transcripts, two letters of reference, a copy of their curriculum vitae and a letter describing their background (occupational health, occupational hygiene, worker safety, etc.) as well as a $60(Cdn) application fee.

Eligible candidates may be invited for an interview with members of the Admissions Committee of the Department.

M.Sc. Applied Program (Distance Education)

Candidates must submit with their application two official transcripts from their university of graduation, two letters of recommendation, a copy of their résumé, a letter describing their career plan, the reasons for their enrolment, and how they plan to accom-

modate their study time within their work schedule as well as a $60(Cdn) application fee.

Ph.D. Program

Candidates must submit with their application two official copies of their university transcripts (undergraduate and graduate), two letters of reference (or completed special forms), a copy of their curriculum vitae and a letter describing their field of interest as well as a $60(Cdn) application fee.

Candidates must also submit with their application an outline of their scientific interests, indicating the field and the topic of their proposed research. Each student will be assigned to one academic staff member of the Department, who will act as his/her supervisor, who will guide him/her in the preparation of a definite research protocol.

55.5 Program Requirements

M.SC. APPLIED PROGRAM (FULL-TIME) (RESIDENT) (ON CAMPUS)

Teaching is organized in eight 3-credit courses and one 6-credit course totalling 30 credits. Promotion to the following semester is dependent upon passing grade. A comprehensive examination is held at the end of the course program.

After successfully completing the course requirements and passing the comprehensive examination, students must carry out an extended project (15 credits). The project requires students to identify an issue in their area of specialization, to review the present state of knowledge relevant to that issue, and either to carry out a survey to assess a particular work situation and make recommendations, or to devise a research protocol to extend knowledge in the area and to carry out a preliminary study to assess the feasibility of the protocol proposed.

Normally, students extend the duration of their project into the Fall term by registering for an additional session.

Required Courses (30 credits)

392-602B	(3)	Occupational Health Practice
392-603A	(3)	Work and Environment Epidemiology I
392-604A	(3)	Monitoring Occupational Environment
392-605D	(6)	Physical Health Hazards
392-608B	(3)	Biological and Chemical Hazards
392-612A	(3)	Principles of Toxicology
392-614B	(3)	Topics in Occupational Health
392-615B	(3)	Occupational Safety Practice
392-616A	(3)	Occupational Hygiene
392-600B		M.Sc.(A) Comprehensive Examination

Project Component – Required (15 credits)

392-699T	(15)	Project Occup. Health & Safety

M.SC. APPLIED PROGRAM (DISTANCE EDUCATION)

The Master distance education program takes three and one-half years to complete.

The first part (3 years) consists of 10 three-credit theory courses. Students enrolled in the program must successfully complete ten courses (30 credits). Equivalencies may be granted upon examination of the application by the professors concerned, and the Faculty of Graduate Studies.

On campus Practicums may be held at the discretion of each professor. These sessions are held in Montréal on the McGill University Campus. Their aim is to offer students direct exposure to various industrial hygiene situations and laboratory activities. Each course has a final examination at the end of the term. Participation in the practica is an essential component of the program.

The second part consists of writing an extended project report (15 credits). The project report will be carried out under the supervision of a member of the teaching staff. Note that students must pass the comprehensive exam before writing their report. A total of 45 credits is offered, the number required to complete the M.Sc. program.

Courses

392-602B-88	(3)	Occupational Health Practice
392-603A-88	(3)	Work & Environment Epidemiology I
392-604A-88	(3)	Monitoring Occupational Environment
392-608B-88	(3)	Biological and Chemical Hazards
392-612A-88	(3)	Principles of Toxicology
392-615B-88	(3)	Occupational Safety Practice
392-616A-88	(3)	Occupational Hygiene
392-617A-88	(3)	Occupational Diseases
392-624B-88	(3)	Social & Behavioural Aspects of Occupational Health
392-625B-88	(3)	Work & Environment Epidemiology II.
392-626B-88	(3)	Basics of Physical Health Hazards
392-627A-88	(3)	Work Physiology and Ergonomics
392-630A-88	(3)	Occupational Disease for OHNs
392-635B-88	(3)	Environmental Risks to Health
392-600B-88		M.Sc.(A) Comprehensive Examination

Each course has a final examination at the end of the term. Students must obtain at least 65% (B-) in each course in the program. Students who fail one course will be invited to withdraw from the program. Special circumstances can be examined.

Project Component – Required (15 credits)

392-699T,D-88 (15) Project Occup. Health & Safety

PH.D. PROGRAM

Three years of resident study are required for this program.

Students are required to take course 392-706D Occupational Health and Hygiene Seminars (2 credits) and are encouraged to take up to 12 credits in areas pertinent to their specialty or in areas necessary to complete their knowledge of occupational health.

All Ph.D. students must take a comprehensive examination within 18 months of registration.

A thesis committee will be established to ensure proper supervision and coverage of the different fields of expertise as required.

55.6 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.

▭ Denotes limited enrolment.

M.SC.(A) APPLIED PROGRAM (RESIDENT) COURSES

392-600B M.SC.(A) COMPREHENSIVE EXAMINATION. (0)

392-602B OCCUPATIONAL HEALTH PRACTICE. (3) This course analyzes the functions, structure and organization of occupational health programs and services.

392-603A WORK AND ENVIRONMENT EPIDEMIOLOGY I. (3) This course provides students with basic knowledge of epidemiology and statistics as applied to occupational health.

392-604A MONITORING OCCUPATIONAL ENVIRONMENT. (3) Principles and practices of environmental and biological monitoring of workplace hazards are addressed. Familiarization with instrumentation and calibration procedures is undertaken. Students learn to identify workplace health hazards, develop effective sampling strategies, use industrial hygiene equipment and interpret results of exposure measurements.

392-605D PHYSICAL HEALTH HAZARDS. (6) Properties, mechanisms of action and health effects of physical agents in the workplace and in the general environment: electromagnetic risks, noise and vibration, ionizing radiation, ventilation and thermal environment. Administrative, engineering and medical control methods, exposure standards and safety measures for these agents.

392-608B BIOLOGICAL AND CHEMICAL HAZARDS. (3) This course will acquaint the student with the physical, chemical, and toxicological properties of common industrial products, important indus-

trial processes and their associate health and safety hazards and the control measures.

392-612A PRINCIPLES OF TOXICOLOGY. (3) Selected topics, including acute, subacute and chronic toxicity assessment, pharmaco-kinetics and pharmaco-dynamics, mutagenicity, carcinogenicity and teratogenicity.

392-614B TOPICS IN OCCUPATIONAL HEALTH. (3) Using a problem oriented approach, this course aims at integrating all notions seen previously in the program. Advanced learning, lectures, readings, student presentations, written assignments.

392-615B OCCUPATIONAL SAFETY PRACTICE. (3) Principles of safety and loss prevention; incident investigations and analyses, occupational safety management tools; loss recognition; safety standards, guidelines and legislation. Selected topics include: fire prevention; workshop, tool and machine safety; fall protection; laboratory safety; confined space entry; safe work permit systems; and materials handling.

392-616A OCCUPATIONAL HYGIENE. (3) An introduction to the principles and practices of industrial hygiene designed to provide the students with the knowledge required to identify health and safety hazards in the workplace.

392-699T PROJECT OCCUP. HEALTH & SAFETY. (15) Under supervision, the student will identify an issue relevant to occupational health and report on work accomplished (i) to review the present state of knowledge and (ii) to conduct a survey and make recommendations or to devise a study proposal and to carry out a preliminary feasibility study.

Students with a strong interest in ergonomics could take course 392-627A-88 Work Physiology and Ergonomics given in the Distance Education program as an additional course. This is not a required course for the resident program students and will not exempt students from taking all the required courses in the resident program.

Those with a strong interest in risk assessment are encouraged to take the summer course 513-668C Epidemiology and Environmental Risk Assessment. This is not a required course and will not exempt the resident program or distance education program students from taking all the required courses in their respective programs. For more information on this course, please contact the Summer Programme Office at tel: (514) 398-3973 or email: summer@epid.lan.mcgill.ca or refer to their website: http://www.epi.mcgill.ca.

M.SC.(A) DISTANCE EDUCATION PROGRAM COURSES

392-600B OR C-88 COMPREHENSIVE EXAMINATION.

☐ **392-602B-88 OCCUPATIONAL HEALTH PRACTICE.** (3) This course analyzes the functions, structure and organization of occupational health programs and services.

☐ **392-603A-88 WORK & ENVIRONMENT EPIDEMIOLOGY I.** (3) This course provides students with basic knowledge of epidemiology and statistics as applied to occupational health.

392-604A-88 MONITORING OCCUPATIONAL ENVIRONMENT. (3) Principles and practices of environmental and biological monitoring of workplace hazards are addressed. Familiarization with instrumentation and calibration procedures is undertaken. Students learn to identify workplace health hazards, develop effective sampling strategies, use industrial hygiene equipment and interpret results of exposure measurements.

☐ **392-608B-88 BIOLOGICAL AND CHEMICAL HAZARDS.** (3) (See 392-625B-88) This course will acquaint the student with the physical, chemical, and toxicological properties of common industrial products, important industrial processes and their associate health and safety hazards and the control measures.

☐ **392-612A-88 PRINCIPLES OF TOXICOLOGY.** (3) Selected topics, including acute, subacute and chronic toxicity assessment, pharmaco-kinetics and pharmaco-dynamics, mutagenicity, carcinogenicity and teratogenicity.

☐ **392-615B-88 OCCUPATIONAL SAFETY PRACTICE.** (3) Principles of safety and loss prevention; incident investigations and analyses, occupational safety management tools; loss recognition; safety standards, guidelines and legislation. Selected topics include: fire prevention; workshop, tool and machine safety; fall protection; laboratory safety; confined space entry; safe work permit systems; and materials handling.

☐ **392-616A-88 OCCUPATIONAL HYGIENE.** (3) An introduction to the principles and practices of industrial hygiene designed to provide the students with the knowledge required to identify health and safety hazards in the workplace.

☐ **392-617A-88 OCCUPATIONAL DISEASES.** (3) Review of occupational health problems structured around target organs: respiratory, musculo-skeletal, skin, cardiovascular, mental disorders and aggressive agents: trauma, physical agents, solvents and metals and infectious agents. Also covered are occupational cancer, conditions associated with hypo-and hyperbaric environments, mutagenicity, teratogenicity and reproduction disorders, pre-employment, period examination and medical activities in the workplace.

☐ **392-624B-88 SOCIAL & BEHAVIOURAL ASPECTS OF OCCUPATIONAL HEALTH.** (3) This course explores the social science of occupational health practice, and describes influences on that practice of recent political, social and economic changes in the workforce and at the workplace; the theory of health promotion; management skills; and evaluation methods

☐ **392-625B-88 WORK & ENVIRONMENT EPIDEMIOLOGY II.** (3) Combined with 392-608B-88 to prepare students to evaluate the relations between exposure to workplace contaminants and health. The course involves the multidisciplinary analysis of four problems: Work-related cancer; Musculo-skeletal problems; Biological hazards; Chemical intoxication.

☐ **392-626B-88 BASICS OF PHYSICAL HEALTH HAZARDS.** (3) Properties, mechanisms of action and health effects of physical agents in the workplace: thermal environment, noise and vibration, electromagnetism and ionizing radiation. Engineering control methods, exposure standards and safety measures for physical agents. Basics of monitoring workers for health impacts. Control of airborne contaminants using ventilation-based dilution methods.

☐ **392-627A-88 WORK PHYSIOLOGY AND ERGONOMICS.** (3) Provide students with basic knowledge of physiological and psychological work requirements, ergonomic approach to work-related health problems and application of this type of approach to preventive and corrective measures.

392-630A-88 OCCUPATIONAL DISEASES FOR OHNS. Designed to meet independent and specific needs of occupational health nurses, it examines potential patologies in the workplace, and subsequent disease outcomes. Focus is on an evidence-based approach to assessment, nursing diagnosis, appropriate interventions in the identification, management of occupational diseases. Worker screening strategies and disease prevention activities are introduced.

392-635B-88 ENVIRONMENTAL RISKS TO HEALTH. (3) Focuses on pathways of exposure from industry to non working populations, on measurement of exposure and observation of effects, modelling and prediction of effects. Identifying, assessing and adapting existing data to predict effects given new exposures is a major theme. Spatial analysis, risk communication and disaster response are covered, too.

392-699T,D-88 PROJECT OCCUP. HEALTH & SAFETY. (15)

PH.D. COURSES

392-700D PH.D. COMPREHENSIVE EXAMINATION.

392-706D OCCUPATIONAL HEALTH AND HYGIENE SEMINARS. (2) A critical appraisal of the occupational health sciences literature which addresses issues in hygiene, safety, epidemiology and toxicology. Students will develop a critical sense of the literature and increase their understanding of different research paradigms.