It is the brain that makes us what we are, and understanding how the brain works and how it is affected by disease is a major goal of Neuroscience. Neuroscience is both pure science, offering challenging basic research pursuits, as well as medical science, with important clinical applications. The approach to problems in Neuroscience has roots in many of the basic sciences including biology, biochemistry, pharmacology, physiology, and psychology. Powerful techniques of molecular biology, biochemistry, and genetics have revealed new molecules, given insight to how gene expression is controlled, and allowed the identification of defective genes responsible for diseases of the nervous system. Neuronal and glial cells are studied in the context of adult development of nervous systems, and how neural networks are formed and maintained. Signalling and information transfer within and between cells are investigated by studying individual cells and their synaptic connections, or through research on complex neuronal circuits. Higher neural functions are explored by mapping neural architecture, through the study of specific systems with sophisticated physiological and imaging techniques, and by investigations of the neurobiological mechanisms of behaviour.

The Department of Neurology and Neurosurgery sponsors an undergraduate course in Neuroscience, and additional undergraduate courses are offered in the Departments of Biology, Pharmacology, Biochemistry, Psychology, Physiology, and Anatomy and Cell Biology. Graduate studies are a very large component of the Department of Neurology and Neurosurgery. The curriculum for graduate degrees in Neurology and Neurosurgery is provided in the Faculty of Graduate Studies and Research Calendar. Inquiries should be directed to the Graduate Program Coordinator, Montreal Neurological Institute, 3801 University Street, Montreal, H3A 2B4.

531-310B Cellular Neurobiology. (3) (2 lectures each week) (Prerequisite or corequisite: 177-200A and 177-201B, or 552-209A, or 552-210B) A survey of the functional organization of nerve cells, signalling in the nervous system, and principles of neural development. Topics include cell polarity, neurotransmitters, neurotrophins, receptors and second messengers, cell lineage, guidance of axon outgrowth, and nerve regeneration. Emphasis will be placed on analysis of neurons at the molecular level.

Professor Sossin (Co-ordinator)

11.18 Neurology and Neurosurgery (531)
Course Lecturers – Assistant Professors
Timothy Kennedy; B.Sc.(McM.), M.Phil, Ph.D.(Columbia) (joint appt. with Anatomy & Cell Biology)
Peter McPherson; B.Sc.(Manit.), Ph.D.(Iowa) (joint appt. with Anatomy & Cell Biology)
David Ramsdale: B.S.(II.); Ph.D.(Calif.)
Wayne Sossin; S.B.(M.I.T.), Ph.D.(Stan.) (joint appt. with Anatomy & Cell Biology)

The Minor Program in Neuroscience is a program designed for undergraduate students interested in how the nervous system functions. The program consists of courses from the departments of Anatomy and Cell Biology (504), Biochemistry (507), Biology (177), Neurology and Neurosurgery (531), Pharmacology and Therapeutics (549), Physiology (552), Psychiatry (555), and Psychology (294). The Minor is composed of 24 credits, 18 of which must be selected from two of the five topic areas listed below. Twelve credits of the 18 must be at the 400/500 level and from at least two different departments. A maximum of 6 credits can be counted both for the student’s primary program and for the Minor Program in Neuroscience, where appropriate.

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

Complementary Courses (24 credits)
6 credits selected from:

- 204-308A (3) Physiological Psychology I: Fundamentals
- or 177-306A (3) Neurobiology and Behaviour
- or 552-311A (3) Intermediate Physiology I
- 504-321A (3) Circuity of the Human Brain
- 531-310B (3) Cellular Neurobiology

18 additional credits:
9 credits each from 2 of the 5 areas listed below, 6 credits in each area must be from 400- or 500-level courses

Neurobiology and Behaviour

- 177-306A (3) Neurobiology and Behaviour
- 177-389B (3) Laboratory in Neurobiology
- 204-318B (3) Physiological Psychology II: Motivation and Learning
- 552-311A (3) Intermediate Physiology I
- 177-430B (3) Neural Basis of Behaviour
- 177-431A (3) Neurobiology of Learning & Memory
- 204-427B (3) Motor Control and Human Performance
- 204-505A (3) The Psychology of Pain
- 552-556B (3) Topics in Systems Neuroscience
- 555-500B (3) Advances in the Neurobiology of Mental Disorders

Molecular and Developmental Neurobiology

- 504-321A (3) Circuity of the Human Brain
- 531-310B (3) Cellular Neurobiology
- 552-311A (3) Intermediate Physiology I
- 177-532B (3) Developmental Neurobiology Seminars
- 177-588A (3) Molecular/Cellular Neurobiology
- 204-431B (3) The Environment and the Developing Brain
- 507-455B (3) Neurochemistry
- 552-451A (3) Advanced Neurophysiology

Neurophysiology

- 177-389B (3) Laboratory in Neurobiology
- 504-322B (3) Neuroendocrinology
- 552-311A (3) Intermediate Physiology I
- 177-431A (3) Neurobiology of Learning & Memory
- 177-588A (3) Molecular/Cellular Neurobiology
- 204-427B (3) Motor Control and Human Performance
- 552-451A (3) Advanced Neurophysiology
- 552-520B (3) Ion Channels
- 552-556B (3) Topics in Systems Neuroscience

Neuropsychology

- 177-306A (3) Neurobiology and Behaviour
- 204-311A (3) Human Behaviour and the Brain
- 204-318B (3) Physiological Psychology II: Motivation and Learning
- 504-321A (3) Circuity of the Human Brain
- 504-322B (3) Neuroendocrinology
- 204-410B (3) Special Topics in Neuropsychology
- 204-431B (3) The Environment and the Developing Brain
- 204-470A (3) Memory and Brain
- 204-505A (3) The Psychology of Pain
- 204-526A (3) Advances in Visual Perception
11.20 Nutrition (382)

Please see the School of Dietetics and Human Nutrition entry beginning on page 437 in the Faculty of Agricultural and Environmental Sciences section for further information about the School’s other courses, programs and academic staff. This information includes a Minor Program in Human Nutrition which can be taken by Science students.

382-307A HUMAN NUTRITION. (3) (Prerequisites: 180-212 and 177-201 or equivalents.) (Credit cannot be obtained for both 382-307 and 382-207.) Cellular and organismal aspects of nutrition with emphasis on biochemical and physiological roles of carbohydrates, lipids, proteins, minerals and vitamins in disease prevention and promotion of optimal health. Professor Jones

11.21 Nursing (576)

For a complete listing of Nursing courses and their descriptions, consult the School of Nursing website (http://www.nursing.mcgill.ca) or refer to the Health Sciences Calendar.

☐ Denotes limited enrolment.

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

576-308 ISSUES IN WOMEN’S HEALTH. (3) (Prerequisite: Introductory Psychology or Sociology or permission of the instructor.) (Complementary course for the Women’s Studies and Social Studies of Medicine Concentrations.) Exploration of a wide range of topics on the health of women. Topics include use of health care system, poverty, roles, immigration, body image, lesbian health, and violence against women. Additional topics vary by year. A Health Science elective open to students in the Faculties of Arts, Science, and Medicine. A. Gilchrist

☐ 576-309 WOMEN’S REPRODUCTIVE HEALTH. (3) (Prerequisite: Introductory Psychology or Sociology or permission of the instructor.) (Restriction: not open for credit to students who have taken 576-308 prior to September 1997.) (Complementary course for the Women’s Studies and Social Studies of Medicine Concentrations.) Concepts of health and medicalization. Canadian and international perspectives. Topics include contraception, abortion, infertility, menstruation, menopause, new reproductive technologies, prenatal care, childbirth. Additional topics vary by year. A Health Science elective open to students in the Faculties of Arts, Science, and Medicine. TBA

11.22 Pathology (546)

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

546-300B HUMAN DISEASE. (3) (Prerequisites: 177-200A, 177-201B or 507-212B, 552-209A. Pre- or co-requisite: 552-210B.) Provides a fundamental understanding of the diseases prevalent in North America, for upper level students in the biological sciences. Includes: general responses of cells and organ systems to injury; assessment of individual diseases by relating the causes, symptoms, diagnosis, treatment and prevention to the primary biological abnormalities in each disorder. Professor Zorychta

11.23 Pharmacology and Therapeutics (549)

McIntyre Medical Building
3655 Promenade Sir-William-Osler
Montreal, QC H3G 1Y6
Telephone: (514) 398-3623
Website: http://www.pharma.mcgill.ca

Chair — TBA
Vice-Chair — Radan Capek

Professors
Jack Aranda; M.D.(Manila Central), Ph.D.(McG.)
Radan Capek; M.D., Ph.D.(Prague)
Paul B.S. Clarke; M.A.(Cantab.), Ph.D.(Lond.) (on leave)
Brian Collier; B.Sc., Ph.D.(Leeds)
A. Claudio Cuello; M.D.(Buenos Aires), M.A., D.Sc.(Oxon.)
Claude De Montigny; M.D., Ph.D.(Montr.), F.R.C.P.(C)
Barbara Hales; M.Sc.(Phil. Coll. of Pharmacy and Science), Ph.D.(McG.)
Peter J. McLeod; M.D.(Manit.), F.R.C.P.(C.)
John B. Richardson; B.Sc., M.D.C.M., L.M.C.C., F.R.C.P., Ph.D.(McG.)
Bernard Robaire; B.A.(Calif.), Ph.D.(McG.)
Allan Tenenhouse; B.Sc., M.D., C.M., Ph.D.(McG.)
Daya R. Varma; M.D. (Lucknow), Ph.D.(McG.)

Associate Professors
Guillermina Almazan; Ph.D.(McG.)
Barbara Espelin; M.D.(Warsaw)
Howard S. Katz; M.Sc., Ph.D., D.D.S.(McG.)
Dusica Maysinger; Ph.D.(Los Angeles)
Stanley Nettel; B.Sc., M.D., C.M.(McG.)
Ante L. Padjen; M.D., M.Sc., D.Sc.(Zagreb)
Alfredo Ribeiro-da-Silva.; M.D., Ph.D.(Oporto) (joint appit. with Anatomy & Cell Biology)
H. Uri Saragovi; Ph.D.(Miami)
Betty I. Sasyniuk; B.S.P., Ph.D.(Man.)
Moshe Szyf; M.Sc., Ph.D.(Hebrew Univ.)
Jacquetta Trasler; M.D.C.M., Ph.D.(McG.)
Edith A. Zorychta; B.Sc.(F.X.), M.Sc., Ph.D.(McG.)

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

Associate Members
Moulay Alaoui-Jamali; Ph.D.(Sorbonne)
Gerald Batist; M.D., C.M.(McG.)
Serge Gauthier, M.D.(Montr.)
Yogesh C. Patel; M.D.(Otago), Ph.D.(Monash)
Roger Prichard; B.Sc., Ph.D.(N.S.W.)
Remi Quirion; M.Sc., Ph.D.(Sher.)

Adjunct Professors
Paul Albert; Ph.D.(Harv.)
Sylvain Chemtob; M.D.(Montr.), Ph.D.(McG.)
Anthony Ford Hutchinson; M.Sc.(Warwick), Ph.D.(Lond.)
Lorella Garafalo; Ph.D.(McG.)
Kathleen Metters; Ph.S.(London)
George S. Robertson; Ph.S.(Dal.)

Pharmacology is the science which deals with all aspects of drugs and their interactions with living organisms. Thus, it involves the physical and chemical properties of drugs, their biochemical and physiological effects, mechanisms of action, pharmacokinetics, and therapeutic and other uses. Since the word “drug” encompasses all chemical substances that produce an effect on living cells, it is evident that pharmacology is a very extensive subject. Pharmacology is a multi-disciplinary science. It has developed its own set of principles and methods to study the mode of the action of drugs, but it has also utilized many techniques and approaches from various disciplines including biochemistry, physiology, anatomy and molecular biology, as well as others. Pharmacology can be subdivided into a number of different areas such as neuropharmacology, molecular biology, reproductive pharmacology, endocrine pharmacology, receptor pharmacology, cardiovascular pharmacology, toxicology, developmental pharmacology, auto-
nomic pharmacology, biochemical pharmacology, and therapeu-
tics.

Training in pharmacology is conducted at both the undergradu-
ate and graduate levels. Because of its breadth, students may be at-
tracted to the subject from a variety of viewpoints; this includes
those completing a Bachelor's degree in any number of basic
science disciplines, such as biology, zoology, chemistry, physics,
biochemistry, microbiology, anatomy and physiology. At the under-
graduate level, four lecture courses are offered. A course involving
research projects in pharmacology is also available to provide the
student with the opportunity to get first-hand experience in a phar-
macology research laboratory. These courses should provide stu-
dents with knowledge concerning the actions of drugs on living
systems and insight into approaches to basic pharmacological
research.

MINOR PROGRAM IN PHARMACOLOGY (24 credits)
[MARS Program Code 6-680000]
The Minor Program in Pharmacology is intended for students regis-
tered in a complementary B.Sc. program who are interested in a
focused introduction to specialized topics in pharmacology to pre-
pare them for professional schools, graduate education, or entry
into jobs in industry or research institutes. Students should declare
their intent to enter the Minor Program in Pharmacology at the
beginning of their U2 year. They must consult with, and obtain the
approval of, the Coordinator for the Minor Program in the Depart-
ment of Pharmacology and Therapeutics.

All courses in the Minor Program must be passed with a mini-
imum grade C or better. Generally, no more than 6 credits of over-
lap are permitted between the Minor and the primary program.

Required Courses (18 credits)
549-300A (3) Drug Action
549-301B (3) Drugs and Diseases
549-562A (3) General Pharmacology I
549-563B (3) General Pharmacology II
549-599A,B,D,T (6) Research Projects in Pharmacology

Complementary Courses (6 credits)
one of the following sets:
177-200A (3) Molecular Biology
and 177-201B (3) Cell Biology and Metabolism
or 507-212B (3) Molecular Mechanisms of Cell Function

OR
552-209A (3) Mammalian Physiology I
and 552-210B (3) Mammalian Physiology II

549-300A DRUG ACTION. (3) (Prerequisites: 177-200A and 177-
201B or 507-212B, 552-209A and 552-210B or permission of in-
structor.) This course covers the fundamental principles of phar-
macology and toxicology. Frequently encountered drugs are used
as a focus to illustrate sites and mechanisms of action, distribution,
metabolism, elimination and adverse effects.  

Professor Zorychta

549-301B DRUGS AND DISEASE. (3) (Prerequisites: 177-200A,
177-201B or 507-212B, 552-209A and 552-210B and 549-300A or
permission of instructor.) This course further explores the basic
principles of pharmacology as illustrated by drugs used in the
treatment of disease. Emphasis is placed on drugs used for dis-
ese prevalent in North America.  

Professor Hales and Staff

549-562A GENERAL PHARMACOLOGY I. (3) (Prerequisites: 552-
209A and 552-210B, 177-200A and 177-201B or 507-311A and
507-312B or equivalent.) (Restrictions: Open to U3 students with
permission of instructors, and students registered in the Minor
Pharmacology Program.) Principles of pharmacology as illustrated
by current issues with an emphasis on the nervous system will be
discussed. Drugs classified by their molecular target of action,
their mechanism of action, and possibly a rationale for therapeutic
use will be presented. Students will be required to examine and in-
terpret scientific data, to write a paper and participate in small
group discussions.

Professor Espin and Staff

549-563B GENERAL PHARMACOLOGY II. (3) (Prerequisites: 552-
209A and 552-210B, 177-200A and 177-201B or 507-311A and
sequences of courses for this program: they are described below.

Students from outside of the Province of Quebec will ordinarily register in the Science Freshman program. Physics offers two

The two main undergraduate programs in Physics at McGill are

The Major program, on the other hand, offers a broad training in classical and modern physics and yet leaves room for the student to take a meaningful sequence of courses in other areas. It is intended primarily for students who wish to pursue careers in fields for which physics provides a basis. However this program also provides a preparation for graduate studies, especially if a student chooses, in consultation with the departmental adviser, a number of Honours Physics courses in the U2 and U3 years.

There are also a number of other Major programs: Atmospheric Sciences and Physics, Physics and Computer Science, Physics and Geophysics, and Physiology and Physics, offered jointly with other departments, and a Minor program in Electrical Engineering, available only to students in the Physics Major program. In addition, there is a Minor in Physics, a Faculty program in Physics and a Joint Faculty program in Mathematics, Chemistry and Physics, which provide a broad base for students less interested in a specialized education. Almost all the Physics programs can be combined with an Internship Year, as part of the University’s IYES program, which provides experience in an industrial or government laboratory as part of the degree program.

For those interested in a career as a high school science teacher, the concurrent program leading to both a B.Sc and a B.Ed degree provides two Physics options. Both of these combine physics courses from the Major program with Education courses. They are, respectively, the Major program in Chemistry and Physics for Teachers, and the Major program in Mathematics and Physics for Teachers. (For details, see section 11.28.)

Students from outside of the Province of Quebec will ordinarily register in the Science Freshman program. Physics offers two sequences of courses for this program: they are described below.

The list of pre- and co-requisites is not absolute. In many cases permission of the Department may be sought to have a specific prerequisite waived. The procedure is to ask the professor in charge of the course to review the request for such a waiver. The prerequisites of the 100-level courses are described in the following section entitled Science Freshman Program.

Courses 198-200A, 198-201B, 198-204A,B, and 198-224A are designed for students from faculties other than Science (such as Arts and Music) and have no prerequisites as such, although a reasonable knowledge of high-school level algebra, geometry and trigonometry is desirable.

All other 200-level courses are designed primarily for Science students and assume successful completion of CEGEP level physics and mathematics programs. The phrase "Prerequisite CEGEP Physics" has been inserted to make this point clear. Students who have not included Calculus III in their CEGEP program, should register in the first term of the U1 year for Mathematics 189-222.

Students interested in any of the Physics programs should contact the Department for an Adviser

Physics 203-101, 203-201, 203-301-78 or equivalent – CEGEP course numbers, standard throughout the Province of Quebec.

SCIENCE FRESHMAN PROGRAM

Students entering McGill with a Quebec CEGEP profile in Science will normally begin their programs in Physics with courses at the 200 level.

Students without this profile will normally take courses 198-131A and 198-142B if they have previously taken physics at the high school level and will be taking differential calculus concurrently with 198-131A and integral calculus concurrently with 198-142B. Those students who have not previously taken physics at the high school level and who intend to do programs in the Biological Sciences may instead take courses 198-101A and 198-102B. All students are expected to have reasonable fluency in algebra, geometry and trigonometry at the high school level. If this is not the case, then Mathematics 189-112A should be taken concurrently with 198-101A. Those for whom this is not necessary are advised to take 189-139A concurrently with 198-101A.

MINOR PROGRAM IN PHYSICS (18 credits) [MARS Program Code 6-]

The 18-credit Minor permits no overlap with any other programs. It contains no Mathematics courses, although many of the courses in it have Math pre- or co-requisites. It will, therefore, be particularly appropriate to students in Mathematics, but it is also available to any Science student with the appropriate mathematical background.

Students in certain programs (e.g. the Major in Chemistry) will find that there are courses in the Minor which are already part of their program, or which they may not take for credit because of a substantial overlap of material with a course or courses in their program. After consultation with an advisor, such students may complete the Minor by substituting any other physics course(s) from the Major or Honours Physics programs.

Required Course (3 credits) 198-259D (3) Lab in Mechanics, Heat & Optics

Complementary Courses (15 credits)

15 credits to be selected as follows:

198-230A (3) Dynamics of Simple Systems
or 198-251A (3) Classical Mechanics I
198-271A (3)
198-260A (3) Relativity and Modern Physics
or 198-214 (3) Astrophyics
or 198-225B (3) Musical Acoustics
198-232B (3) Heat and Waves
or 198-253B (3) Thermal Physics
198-240B (3) Computers for Physics
or 198-241B (3) Signal Processing
198-340A (3) Electricity and Magnetism
or 198-350A (3) Electromagnetism

**FACULTY PROGRAM IN PHYSICS** (54 credits)
[MARS Program Code 4-720000]

**Required Courses** (36 credits)
198-230A (3) Dynamics of Simple Systems
198-232B (3) Heat and Waves
198-241B (3) Signal Processing
198-259D (3) Lab in Mechanics, Heat & Optics
198-333B (3) Thermal & Statistical Physics
198-340A (3) Electricity and Magnetism
198-436B (3) Modern Physics
198-434B (3) Optics
189-315B (3) Ordinary Differential Equations
189-314A,B (3) Advanced Calculus
189-223A,B (3) Linear Algebra
189-222A,B (3) Calculus III
198-446A (3) Quantum Physics
198-333B (3) Thermal and Statistical Physics
198-331B (3) Mechanics
198-328A (3) Electronics
198-339B (3) Measurements Laboratory
198-342B (3) Electromagnetic Waves
198-340A (3) Electricity and Magnetism
186-350B (3) Tectonics
198-259D (3) Lab in Mechanics, Heat & Optics
198-241B (3) Signal Processing
198-240B (3) Computers for Physics
198-232B (3) Heat and Waves
189-319B (3) Advanced Calculus

**Complementary Courses** (18 credits)
at least 3 credits selected from:
198-434B (3) Optics
198-439A (3) Lab in Modern Physics
the remainder selected from:
198-328A (3) Electronics
198-331B (3) Mechanics
198-339B (3) Measurements Laboratory
198-342B (3) Electromagnetic Waves
186-320A (3) Elementary Earth Physics
189-316B (3) Functions of a Complex Variable
189-317A (3) Numerical Analysis
189-319B (3) Partial Differential Equations
308-202A,B (3) Introduction to Computer I

**JOINT FACULTY PROGRAM IN MATHEMATICS, CHEMISTRY AND PHYSICS** See page 390 in the Mathematics and Statistics entry for complete program information.

**MAJOR PROGRAM IN PHYSICS** (60 credits)
[MARS Program Code 1-720000]

**U1 Required Courses** (21 or 23 credits)
198-230A (3) Dynamics of Simple Systems
198-232B (3) Heat and Waves
198-240B (3) Computers for Physics
198-259D (3) Lab in Mechanics, Heat & Optics
189-222A (3) Calculus III
198-233A (3) Linear Algebra
198-241B (3) Signal Processing
or 304-200 (3) Fundamentals of Electrical Engineering
and 304-210 (5) Circuit Analysis

**U2 Required courses** (24 credits)
198-328A (3) Electronics
198-331B (3) Mechanics
198-333B (3) Thermal & Statistical Physics
198-339B (3) Measurements Laboratory
198-340A (3) Electricity and Magnetism
198-342B (3) Electromagnetic Waves
189-314A (3) Advanced Calculus
189-315B (3) Ordinary Differential Equations

**U3 Required Courses** (15 credits)
198-434B (3) Optics
198-436B (3) Modern Physics
198-439A (3) Lab in Modern Physics
198-446A (3) Quantum Physics
198-449B (3) Project Laboratory

**JOINT MAJOR PROGRAM IN PHYSICS AND GEOPHYSICS**
(65 credits) [MARS Program Code 1-720400]
The Joint Major program in Physics and Geophysics provides a firm basis for graduate work in Geophysics and related fields as well as a sound preparation for those who wish to embark on a career directly after the B.Sc.

**U1 Required Courses** (29 credits)
198-230A (3) Dynamics of Simple Systems
198-232B (3) Heat and Waves
198-241B (3) Signal Processing
189-259D (3) Lab in Mechanics, Heat & Optics
186-203B (3) Structural Geology I
186-210A (3) Introduction to Mineralogy
186-231E (2) Field School I
189-222A (3) Calculus III
189-223A (3) Linear Algebra
189-314B (3) Advanced Calculus

**U2 Required Courses** (27 credits)
198-331B (3) Mechanics
198-333B (3) Thermal & Statistical Physics
198-339B (3) Measurements Laboratory
198-340A (3) Electricity and Magnetism
198-342B (3) Electromagnetic Waves
186-350B (3) Tectonics
186-510B (3) Global Geodynamics and Geomagnetism
or 186-330B (3) Earthquakes & Earth Structure
189-315A (3) Ordinary Differential Equations
189-319B (3) Partial Differential Equations

**U3 Required Courses** (9 credits)
198-446A (3) Quantum Physics
198-332B (3) Physics of Fluids
186-510B (3) Global Geodynamics and Geomagnetism
or 186-330B (3) Earthquakes & Earth Structure

**JOINT MAJOR PROGRAM IN ATMOSPHERIC SCIENCE AND PHYSICS** Students should consult undergraduate advisers in both departments. See page 355 in the Atmospheric and Oceanic Sciences section for complete program information.
The Major program in Physics and Atmospheric Science provides a firm basis for graduate work in Atmospheric Science and related fields as well as a sound preparation for those who wish to embark on a career directly after the B.Sc.

**JOINT MAJOR IN PHYSICS AND COMPUTER SCIENCE**
(66 credits) [MARS Program Code TBA] (Awaiting Final Approval)
The Joint Major in Physics and Computer Science is designed to give motivated students the opportunity to combine the two fields in a way that will distinguish them from the B.Sc.’s in either field by itself. The two disciplines complement each other, with physics providing an analytic problem-solving outlook and basic understanding of nature, while computer science enhances the ability to make practical and marketable applications, in addition to having its own theoretical interest. Graduates of this program may be able to present themselves as being more immediately useful than a pure physics major, but with more breadth than just a programmer. They will be able to demonstrate their combined expertise in the Special Project courses which is the centerpiece of the final year of the program.

**U1 Required Courses** (21 credits)
189-222A,B (3) Calculus III
189-223A,B (3) Linear Algebra
189-240A (3) Discrete Structures and Computing
198-230A (3) Dynamics of Simple Systems
198-240B (3) Computers for Physics
198-259D (3) Lab in Mechanics, Heat & Optics
308-250A (3) Introduction to Computer Science

**U2 Required Courses** (24 credits)
189-314A,B (3) Advanced Calculus
189-315A,B (3) Differential Equations
198-232B (3) Heat and Waves
198-241B (3) Signal Processing
JOINT HONOURS PROGRAM IN MATHEMATICS AND PHYSICS (81 credits) [MARS Program Code 3-634500]

This is a specialized and demanding program intended for students who wish to develop a strong basis in both Mathematics and Physics in preparation for graduate work and a professional or academic career. Although the program is optimized for theoretical physics, it is broad enough and strong enough to prepare students for further study in either experimental physics or in mathematics. The minimum requirement for entry into the program is completion with high standing of the usual CEGEP courses in physics and in mathematics. In addition, a student who has not completed the equivalent of 189-222 must take it in the first term without receiving credits toward the 81 credits required in the Joint Honours program.

To remain in the Honours program and to be awarded the Honours degree, the student must maintain a 3.00 GPA in the required and complementary courses, and a grade of C or better in each required or complementary course.

The student will have two advisors, one from Mathematics and the other from Physics.

U1 Required Courses (27 credits)
198-241B (3) Signal Processing
198-251A (3) Classical Mechanics
189-248A (3) Advanced Calculus I
198-259D (3) Lab in Mechanics, Heat & Optics
189-260A (3) Relativity and Modern Physics
189-247B (3) Linear Algebra
189-222A (3) Advanced Calculus I
198-249B (3) Advanced Calculus II
189-354A (3) Analysis III
198-251B (3) Algebra II
189-325A (3) Ordinary Differential Equations
189-248A (3) Advanced Calculus I
198-260A (3) Relativity and Modern Physics
189-325A (3) Ordinary Differential Equations
198-350A (3) Electromagnetism
198-357A (3) Quantum Physics I
198-362A (3) Statistical Mechanics
189-352A (3) Electromagnetic Waves
189-354A (3) Quantum Physics I
189-380A (3) Differential Equations
189-370A (3) Algebra III
189-355A (3) Analysis IV

U2 Required Courses (24 credits)
198-328A (3) Electromagnetism
198-365A (3) Quantum Mechanics
198-357A (3) Quantum Physics I
189-262B (3) Statistical Mechanics
189-357A (3) Quantum Mechanics
189-464B (3) Honours Research Project
189-259D (3) Lab in Modern Physics
189-469A (3) Lab in Modern Physics II
198-469B (3) Honours Project Lab

U3 Required Courses (15 credits)
198-514B (3) General Relativity
198-551A (3) Quantum Theory
198-557A (3) Nuclear Physics
198-564A (3) Solid State Physics
198-559A (3) Advanced Statistical Mechanics
198-562A (3) Electromagnetic Theory
198-567B (3) Particle Physics

U1 Complementary Courses (15 credits)
9 credits selected from:
198-322B (3) Quantum Mechanics
198-328A (3) Electromagnetism
189-248A (3) Advanced Calculus I
198-259D (3) Lab in Mechanics, Heat & Optics
198-350A (3) Electromagnetism
189-257B (3) Ordinary Differential Equations
198-352A (3) Electromagnetic Waves
198-357A (3) Quantum Physics I
189-355A (3) Analysis IV

U3 Complementary Courses (12 credits)
9 credits selected from:
198-322B (3) Quantum Mechanics
198-328A (3) Electromagnetism
189-248A (3) Advanced Calculus I
198-259D (3) Lab in Mechanics, Heat & Optics
198-350A (3) Electromagnetism
189-357A (3) Quantum Physics I
189-355A (3) Analysis IV

MINOR PROGRAM IN ELECTRICAL ENGINEERING (23 or 25 credits) [Program registration done by Student Affairs Office]

The Minor program does not carry professional recognition. Only students who satisfy the requirements of the Major in Physics are eligible for this Minor. Students registered for this option cannot count 198-241 towards the requirements of the Major in Physics, and should replace this course by another Physics or Mathematics course. Students who select 304-334 in the Minor cannot count 198-328 towards the requirements of the Major in Physics, and should replace this course by another Physics or Mathematics course.
Required Courses (17 or 19 credits)
- 304-200 (3) Fundamentals of Electrical Engineering
- 304-210 (5) Circuit Analysis
- 304-303 (3) Signals and Systems
- 304-330 (3) Electronic Circuits
- 304-305 (3) Probability and Random Signals
  or 304-334 (5) Electronic Circuits II

Complementary Courses (6 credits)

INTERNSHIP PROGRAMS – INTERNSHIP YEAR FOR ENGINEERING AND SCIENCE (IYES)
The following programs are also available with an Internship component. For more information, please see section 2.8 in the Faculty of Engineering section.

Faculty Program in Physics
- Major in Physics
- Honours in Physics
- Joint Honours Program in Physics & Mathematics
- Joint Faculty Program in Mathematics, Chemistry & Physics
- Joint Major Program in Atmospheric Science & Physics
- Joint Major Program in Physics & Geophysics

COURSE DESCRIPTIONS
Instructors’ names are subject to change, since course assignments are made after this Calendar goes to press. See the Department’s Web page http://www.physics.mcgill.ca for up-to-date information.

The course credit weight is given in parentheses (#) after the information.

Denotes courses offered only in alternate years
★ Denotes courses not offered in 2000-01.

NOTE:
The course title.

The course credit weight is given in parentheses (#) after the

198-202B INTRODUCTORY PHYSICS – MECHANICS, (4) (3 hours lectures; 2 hours laboratory; tutorial sessions) (Note open to students taking or having taken 198-131A, CEGEP physics 203-101 or equivalent.) The object of this course is to give the students a basic understanding of the principles of physics, illustrating these, where possible, with current examples of their use in biology and medicine. (Laboratory sections have limited enrolment.)

Professor Moore

198-109D GENERAL PHYSICS LABORATORY. (2) (2 hours laboratory; 2 hours laboratory; tutorial sessions) (Prerequisite: 198-101, Corequisite: 189-139) (Not open to students taking or having taken 198-124B, CEGEP physics 203-101 or equivalent.) Electric field and potential. D.C. circuits and measurements. Capacitance. Magnetic field and induction. A.C. circuits Semiconductor devices and their application. Electromagnetic waves. (Laboratory sections have limited enrolment.)

Dr. Altounian

These courses, 101A and 102B together satisfy the minimum requirement in physics for Medical School.

198-109D GENERAL PHYSICS LABORATORY. (2) (2 hours laboratory) (Not open to students who have taken or are taking 198-101 or 198-102.) The laboratory component of 198-101A and 198-102B. May be taken only by students who have completed the lecture component but not the laboratory of 198-101 and 198-102.

198-119D GENERAL PHYSICS LABORATORY. (2) (3 hours laboratory) The laboratory component of 198-131A and 198-142B. This course may be taken only by students who have completed the lecture components of these courses but not the laboratory.

198-131A MECHANICS AND WAVES, (4) (3 hours lectures; 1 hour tutorial; 3 hours laboratory in alternate weeks; tutorial sessions) (Corequisite: 189-139A) (Not open to students taking or having taken 198-101A, CEGEP physics 203-101 or equivalent.) The basic laws and principles of Newtonian mechanics; oscillations and waves. (Laboratory sections have limited enrolment.)

Professor Harris

198-142B ELECTROMAGNETISM & OPTICS, (4) (3 hours lectures, 3 hours laboratory in alternate weeks; tutorial sessions) (Prerequisite: 198-131A. Corequisite: 189-141B) (Not open to students taking or having taken 198-102B, CEGEP physics 203-101 or equivalent.) The basic laws of electricity and magnetism; geometrical and physical optics. (Laboratory sections have limited enrolment.)

Professor Grutter

198-200A SPACE, TIME & MATTER. (3) (2 hours lectures) (Not open to students in Science or Engineering.) See “Science for Arts Students” in the Arts section.

Professor Ragan

198-204A,B PLANETS, STARS & GALAXIES. (3) (3 hours lectures; 3 evening periods for star identification and use of telescope.) (Not open to students who have taken or are taking 198-214A.) An elementary astronomy course for non-science students (see “Science for Arts Students” in the Arts section) and for science students not taking a Physics program.

Professors Crawford and Burgess

198-208A TOPICS IN PHYSICS. (1 credit; 2 hours lectures, first six weeks) (Not open to students in Physics programs.) Topic for 2000-01: The Safe Use of Nuclear Radiation.

Professor Cohen

198-217B PHYSICS AND THE LIFE SCIENCES. (3) (2 hours lectures) (Prerequisites: CEGEP Physics or permission of instructor.) (Not open to students who are taking or have taken 198-199B.)

Professor Ragan

198-224A PHYSICS & PSYCHOPHYSICS OF MUSIC. (3) (3 hours lectures) (Designed for students in the Faculty of Music but suitable for students with an interest in music, and how it is received.) An introduction to astrophysics with emphasis placed on methods of observation and current models. Stellar radiation and detectors, stellar classification systems, structures and evolution. Pulsars, quasars, black holes. Galaxies, large scale structure of the universe, cosmology.

Professor Ragan

198-208A TOPICS IN PHYSICS. (1 credit; 2 hours lectures, first six weeks) (Not open to students in Physics programs.) Topic for 2000-01: The Safe Use of Nuclear Radiation.

Professor Cohen

198-225B MUSICAL ACOUSTICS. (3) (3 hours lectures) (Prerequisites: CEGEP Physics or both 189-112 and 198-224A) (Designed for students in music who have interests in sound recording and reproduction and also suitable for students in science with an interest in music.) Physical acoustics with applications to music. Resonators and radiators, acoustic impedance. Acoustic properties of strings, bars, membranes, pipes and horns. Application to selected musical instruments. Direction characteristics of sound sources. Room acoustics.

Professor Cline

198-230A DYNAMICS OF SIMPLE SYSTEMS. (3) (3 hours lectures) (Prerequisite: CEGEP physics. Corequisite: Mathematics 189-222A) (Not open to students taking or having passed 198-251A.) Translational motion under Newton’s laws; forces, momentum, work/energy theorem. Special relativity; Lorentz transforms, relativistic mechanics, mass/energy equivalence. Topics in rotational dynamics. Noninertial frames.

Professor Gale

198-232B HEAT AND WAVES. (3) (3 hours lectures) (Prerequisite: 198-230A) (Not open to students taking or having passed 198-253B.) First and second laws of thermodynamics, kinetic theory of gases, optical interference, polarization, electro-optics, physics of microscopic systems.

Professor Mark

198-240B COMPUTERS FOR PHYSICS, (3) (2 hours lectures, 3 hours laboratory) (Prerequisite 198-230A or 198-251A) (Restricted to students in first year Honours and Majors physics or by
permission of instructor.) The course will extend and consolidate previous knowledge of mechanics and general physics by introducing and applying techniques for data analysis, numerical computation and simulation. Included will be an introduction to local facilities, a programming language and computer graphics.

Professor Harris

198-241B SIGNAL PROCESSING. (3) (2 hours lectures; 3 hours laboratory alternate weeks) (Prerequisite: CEGEP physics) Linear circuit elements, resonance, network theorems, diodes, transistors, amplifiers, feedback, integrated circuits.

Professor Lee

198-242B ELECTRICITY & MAGNETISM. (2) (2 hours lectures) (Prerequisites CEGEP Physics, 189-222A,B) Properties of electromagnetic fields, dipole and quadrupole fields and their interactions, chemical bonding of molecules, electromagnetic properties of materials, Maxwell's equations and properties of electromagnetic waves, propagation of waves in media.

Dr. Altonian

198-251A CLASSICAL MECHANICS I. (3) (3 hours lectures) (Prerequisite: CEGEP physics, Corequisite: 189-222A) Not open to student taking or having taken 198-230A.) Newton's laws, work and energy, angular momentum, Harmonic oscillator, forced oscillations, Inertial forces, rotating frames. Central forces, centre of mass, planetary orbits, Kepler's laws.

TBA

198-253B THERMAL PHYSICS. (3) (3 hours lectures) (Prerequisite: CEGEP physics, Corequisite: 189-222A,B) Not open to students taking or having taken 198-232B.) Energy, work, heat; first law. Temperature, entropy; second law. Absolute zero; third law. Equilibrium, equations of state, gases, liquids, solids, magnets; phase transitions.

Professor Guo

198-259D LAB IN MECHANICS, HEAT & OPTICS. (3) (3 hours) (Prerequisite: CEGEP physics. Corequisite: 198-230A or 198-251A and 198-232B or 198-253B.) Illustrative experiments on topics in mechanics, heat and optics; a project.

Professors Lee, Muir and Dr. Buchinger

198-260A RELATIVITY AND MODERN PHYSICS. (3) (3 hours lectures) Corequisite: 189-222A.) History of special relativity; Lorentz transformations; kinematics and dynamics; transformation of electric and magnetic forces; introduction to topics in modern physics.

Professor Lam

198-328A ELECTRONICS. (3) (2 hours lectures; 3 hours laboratory) Semiconductor devices, basic transistor circuits, operational amplifiers, combinatorial and sequential logic, integrated circuits, analog to digital converters. The laboratory component covers design, construction and testing of basic electronic circuits.

Professor Das Gupta


Professor David Ryan


Professor Lovejoy

198-333B THERMAL & STATISTICAL PHYSICS. (3) (3 hours lectures) (Prerequisite:198-232B) (Not open to students taking or having passed 198-362B.) Introductory equilibrium statistical mechanics. Quantum states, probabilities, ensemble averages. Entropy, temperature, Boltzmann factor, chemical potential. Photons and phonons. Fermi-Dirac and Bose-Einstein distributions; applications.

Professor Strom-Olsen

198-339B MEASUREMENTS LABORATORY. (3) (6 hours) (Prerequisite: 198-241B) Introduction to modern techniques of measurement. The use of computers in performing and analysing experiments. Data reduction, statistical methods, report writing.

Extensive use of computers is made in this laboratory; therefore some familiarity with computers and computing is an advantage.

Professor Grutter and Dr. Buchinger


Professor Stairs

198-342B ELECTROMElecTIC WAVES. (3) (3 hours lectures) (Prerequisites: 198-340A or 198-242A,B, Mathematics 189-314A,B, 189-315A,B) Not open to students having passed 304-357A.) Maxwell's equations. The wave equation. The electromagnetic wave, reflection, refraction, polarization. Guided waves. Transmission lines and wave guides. Vector potential. Radiation. The elementary dipole; the half-wave dipole; vertical dipole; folded dipoles; Yagi antennas. Accelerating charged particles. Professor Myers

198-350A ELECTROMAGNETISM. (3) (3 hours lectures) (Prerequisites: 189-248A,B, 189-325B, Honours students, or permission of the instructor.) Not open to students having taken 198-340A.) Fundamental laws of electric and magnetic fields in both integral and differential form.

Professor Lovejoy

198-352A ELECTROMAGNETIC WAVES. (3) (3 hours lectures) (Prerequisite: 198-350A. Honours students, or permission of the instructor.) Vector and scalar potentials; plane waves in homogeneous media; refraction and reflection; guided waves; radiation from simple systems; dipole and quadrupole radiation; introduction to fields of moving charges; synchrotron radiation; Bremsstrahlung.

Professor Trischuk

198-357A QUANTUM PHYSICS I. (3) (3 hours lectures) (Honours students or permission of instructor.) Not open to students taking or having passed 198-446A.) Experimental basis for quantum mechanics; wave-packets; uncertainty principle. Hilbert space formalism. Schrodinger equation: eigenvalues and eigenvectors: applications to 1-d problems including the infinite and finite potential wells and the harmonic oscillator. Tunneling. Time independent perturbation theory.

Professor Das Gupta

198-359B LABORATORY IN MODERN PHYSICS. (3) (6 hours) (Prerequisite: 198-328A, Corequisite: 198-457B, Honours students or permission of instructor.) Advanced level experiments in modern physics stressing quantum effects and some properties of condensed matter.

Professor D.H. Ryan and Dr. Buchinger

198-362B STATISTICAL MECHANICS. (3) (3 hours lectures) (Prerequisites: 189-248B or equivalents, 198-253B. Honours students, or permission of the instructor.) Not open to students having taken 198-333B.) Quantum states and ensemble averages. Fermi-Dirac, Bose-Einstein and Boltzmann distribution functions and their applications.

Professor Das Gupta

198-413A THE PHYSICAL BASIS OF PHYSIOLOGY. (3) (3 hours lectures) (Prerequisite: 189-315A,B, or 189-325B, and permission of the instructor.) (Intended for Major or Honours students in Physics, Physiology, Physiology and Physics, or Mathematics and others with permission.) Analytic and computer simulation techniques are used to examine the role of nonlinearities and time delays in determining the dynamic behaviour of physiological control systems and their relation to normal and pathophysiological states. Examples drawn from the control of respiration, cellular proliferation and differentiation, biochemical feedback networks, thermo-regulatory mechanisms, and neural feedback.

Professor Mackey

198-434B OPTICS. (3) (3 hours lectures) Geometrical optics, wave optics, lasers, Fourier transform spectroscopy, holography, optical data processing, stellar interferometry.

Professor Trischuk

198-436B MODERN PHYSICS. (3) (3 hours lectures) (Prerequisite: 198-446A) (Not open to students in Honours Physics or in Joint
Honours in Mathematics and Physics.) One electron atoms, radiation, multielectron atoms, molecular bonds. Selected topics from condensed matter, nuclear and elementary particle physics. 

**Professor Patel**

**198-439A LABORATORY IN MODERN PHYSICS.** (3) (6 hours) (Pre-requisite: 198-339B. Corequisite: 198-446A.) (Not open to students with credit in 198-359B except with permission of instructor.) Advanced level experiments in modern physics stressing quantum effects and some properties of condensed matter. 

**Professor Barrette and Dr. Buchinger**

**198-446A QUANTUM PHYSICS.** (3) (3 hours lectures) (Pre-requisite: 198-223A or 198-251A) (Not open to students taking or having taken 198-357A or 198-457B.) de Broglie waves, Bohr atom. Schrödinger equation, wave functions, observables. One dimensional potentials. Schroedinger equation in three dimensions. Angular momentum, hydrogen atom. Spin, experimental consequences. 

**Professor de Takacsy**

**198-449B PROJECT LABORATORY.** (3) (6 hours) (Pre-requisite: 198-328A, 198-439A) Supervised project work in an area related to material covered in upper year courses. 

**Professor Moore and Dr. Buchinger**

**198-451B CLASSICAL MECHANICS.** (3) (3 hours lectures) (Pre-requisite: 198-251A. Honours students, or permission of instructor.) (Not open to students having taken 198-331B.) Rigid bodies, angular momentum, gyroscope, moment of inertia, principal axes, Euler's equations. Coupled oscillations and normal modes. Lagrangian mechanics and actions. Hamiltonian mechanics. Topics in advanced analytical mechanics. 

**Professor Strom-Olsen**

**198-457B QUANTUM PHYSICS II.** (3) (3 hours lectures) (Honours students or permission of instructor.) (Not open to students having taken 198-446A.) Angular momentum and spin operators. Operator methods in quantum mechanics. Coupling of spin and angular momenta. Variational principles and elements of time dependent perturbation theory (the Golden Rule). Solution of the Schrodinger equation in three dimensions. Applications to the hydrogen and helium atoms and to simple problems in atomic and molecular physics. 

**Professor Stairs**

**198-459D HONOURS RESEARCH PROJECT.** (6) (6 hours) (Honours students or permission of instructor.) (Not open to students taking the sequence 198-469A/198-479B.) An experimental project, supervised by members of staff, on some topic related to the ongoing research in the department. 

**Professor David Ryan and Dr. Buchinger**

**198-469A LAB IN MODERN PHYSICS II.** (3) (6 hours) (Honours students, or permission of instructor) (Pre-requisite: 198-359B) (Not open to students taking 198-459D.) Advanced level experiments in modern physics stressing quantum effects and some properties of condensed matter. Continuation of 198-359B. 

**Professor Barrette and Dr. Buchinger**

**198-479B HONOURS PROJECT LAB.** (3) (6 hours) (Honours students, or permission of instructor) (Pre-requisite 198-469A) (Not open to students taking 198-459D.) Supervised project work in an area related to material covered in upper year courses. 

**Professor David Ryan and Dr. Buchinger**

**198-489A,B SPECIAL PROJECT.** (3) (6 hours) (Only open to students in their final year of the Joint Major in Physics and Computer Science after consultation with the advisor(s) for the program.) A project incorporating aspects of both physics and computer science, under the joint supervision of the two departments. The Physics aspect may be either laboratory-based or theoretical in nature. The Computational aspect will involve the development and implementation of algorithms arising from the investigation. 

**TBA**

**198-514B GENERAL RELATIVITY.** (3) (3 hours lectures) (Honours students, or permission of the instructor.) Transition from special to general relativity. Non-Euclidian geometry. The basic laws of Physics in co-variant form, Einstein's equations. Gravitational waves; neutron stars; black holes; cosmology. 

**Professor Myers**

**198-551A QUANTUM THEORY.** (3) (3 hours lectures) (Honours students, or permission of the instructor.) General formulation, scattering theory, WKBJ approximation, time-dependent perturbation, theory and applications, angular momentum, relativistic wave equations. 

**Professor Gale**

**198-557A NUCLEAR PHYSICS.** (3) (3 hours lectures) (Honours students, or permission of the instructor.) General nuclear properties, nucleon-nucleon interaction and scattering theory, radioactivity, nuclear models, nuclear reactions. 

**Professor Mark**

**198-558A SOLID STATE PHYSICS.** (3) (3 hours lectures) (Honours students, or permission of the instructor.) Properties of crystals, lattice vibrations and thermal properties of insulators, free electron model and band structure, semi-conductors, metals, optical properties. 

**Professor D.H. Ryan**

**198-559A ADVANCED STATISTICAL MECHANICS.** (3) (3 hours lectures) (Honours students, or permission of the instructor.) Self averaging and central-limit theorem; thermodynamic fluctuations; ensemble theory; surface roughening; broken symmetry and Goldstone's theorem; phase transitions; mean-field, Landau and Onstein-Zernicke theory; Monte Carlo method; molecular dynamics; scaling; renormalization group; epsilon expansion, non-equilibrium theory. 

**Professor Grant**

**11.25 Physiology (552)**

McIntyre Medical Sciences Building, Room 1021
3655 Promenade Sir-William-Osler
Montreal, QC H3G 1Y6
Telephone: (514) 398-4316
Fax: (514) 398-7452
Website: http://www.physio.mcgill.ca

Chair — Alvin Shrier
Emeritus Professor
G. Melvill Jones; B.A., M.A., M.B., B.Ch., M.D.(Cantab.)

**Professors**

Catherine Bushnell; B.A.(Maryland), Ph.D.(American U.) (Harold Griffith Professor of Anaesthesia) (joint appit. with Dentistry)

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

Monroe W. Cohen; B.Sc., Ph.D.(McG.)

Ellis J. Cooper; B.Eng.(Sir G.Wms.), M.Sc.(Surrey), Ph.D.(McM.)

Mony M. Frojmovic; B.Sc., Ph.D.(McG.)

Leon Glass; B.S.(Brooklyn), Ph.D.(Chic.)

Phil Gold; C.C., B.Sc., M.Sc., Ph.D., M.D., C.M.(McG.), F.R.C.P.(C), F.R.S.C. (joint appit. with Medicine)

David Goltzman; B.Sc., M.D., C.M.(McG.). (Antoine G. Massabki Professor of Medicine) (joint appit. with Medicine)

John Hanrahan; Ph.D.(U.B.C.)

James L. Henry; B.Sc.(Tor.), M.Sc., Ph.D.(W.Ont.)

Robert E. Kearney; B.Eng., M.Eng., Ph.D.(McG.) (joint appit. with Biomedical Engineering)

Kresimir Knjivec; O.C., B.Sc., Ph.D., M.B., Ch.(Edin.), F.R.S.C. (joint appit. with Anaesthesia Research)

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

Mortimer Levy; B.Sc., M.D., C.M.(McG.), F.R.C.P(C) (joint appit. with Medicine)

Michael Mackey; B.A., Ph.D.(Wash.)

Jacapo P. Mortola; M.D.,Milan

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

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

Alvin Shrier; B.Sc.(C'dia), Ph.D.(Dal.) (Hosmer Professor of Physiology)
Physiology has its roots in many of the basic sciences including biology, chemistry, mathematics, and physics. Physiology overlaps with other biomedical sciences such as anatomy, biochemistry, pathology and pharmacology, and with psychology and biomedical engineering, and is one of the prime contributors of basic scientific knowledge to the clinical medical sciences.

Members of the Department of Physiology at McGill are engaged in studies dealing with molecules, single cells, or entire systems in a variety of vertebrates, including man. A wide range of interest and expertise is represented, including cardiovascular, respiratory, gastrointestinal and renal physiology, the physiology of exercise, neurophysiology, endocrinology, immunology, biophysics and biomathematics. Some faculty members have formal or informal links with the departments of mathematics, physics, electrical engineering, chemistry and clinical departments (medicine, surgery, pediatrics, neurology, obstetrics and anesthesia), reflecting and reinforcing the close ties between physiology and other disciplines.

Graduates at the B.Sc. level have found rewarding careers in teaching, in secondary schools and CEGEPs, government service, and laboratory technical assistance, such as in pharmaceutical houses, hospitals, and institutions of higher learning. Moreover, physiology provides an excellent background for medical, dental or other postgraduate work, in such fields as physiology, experimental medicine, pharmacology, and is one of the prime contributors of basic scientific knowledge to the clinical medical sciences.

The programs offered in Physiology differ in their orientation but they all have a common core of material covering cardiovascular, respiratory, gastrointestinal and renal physiology, neurophysiology, endocrinology and immunology. The specified U1 courses are identical for all programs except the Joint Major Programs in Physiology and other disciplines. Admission to the Major Program will be in U2, upon completion of the U1 required courses, and in consultation with the student’s adviser.

If not previously taken 180-212A,B Organic Chemistry I must be completed in addition to the 54 program credits.

### Required Courses (33 credits)

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<tr>
<th>Code</th>
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<tr>
<td>552-209A</td>
<td>Mammalian Physiology I</td>
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<tr>
<td>552-210B</td>
<td>Mammalian Physiology II</td>
</tr>
<tr>
<td>552-212D</td>
<td>Introductory Physiology Lab</td>
</tr>
<tr>
<td>552-311A</td>
<td>Intermediate Physiology I</td>
</tr>
<tr>
<td>552-312B</td>
<td>Intermediate Physiology II</td>
</tr>
<tr>
<td>552-313B</td>
<td>Intermediate Physiology III</td>
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<tr>
<td>552-314A</td>
<td>Integrative Neuroscience</td>
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<tr>
<td>177-200A</td>
<td>Molecular Biology</td>
</tr>
<tr>
<td>177-202B</td>
<td>Basic Genetics</td>
</tr>
<tr>
<td>177-301A,B</td>
<td>Cell and Molecular Laboratory</td>
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<tr>
<td>180-222A,B</td>
<td>Organic Chemistry II</td>
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</tbody>
</table>

### Complementary Courses (21 credits)

6 credits selected from:
- 177-201B (3) Cell Biology and Metabolism
- or 507-212B (3) Molecular Mechanisms of Cell Function
- or 177-373A (3) Biostatistical Analysis
- or 177-309A (3) Mathematical Models in Biology

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

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

### MAJOR PROGRAM IN PHYSIOLOGY (63-64 credits)

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

If not previously taken 180-212A,B Organic Chemistry I must be completed in addition to the 63-64 program credits.

#### U1 Required Courses (18 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>552-209A</td>
<td>Mammalian Physiology I</td>
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<tr>
<td>552-210B</td>
<td>Mammalian Physiology II</td>
</tr>
<tr>
<td>552-212D</td>
<td>Introductory Physiology Lab</td>
</tr>
<tr>
<td>177-200A</td>
<td>Molecular Biology</td>
</tr>
<tr>
<td>177-202B</td>
<td>Basic Genetics</td>
</tr>
<tr>
<td>180-222A,B</td>
<td>Organic Chemistry II</td>
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</table>

#### U2 and U3 Required Courses (18 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>552-311A</td>
<td>Intermediate Physiology I</td>
</tr>
<tr>
<td>552-312B</td>
<td>Intermediate Physiology II</td>
</tr>
<tr>
<td>552-313B</td>
<td>Intermediate Physiology III</td>
</tr>
<tr>
<td>552-314A</td>
<td>Integrative Neuroscience</td>
</tr>
<tr>
<td>177-301A,B</td>
<td>Cell and Molecular Laboratory</td>
</tr>
<tr>
<td>507-311A</td>
<td>Metabolic Biochemistry</td>
</tr>
</tbody>
</table>

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

12-13 credits selected from:
- 177-201B (3) Cell Biology and Metabolism
- or 507-212B (3) Molecular Mechanisms of Cell Function
- or 177-373A (3) Biostatistical Analysis
- or 177-309A (3) Mathematical Models in Biology
- or 180-203A (3) A Survey of Physical Chemistry
- or 180-204A,B (3) Physical Chem./Biol. Sci. I
- or 504-214A (3) Systemic Human Anatomy
- or 504-261A (4) Introduction to Dynamic Histology

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

6 credits selected from science courses – see approved list in Department
### JOINT MAJOR PROGRAM IN PHYSIOLOGY AND MATHEMATICS (71 credits) [MARS Program Code 1-725400]

**U1 Required Courses** (14 credits)
- 552-212D (2) Introductory Physiology Lab
- 189-222A,B (3) Calculus III
- 189-247A,B (3) Linear Algebra
- 177-200A (3) Molecular Biology
- 177-309A (3) Mathematical Models in Biology

**U1 Complementary Courses** (15 credits)
- 9 credits selected from:
  - 552-209A (3) Mammalian Physiology I
  - and 552-210B (3) Mammalian Physiology II
  - or 552-201A (3) Human Physiology: Control Systems
  - and 552-202B (3) Human Physiology: Body Functions
  - 177-201B (3) Cell Biology and Metabolism
  - or 507-212B (3) Molecular Mechanisms of Cell Function
- 6 credits selected from:
  - 189-248A (3) Advanced Calculus I
  - or 189-314A,B (3) Advanced Calculus
  - or 189-325A,B (3) Ordinary Differential Equations
  - or 189-315A,B (3) Ordinary Differential Equations

**U2 Required Courses** (21 credits)
- 552-311A (3) Intermediate Physiology I
- 552-312B (3) Intermediate Physiology II
- 552-313B (3) Intermediate Physiology III
- 189-242A (3) Analysis I
- 189-243B (3) Real Analysis
- 189-323A (3) Probability Theory
- 189-324B (3) Statistics

**U2 Complementary Courses** (3 credits)
- 198-413A (3) The Physical Basis of Physiology
- or 189-437A (3) Mathematical Methods in Biology

**U3 Required Courses** (3 credits)
- 189-319B (3) Partial Differential Equations

**U3 Complementary Courses** (15 credits)
- 6 credits selected from Physiology courses (e.g. 552-461D)
- 3 credits selected from upper level science courses
- 6 credits selected from:
  - 189-316B (3) Functions of a Complex Variable
  - or 189-249B (3) Advanced Calculus II
  - 189-317A,B (3) Numerical Analysis
  - 189-322B (3) Dynamical Systems, Fractals and Chaos
  - 189-447B (3) Stochastic Processes

**JOINT MAJOR PROGRAM IN PHYSIOLOGY AND PHYSICS (77 credits) [MARS Program Code 1-725500]**

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

**U1 Required Courses** (17 credits)
- 552-212D* (2) Introductory Physiology Lab
- 198-230A (3) Dynamics of Simple Systems
- 198-232B (3) Heat and Waves
- 198-241B (3) Signal Processing
- 198-259D (3) Lab in Mechanics, Heat & Optics
- 189-222A,B (3) Calculus III

**U1 Complementary Courses** (12 credits)
- 552-209A (3) Mammalian Physiology I
- and 552-210B* (3) Mammalian Physiology II
- or 552-201A (3) Human Physiology: Control Systems
- and 552-202B (3) Human Physiology: Body Functions
- or 189-247A (3) Linear Algebra
- 189-314B (3) Advanced Calculus
- or 189-248A (3) Advanced Calculus I
- * The corequisite 177-200A, 177-201B is waived for this program.

**U2 Required Courses** (21 credits)
- 552-311A (3) Intermediate Physiology I
- 552-312B (3) Intermediate Physiology II

**U3 Required Courses** (6 credits)
- 552-313B (3) Intermediate Physiology III
- 198-328A (3) Electronics
- 198-333B (3) Thermal & Statistical Physics
- 198-339B (3) Measurements Laboratory
- 198-340A (3) Electricity and Magnetism

**U2 Complementary Courses** (6 credits)
- 198-413A (3) The Physical Basis of Physiology
- or 189-437A (3) Mathematical Methods in Biology
- or 189-315A (3) Ordinary Differential Equations
- or 189-325B (3) Ordinary Differential Equations

**U3 Required Courses** (12 credits)
- 552-461D (6) Experimental Physiology
- 198-446A (3) Quantum Physics
- 399-519A (3) Analysis of Biomedical Systems and Signals

**U3 Complementary Courses** (9 credits)
- 3 credits selected from upper level Physiology courses
- 6 credits to be approved by Physiology and Physics

**HONOURS PROGRAM IN PHYSIOLOGY (71 credits) [MARS Program Code 2-750000]**

All admissions to the Honours program will be in U2, and the student must have a U1 GPA of 3.30, with no less than a B in 552-209A and 210B. Admission to U3 requires a U2 CGPA of 3.20 with no less than a B in U2 Physiology courses. Decisions for admission to U3 will be heavily influenced by student standing in U2 courses.

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

The deadline to apply to the Honours Program is June 1. Application forms are available in McIntyre 1021. Students should include in their letters telephone numbers where they can be reached during the last week of August. Students are responsible for picking up their letters of decision in McIntyre 1021 no later than one week before classes start.

Graduation: To graduate from the Honours Physiology Program the student will have a CGPA of 3.20 with a mark no less than a B in all Physiology courses.

If not previously taken 180-212A,B,Organic Chemistry I must be completed in addition to the 71 program credits.

**Required Courses** (56 credits)
- 552-209A (3) Mammalian Physiology I
- 552-210B (3) Mammalian Physiology II
- 552-212D (2) Introductory Physiology Lab
- 552-311A (3) Intermediate Physiology I
- 552-312B (3) Intermediate Physiology II
- 552-313B (3) Intermediate Physiology III
- 552-314A (3) Integrative Neuroscience
- 552-351B (3) Research Techniques in Physiology
- 552-359D (1) Tutorial in Physiology
- 552-459D (6) Physiology Seminar
- 552-461D (6) Experimental Physiology
- 177-200A (3) Molecular Biology
- 177-202B (3) Basic Genetics
- 177-301A,B (3) Cell and Molecular Laboratory
- 180-222A,B (4) Organic Chemistry II
- 504-261A (4) Introduction to Dynamic Histology
- 507-311A (3) Metabolic Biochemistry

**Complementary Courses** (15 credits)
- 9 credits selected from:
  - 177-201B (3) Cell Biology and Metabolism
  - or 507-212B (3) Molecular Mechanisms of Cell Function
  - or 189-315A (3) Ordinary Differential Equations
  - or 189-325B (3) Ordinary Differential Equations
- 6 credits selected from physiology courses – see approved list in Department.
INTERDEPARTMENTAL HONOURS PROGRAM IN IMMUNOLOGY
The Departments of Biochemistry, Microbiology and Immunology, and Physiology offer an Interdepartmental Honours Program in Immunology. Physiology students interested in the program should contact Dr. W.S. Lapp. Details of this program may be found in section 11.13.

COURSE DESCRIPTIONS
The course credit weight is given in parentheses (#) after the course title.

- Denotes courses not offered in 2000-01.
- Denotes courses offered in alternate years only
- Denotes limited enrolment

For more detailed information about courses and programs consult the Department’s website.

552-100A THE BODY MATTERS. (3) (3-hour seminar per week) (Not open to students who have taken or are taking 552-201, 552-202, 552-209, 552-210, or 552-211.) Designed for anyone with an interest in exercise, the course covers the principles of medicine and physiology as they apply to current lifestyles. Topics will include how and why injuries occur, the effects of exercise on the body, and general health considerations such as “Does exercise prevent or promote osteoarthritis?”.

- Professor Shrier

552-198A FEEDBACK & RHYTHMS IN PHYSIOLOGY. (3) (3 hours seminar) (FYS – for first year students only, maximum 25.) (Corequisite: 189-140)

- Professor Trippenbach and Staff

552-199A HISTORY OF GENETIC ENGINEERING. (3) (3 hours seminar per week) (FYS - for first year students only, maximum 20.)

552-201A HUMAN PHYSIOLOGY: CONTROL SYSTEMS. (3) (3 hours lecture weekly) (Prerequisites: collegial courses in biology or anatomy, and in chemistry and physics; with 180-212 or equivalent, as a pre- or co-requisite.) For students in Physical and Occupational Therapy, Nursing, and others with permission of the course coordinator. (Not open to students who have taken 552-209A.) Physiology of body fluids, blood, nerve and muscle, peripheral nerves, central nervous system, special senses, autonomic nervous system, defense mechanisms.

- Professor White and Staff

552-202B HUMAN PHYSIOLOGY: BODY FUNCTIONS. (3) (3 hours lecture weekly) (Prerequisites: collegial courses in biology or anatomy, and in chemistry and physics; with 180-212 or equivalent, as a pre- or co-requisite.) For students in Physical and Occupational Therapy, Nursing, Education, and others with permission of the course coordinator. (Not open to students who took 552-201A in 1976-77 or earlier, or 552-210B.) Physiology of the cardiovascular, respiratory, excretory, endocrine, and digestive systems; organic and inorganic metabolism; nutrition; exercise and environmental stress.

- Professor Orlowski and Staff

552-201A and 552-202B are companion courses and it is recommended that they be taken in that sequence; under special circumstances they may be taken in separate years or in the reverse sequence.

552-209A MAMMALIAN PHYSIOLOGY I. (3) (3 hours lectures weekly) (Prerequisites: as for 552-201A and 552-202B. Pre- or co-requisites: 177-200A, 177-201B or 507-212B) (Not open to students who have taken 552-211D or 552-210A.) (For students in the Faculty of Science, and other students by permission of the instructor.) The course covers the physiology of body fluids, blood, body defense mechanisms, peripheral and central nervous system, muscle. Students must be prepared to attend evening (19:00 - 20:00) class tests.

- Professor Stochaj and Staff

552-210B MAMMALIAN PHYSIOLOGY II. (3) (3 hours lectures weekly) (Prerequisites: as for 552-201A and 552-202B. Pre or co-requisite: 177-200A) (Not open to students who have taken 552-211D or 552-210B.) (For students in the Faculty of Science, and other students by permission of the instructor.) Although 552-210B may be taken without the prior passing of 552-209A, students should note that they may have some initial difficulties because of lack of familiarity with some basic concepts introduced in 552-209A. The course covers the physiology of the autonomic nervous system; cardiovascular, respiratory and digestive systems; of the kidney; and of physical exercise. Students must be prepared to attend evening (19:00 - 20:00) class tests. Tutorials are given from 18:00 to 19:00 hours.

- Professor Trippenbach and Staff

552-212D INTRODUCTORY PHYSIOLOGY LAB. (2) (One 3-hour lab and one 1-hour lecture every second week) (Corequisites: 552-209A and 552-210B.) (Required for Physiology students enrolled in 552-209A and 552-210B. Open to Honours and Major students from some other departments.) (For students in a Physiology program, 552-212D should be taken concurrently with 552-209A and 552-210B.) Exercises illustrating fundamental principles in human physiology: blood, neurophysiology, smooth muscle; cardiovascular, respiratory, endocrine, and renal physiology.

- Professors Guevara, Wechsler and Staff

552-311A INTERMEDIATE PHYSIOLOGY I. (3) (3 hours of lectures per week; 1-3 hours optional lab/demonstration/tutorial arranged for a maximum of 3 afternoons per term.) (Prerequisite: 552-209A and 552-210B or equivalent, or permission of the instructor.) In-depth presentation of experimental results and hypotheses on cellular communication in the nervous system and the endocrine system.

- Professors Cooper, Farookhi and Staff

552-312B INTERMEDIATE PHYSIOLOGY II. (3) (3 hours of lectures per week; 1-3 hours optional lab/demonstration/tutorial arranged for a maximum of 3 afternoons per term.) (Prerequisite: 552-209A and 552-210B or equivalent, 552-311A or permission of the instructor.) In-depth presentation of experimental results and hypotheses underlying our current understanding of topics in immunology, kidney function and respiration explored beyond the introductory level.

- Professor Hanrahan and Staff

552-313B INTERMEDIATE PHYSIOLOGY III. (3) (3 hours of lectures per week; 1-3 hours optional lab/demonstration/tutorial arranged for a maximum of 3 afternoons per term.) (Prerequisites: 552-209A and 552-210B or equivalent, 552-311A or permission of the instructor.) In-depth presentation of experimental results and hypotheses underlying our current understanding of the physiology of the cardiovascular system; blood physiology including hemostasis and thrombosis; transport of fluids and cells; general cell kinetics and regulation, and gastrointestinal physiology.

- Professor Frojmovic and Staff

552-314A INTEGRATIVE NEUROSCIENCE. (3) (3 hours of lectures per week) (Prerequisites: 552-209A and 552-210B) In depth presentation of experimental results and hypotheses underlying our current understanding of how single neurons and ensembles of neurons encode sensory information, generate behaviour, and control cognitive functions such as emotion, learning, and memory, during voluntary behaviours.

- Professor Cullen and Staff

552-351B RESEARCH TECH. IN PHYSIOLOGY. (3) (2 hour lecture and 3 hour lab weekly) (Prerequisites: 552-209, 552-210 and 552-311. Corequisites: 552-312 and 552-313.) (Restricted to Honours Physiology students.) The course provides an overview of common research methods in Physiology, including critical analysis and practical experience with some of the methods. Topics include ethics of animal experimentation, data analysis, membrane bio-physics, radioimmunossay, ion sensitive dyes, immunocytochemistry, autoradiography, electron microscopy, and molecular biology.

- Professor Trippenbach and Staff

552-359D TUTORIAL IN IMMUNOLOGY. (6) (7 hours lab, 2 hours seminar weekly.) (Enrolment restricted to U3 Honours Immunology students.) (Please see regulations concerning Project Courses, section 2.6.2 in the Faculty Degree Requirements section.) Individual research projects in Immunology under
the guidance of staff members in the three participating departments: Physiology, Biochemistry, and Microbiology and Immunology. The students will meet to discuss their research projects in a seminar format during the winter term. They will be evaluated on their laboratory and seminar performance. **Professor Lapp**

**552-423A PHYSIOLOGICAL DYNAMICS.** (3) (Prerequisite: 552-209A and 552-210B or equivalent, and 177-309 or 189-315, or permission of the instructor.) The control of physiological system function from a theoretical standpoint. The basic roles of mass and momentum transport, pacemaker activity and wave propagation, and neural information processing are emphasized. These are related to the concepts of feedback, stability, and oscillation in normal and patho-physiological states. **Professors Mackey and Glass**

- **552-444A THEORETICAL ELECTROPHYSIOLOGY.** (3) (3 hours lecture/seminar per week) (Prerequisites: 552-209A and 552-210B or equivalent; 177-309A or 189-315A,B.) (Offered in even numbered years.)

- **552-451A ADVANCED NEUROPHYSIOLOGY.** (3) (3 hours lecture) (Prerequisite: 552-311A or equivalent and 177-310B.) (Limited enrolment. Password required.) Topics of current interest in neurophysiology including the development of neurons and synapses, physiology of ionic channels, presynaptic and postsynaptic events in synaptic transmission and neuronal interactions in CNS function. **Professors Cohen and Cooper**

- **552-459D PHYSIOLOGY SEMINAR.** (6) (2 hours seminar) (Prerequisite: permission of instructors.) (Required course for U3 Honours students. Limited enrolment – 12 students maximum. Password required.) Discussion of topics in mammalian, cellular and molecular physiology. Students will be required to write one essay and make at least one oral presentation per term. A final course essay is required. **Professor Faroohki**

- **552-461D EXPERIMENTAL PHYSIOLOGY.** (6) (Permission of the instructor required. Password required.) (This course is a requirement for U3 students in the Honours Physiology program and the Major program in Physiology and Physics, and is open to a limited number of other U3 Physiology students.) (Please see regulations concerning Project Courses, section 2.6.2 in the Faculty Degree Requirements section.) Individual project work under the supervision of Departmental Staff members. **Professor Wechsler and Staff**

- **552-502B EXERCISE PHYSIOLOGY.** (3) (Prerequisite: 552-311A, 552-312B, and 552-313B) Behaviour of physiological processes in response to physical effort, in areas such as structural basis of muscle contraction, neural control of muscle, mechanics and energetics of muscle contraction, fuel utilization, fatigue, physiological adjustments during exercise and influence of training. **Professor Siwnych and Staff**

- **552-508A ADVANCED RENAL PHYSIOLOGY.** (3) (Prerequisite: 552-312B or the equivalent.) (Limited enrolment. Open to advanced undergraduate and graduate students.) Offered in conjunction with the Department of Medicine. Lectures and seminars will cover advanced concepts in selected areas of kidney physiology (glomerular and tubular function) as well as membrane and epithelial transport. Students will be expected to critically discuss selected experimental papers. **Professor Levy and Staff**

- **552-513B CELLULAR IMMUNOLOGY.** (3) (4 hours lectures plus term paper) (Prerequisites: 528-314B, or permission of the instructor.) This course deals with cellular interactions, regulation and effector mechanisms of the normal immune response in relation to diseases and pathogenic processes. It is taught at an advanced level. **Professor Lapp**

- **552-515A PHYSIOLOGY OF BLOOD II.** (3) (2 hours lecture plus 1 hour seminar weekly) (Prerequisites: 552-313B, or permission of the instructor.) Study of the cell and molecular physiology of hemostasis and its pathophysiology (bleeding and thrombosis). Emphasizes on molecular mechanisms regulating clot formation, fibrinolysis, and cell adhesion/aggregation. Experimental approaches and specific clinical disorders will be analyzed. Weekly discussions, and a major term paper. **Professors Frojmovic, Solymos and staff**

- **552-516B PHYSIOLOGY OF BLOOD II.** (3) (2 hours lecture plus 1 hour seminar weekly) Bone marrow hematopoiesis, with emphasis on regulation of stem cell proliferation and differentiation along hematopoietic pathways. Formation and differentiation of red and white blood cells and some of the diseases associated with hematopoiesis will be covered. Emphasis will be given to the molecular mechanisms involved in the normal and pathological conditions. **Professors Ponka and Hiscott**

- **552-517B ARTIFICIAL INTERNAL ORGANS.** (3) (Prerequisite: permission of instructors. Password required.) Physiological, bioengineering, chemical and clinical aspects of artificial organs including basic principles and physiopathology of organ failure. Examples: oxygenator, cardiac support, vascular substitutes, cardiac pacemaker, biomaterials and tissue engineering, biocompatibility. **Professors Prakash and Chang**

- **552-518A ARTIFICIAL CELLS & BIOTECHNOLOGY.** (3) (Prerequisite: permission of instructors. Password required.) Physiology, biotechnology, chemistry and biomedical application of artificial cells, blood substitutes, immobilized enzymes, microorganisms and cells, hemoperfusion, artificial kidneys, and drug delivery systems. 552-517B and 552-518A when taken together, will give a complete picture of this field. However, the student can select one of these. **Professors Chang and Yu**

- **552-520B ION CHANNELS.** (3) (1.5 hour lecture, 1.5 hour seminar) (Prerequisite: 552-311A) (Priority to Graduate and Honours students; others by permission of instructors. Password required.) (Offered in odd numbered years.) A discussion of the principal theories and interesting new developments in the study of ion channels. Based on a textbook, computer exercises & critical reading and presentation of research papers. Topics include: Properties of voltage- and ligand-gated channels, single channel analysis, structure and function of ion channels. **Professors Drapeau, Bourque and Hanrahan**

- **552-531B TOPICS IN APPLIED IMMUNOLOGY.** (3) (Permission of the instructor. U3 InterDept. Honours Immunology students and graduate students with strong immunology background i.e. 552-513A and 507-503B.) Seminar format course in which experts in immunologic mechanisms of resistance against a variety of infectious diseases, including AIDS, malaria, and tuberculosis oversee student moderators in their presentation of recent scientific literature in the field. **Professors Stevenson and Bernard**

- **552-550A PHYSIOLOGY OF BONE.** (3) (1 hour of lecture, 2 hours of seminar per week) (Prerequisites: 552-311A, and 177-202B or equivalent) (Restricted to U3 Physiology students, and graduate students in biomedical departments; others by permission of the instructor.) Students will develop a working knowledge of cartilage and bone. Discussion topics will include: molecular and cellular environment of bone; heritable and acquired skeletal defects; research models used to study metabolic bone disease. (Awaiting University Approval) **Professor Henderson**

- **552-552B CELLULAR & MOLECULAR PHYSIOLOGY.** (3) (1 hour lecture, 2 hours seminar weekly) (Pre-requisite: 552-311A) (Permission will be given to Physiology Honours and Graduate students. Limited enrolment.) Discussions of recent significant advances in our understanding of the gene products involved in diverse cellular signalling pathways. Topics will include cell-surface hormone receptors, nuclear steroid hormone receptors, and ion channels and transporters. Students will present and critically evaluate experimental approaches, results and interpretations of selected research publications. **Professors Oriowski and White**

- **552-556B TOPICS IN SYSTEMS NEUROSCIENCE.** (3) (Permission of the instructor required. Limited enrolment. Password required.) (Not open to students who have taken 552-456B.) Topics of current interest in systems neurophysiology and behavioural neuroscience including: the neural representation of sensory information and motor behaviours, models of sensory motor integration, and the computational analysis of problems in motor control and perception. Students will be expected to present and critically discuss journal articles in class. **Professors Cullen and Guitton**