



479th REPORT OF THE ACADEMIC POLICY COMMITTEE TO SENATE

On the APC meeting held on February 23rd, 2017

I. TO BE APPROVED BY SENATE

(A) NEW TEACHING PROGRAMS REQUIRING SENATE APPROVAL

Graduate and Postdoctoral Studies

Ph.D. in Quantitative Life Sciences (0 cr.) – *appendix A*

At a meeting on February 23rd, 2017, APC reviewed and approved a proposal to create a new Ph.D. program in Quantitative Life Sciences. The demand for interdisciplinary research in quantitative life sciences has been growing worldwide and universities around the globe have launched similar programs in the past few years. The proposal is timely and already in demand by McGill university students and researchers. The objective of this new inter-department and inter-faculty program is to train the next generation of leaders in the rapidly evolving world of biology, medicine and biotechnology, providing them with the necessary interdisciplinary skills that both Canada and Quebec need to maintain their position of world leaders in biology and life sciences research. There is at McGill a large multidisciplinary group of researchers focused on the most important life sciences questions that will connect in this new program, which will capitalize on the commonalities in quantitative methods in disparate fields. The Ph.D. will be housed in Graduate and Postdoctoral Studies and be overseen by a steering committee comprised of key members from across the disciplines and the Dean of GPS. The current ad hoc Ph.D. in Quantitative Life Sciences will be retired once this new program is approved. Ministry approval will be required.

APC therefore recommends that Senate approve the following resolution:

Be it resolved that Senate approve the proposed Ph.D in Quantitative Life Sciences.

(B) ACADEMIC PERFORMANCE ISSUES / POLICIES / GOVERNANCE/AWARDS - *none*

(C) CREATION OF NEW UNITS / NAME CHANGES / REPORTING CHANGES – *none*

(D) CHANGES IN DEGREE DESIGNATION – *none*

(E) INTER-UNIVERSITY PARTNERSHIPS – *none*

(F) OTHER – *none*

II. TO BE ENDORSED BY SENATE / PRESENTED TO SENATE FOR DISCUSSION – *none*

III. APPROVED BY APC IN THE NAME OF SENATE

(A) DEFINITIONS – *none*

(B) STUDENT EXCHANGE PARTNERSHIPS / CONTRACTS / INTERUNIVERSITY PARTNERSHIPS - *none*

(C) OTHER - none

IV. FOR THE INFORMATION OF SENATE

A) ACADEMIC UNIT REVIEWS – none

B) APPROVAL OF COURSES AND TEACHING PROGRAMS

1. Programs

a) APC Approvals (new options/concentrations and major revisions to existing programs)

i. New Programs

Schulich School of Music

B.Mus.; Minor in Jazz Performance (18 cr.)

At a meeting on February 23rd, 2017, APC reviewed and approved a proposal to create a new Minor in Jazz Performance, which will provide Bachelor of Music students in the classical stream with the opportunity to acquire skills and experience playing or singing in the jazz idiom. This will draw on existing courses and resources, and allow the Schulich School of Music to respond to frequent demands for greater flexibility in its offerings for students who wish to develop abilities in more than one musical style.

ii. Major Revisions of Existing Programs

Faculty of Arts

B.A.; Faculty Program in Industrial and Labour Relations (54 cr.)

At a meeting on February 23rd, 2017, APC reviewed and approved a proposal to revise the existing B.A.; Faculty Program in Industrial Relations (54 cr.), which will be retired and replaced by the B.A.; Faculty Program in Industrial and Labour Relations (54 cr.). Beyond the title change, the revisions mostly affect the course requirements. This program will provide students with a basic knowledge of industrial relations, institution and practices, as well as the principal social and economic forces that underlies them. The Ministry needs to be informed of those changes.

b) APC Subcommittee on Courses and Teaching Programs (SCTP) Approvals
(Summary Reports: <http://www.mcgill.ca/sctp/documents/>)

i. Moderate and Minor Program Revisions

Approved by SCTP on 5th January 2017, reported to APC on February 23rd, 2017

Faculty of Agricultural and Environmental Sciences

B.Sc.(Ag.Env.Sc.); Specialization in Animal Health and Disease (24 cr.)

B.Eng.(Bioresource); Major in Bioresource Engineering (113 cr.)

B.Eng.(Bioresource); Major in Bioresource Engineering; Professional Agrology (113 cr.)

Faculty of Arts

B.A.; Faculty Program in Environment; Economics and the Earth's Environment (54 cr.)

School of Continuing Studies

Certificate in Indigenous Language and Literacy Education (30 cr.)

Certificate in Middle School Education in Indigenous Communities (30 cr.)

Faculty of Education

B.Ed. in Secondary English (120 cr.)

B.Ed. in Secondary Mathematics (120 cr.)

B.Ed. in Secondary Science and Technology (120 cr.)

B.Ed. in Secondary Social Sciences; History and Citizenship Geography (120 cr.)
B.Ed. in Secondary Social Sciences; History and Citizenship, Ethics and Religious Culture (120 cr.)
B.Ed. in Teaching English as a Second Language – TESL Elem&Secondary (120 cr.)
B.Ed. in Teaching English as a Second Language – TESL Elem&Secondary; Teaching Greek Language Culture (120 cr.)
B.Ed. in Kindergarten and Elementary Pédagogie de l’Immersion Française (120 cr.)
B.Ed. in Kindergarten and Elementary Jewish Studies (120 cr.)
B.Ed. in Kindergarten and Elementary Education (120 cr.)

Graduate and Postdoctoral Studies

M.A.in Islamic Studies (45 cr.)
M.A.in Islamic Studies; Gender and Women’s Studies (45 cr.)
Ph.D. in Islamic Studies (0 cr.)
Ph.D. in Islamic Studies; Gender and Women’s Studies (0 cr.)
Ph.D. in Sociology (0 cr.)
M.A.in Education and Society; Non-Thesis (45 cr.)
M.A. in Education and Society; Non-Thesis; Gender and Women’s Studies (45 cr.)
M.A. in Teaching and Learning; Non-Thesis- English or French Second Language (60 cr.)
M.A. in Teaching and Learning; Non-Thesis; English Language Arts (60 cr.)
M.A. in Teaching and Learning; Non-Thesis – Mathematics (60 cr.)
M.A. in Teaching and Learning; Non-Thesis; Social Sciences (60 cr.)
M.A. in Teaching and Learning; Non-Thesis; Science and Technology (60 cr.)
M.Sc. in Epidemiology (48 cr.)
M.Sc. in Epidemiology; Non-Thesis – Pharmacoepidemiology (48 cr.)
M.Sc. in Public Health; Non-Thesis (60 cr.)
M.Sc. in Public Health; Non-Thesis – Global Health (60 cr.)
M.Sc. in Public Health; Non-Thesis – Population Dynamics (60 cr.)

Schulich School of Music

D.Mus. in Music; Performance Studies (0 cr.)
Ph.D. in Music (Composition, Music Education, Music Technology, Sound Recording, Theory) (0 cr.)

Faculty of Medicine

B.Sc. (Nursing) (103 cr.)

Approved by SCTP on February 2nd, 2017, reported to APC on February 23rd, 2017

Faculty of Education

B.Sc.(Kinesiology); Major in Kinesiology (90 cr.)
B.Sc.(Kinesiology); Honours in Kinesiology (90 cr.)

Graduate and Postdoctoral Studies

M.A. in Educational Psychology; Learning Sciences (45 cr.)
M.A. in Education and Society; Mathematics and Science Education (45 cr.)
M.A. in Kinesiology and Physical Education (45 cr.)
M.Sc. in Kinesiology and Physical Education (45 cr.)
Graduate Certificate in Surgical Innovation (15 cr.)
Graduate Diploma in Surgical Innovation (15 cr.)
M.Sc. in Experimental Surgery (45 cr.)
M.Sc. in Experimental Surgery; Surgical Education (45 cr.)
M.Sc. in Experimental Surgery; Surgical Innovation (45 cr.)
Ph.D. in Experimental Surgery (0 cr.)

Desautels Faculty of Management

B.Com.; Major in General Management; Concentration in Managing for Sustainability (15 cr.)

B.Com.; Major in Managing for Sustainability (39 cr.)

Faculty of Science

B.Sc.; Major in Geography (58 cr.)

B.Sc.; Major in Atmospheric Science (62 cr.)

B.Sc.; Honours in Atmospheric Science (72-74 cr.)

B.Sc.; Minor in Atmospheric Science (18 cr.)

B.Sc.; Major in Biology; Quantitative Biology (73 cr.)

B.Sc.; Honours in Biology; Quantitative Biology (79 cr.)

B.Sc.; Major in Environment; Earth Sciences and Economics (66 cr.)

B.Sc.; Major in Neuroscience (65 cr.)

B.Sc.; Honours in Neuroscience (74 cr.)

ii. Program Retirements

Approved by SCTP on 5th January 2017, reported to APC on February 23rd, 2017

Faculty of Arts

B.A. Concentration mineure en langue et littérature française; langue française et traduction (18 cr.)

School of Continuing Studies

Certificate in Finance (30 cr.)

Diploma in Finance (30 cr.)

Certificate in Aboriginal Education for Certified Teachers (30 cr.)

Certificate in Aboriginal Literacy Education (30 cr.)

Certificate in Middle School Education in Aboriginal Communities (30 cr.)

Approved by SCTP on 2nd February 2017, reported to APC on February 23rd, 2017

Faculty of Arts

B.A.; Faculty Program in Industrial Relations (54 cr.)

School of Continuing Studies

B.Ed. for Certified Teachers in Elementary Education: Native and Northern (90 cr.)

Faculty of Science

B.Sc.; Major in Earth and Planetary Sciences (66 cr.)

B.Sc.; Honours in Earth Sciences (75 cr.)

2. Courses

a) New Courses

Reported as having been approved by SCTP on 5th January 2017:39

Faculty of Arts: 13

Faculty of Education: 6

Graduate and Postdoctoral Studies: 2

Faculty of Medicine: 17

Schulich School of Music: 1

Reported as having been approved by SCTP on 2nd February 2017:14

School of Continuing Studies: 2

Faculty of Engineering: 2
Faculty of Medicine: 3
Faculty of Science: 7

b) Course Revisions

Reported as having been approved by SCTP on 5th January 2017: 61

Faculty of Agricultural and Environmental Sciences: 1

Faculty of Arts: 14

Faculty of Education: 4

Faculty of Medicine: 19

Schulich School of Music: 23

Reported as having been approved by SCTP on 2nd February 2017: 25

School of Continuing Studies: 7

Faculty of Education: 2

Faculty of Engineering: 7

Desautels Faculty of Management: 1

Faculty of Medicine: 2

Schulich School of Music: 2

Faculty of Science: 4

c) Course Retirements

Reported as having been approved by SCTP on 5th January 2017: 5

Faculty of Arts: 1

Faculty of Medicine: 4

Reported as having been approved by SCTP on 2nd February 2017: 1

Faculty of Education: 1

(B) OTHER - none



<p>1.0 Degree Title Please specify the two degrees for concurrent degree programs</p> <p>1.1 Major (Legacy = Subject) (30-char. max.)</p> <p>1.2 Concentration (Legacy = Concentration/Option) If applicable to Majors only (30 char. max)</p> <p>1.3 Minor (with Concentration, if Applicable) (30char. max)</p>	<p>2.0 Administering Faculty/Unit</p> <p>3.0 Effective Term of Implementation (Ex. Sept. 2004 = 200409) Term</p>
<p>Ph.D.</p> <p>Quantitative Life Sciences</p> <p></p> <p></p>	<p>Graduate and Postdoctoral Studies</p> <p>Offering Faculty/Department GPS/Interfaculty Studies (IFS)</p> <p>201809</p>

4.0 Rationale and Admission Requirements for New Proposal

Quantitative Life Sciences is the application of mathematical, computational and other quantitative methods to study biological systems at all scales – from single molecules to the environment. Applicants to the program are expected to have demonstrated strong quantitative skills and a background in mathematics, statistics and computer science, and are expected to hold a M.Sc. in a relevant field and an undergraduate degree in biology, physiology, genetics, computer science, mathematics, statistics, physics or chemistry. Applicants who do not have formal training in life sciences need to have a demonstrated interest, e.g. in the form of an undergraduate research project or the completion of life-science courses.

5.0 Program Information
Please check appropriate box(es)

<p>5.1 Program Type</p> <p><input type="checkbox"/> Bachelor's Program</p> <p><input type="checkbox"/> Master's</p> <p><input type="checkbox"/> M.Sc. (Applied) Program</p> <p><input type="checkbox"/> Dual Degree/Concurrent Program</p> <p><input type="checkbox"/> Certificate</p> <p><input type="checkbox"/> Diploma</p> <p><input type="checkbox"/> Graduate Certificate</p> <p><input type="checkbox"/> Graduate Diploma</p> <p><input checked="" type="checkbox"/> Ph.D. Program</p> <p><input type="checkbox"/> Doctorate Program (Other than Ph.D.)</p> <p><input type="checkbox"/> Private Program</p> <p><input type="checkbox"/> Off-Campus Program</p> <p><input type="checkbox"/> Distance Education Program (By Correspondence)</p> <p><input type="checkbox"/> Other: Please specify</p> <p></p>	<p>5.2 Category</p> <p><input type="checkbox"/> Faculty Program (FP)</p> <p><input type="checkbox"/> Major</p> <p><input type="checkbox"/> Joint Major</p> <p><input type="checkbox"/> Major Concentration (CON)</p> <p><input type="checkbox"/> Minor</p> <p><input type="checkbox"/> Minor Concentration (CON)</p> <p><input type="checkbox"/> Honours (HON)</p> <p><input type="checkbox"/> Joint Honours Component (HC)</p> <p><input type="checkbox"/> Internship/Co-op</p> <p><input checked="" type="checkbox"/> Thesis (T)</p> <p><input type="checkbox"/> Non-Thesis (N)</p> <p><input type="checkbox"/> Other: Please specify</p> <p></p>	<p>5.3 Level</p> <p><input type="checkbox"/> Undergraduate</p> <p><input type="checkbox"/> Dentistry/Law/Medicine</p> <p><input type="checkbox"/> Continuing Studies (Non-Credits)</p> <p><input type="checkbox"/> Masters & Grad Dip & Certs</p> <p><input checked="" type="checkbox"/> Doctorate</p> <p><input type="checkbox"/> Post-Graduate Medicine/ Dentistry</p> <p><input type="checkbox"/> Graduate Qualifying</p> <p><input type="checkbox"/> Postdoctoral Fellows</p> <p>5.4 FQRSC (Research) Indicator (For GPS)</p> <p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>
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6.0 Total Credits

0

7.0 Consultation with

Related Units Yes No

Financial Consult Yes No

Attach list of consultations.

8.0 Program Description (Maximum 150 words)

The general objective of the Quantitative Life Sciences (QLS) Program is to train Ph.D. students to develop quantitative approaches (technological, computational and statistical) for the collection, analysis, and interpretation of complex data from the life sciences. Our students will ask questions that will drive the biology and medicine of tomorrow, and be equipped to answer them. The goal of these research fields is to understand the biological whole: how complex interactions among the individual components (e.g. molecules, genes, cells) underlie entire living systems (e.g. cells, organisms, environments). Key elements of the proposed program have been designed to broaden the contextual knowledge of students, to encourage interactions between traditional fields of research and to create a sense of community. The QLS will span departments and faculties, and provide breadth of understanding as well as depth of knowledge to core aspects of bioscience research.

9.0 List of proposed program for the New Program/Major or Minor/Concentration

If new concentration (option) of existing Major/Minor (program), please attach a program layout (list of courses) of existing Major/Minor.

Proposed program (list course as follow: Subj Code/Crse Num, Title, Credit weight, under the heading of: Required Courses, Complementary Courses, and Elective Courses).

Overview:

The proposed program will include 5 basic elements:

1. [Breadth] One two semester required foundational course
2. [Breadth] A research seminar with invited speakers
3. [Depth] Complementary courses including both life science and quantitative courses, to be selected on based on the student's chosen area of research/stream and in conjunction with the student's supervisory committee
4. [Breadth + Depth] A comprehensive exam
5. [Depth] A research thesis

Required Courses (6 credits)

QLSC 600D1/D2 Foundations of Quantitative Life Sciences (6 credits)

QLSC 701 Ph.D. Comprehensive Exam (0 credits)

Complementary Courses (9-11 credits)

Students will be required to take one or two courses from each of the Quantitative and Life Science Blocks for a total of three, stream-specific courses.

Biophysics Stream

Quantitative Block		Life Sciences Block	
BMDE 512 Finite-Element Modelling: BME	3 credits	BIOC 605 Protein Biology and Proteomics	3 credits
BMDE 519 Biomedical Signals & Systems	3 credits	BIOL 551 Principles of Cellular Control	3 credits
BIEN 530 Imaging and Bioanalytical Instrumentation	3 credits	PHGY 518 Artificial Cells	3 credits
CHEM 514 Biophysical Chemistry	3 credits	PHGY 520 Ion Channels	3 credits
CHEM 520 Methods in Chemical Biology	3 credits		
COMP 551 Applied Machine Learning	4 credits		
PHYS 519 Advanced Biophysics	3 credits		
PHYS 559 Advanced Statistical Mechanics	3 credits		

Computational and Statistical Molecular Biology Stream

Quantitative Block		Life Sciences Block	
BIOS 601 Epidemiology: Introduction and statistical models	4 credits	BIOC 603 Genomics and Gene Expression	3 credits
BMDE 502 BME Modelling & Identification	3 credits	BIOL 551 Principles of Cellular Control	3 credits
COMP 551 Applied Machine Learning	4 credits	EXMD 602 Techniques in Molecular Genetics	3 credits
COMP 561 Computational Biology Methods and Research	4 credits	HGEN 661 Population Genetics	3 credits
COMP 598 Topics in Computer Science 1	3 credits	HGEN 692 Human Genetics	3 credits
HGEN 677 Statistical Concepts in Genetics and Genomics Analysis	3 credits	PHAR 503 Drug Discovery & Development 1	3 credits
MATH 523 Generalized Linear Models	4 credits	PHAR 505 Structural Pharmacology	3 credits
MATH 533 Honours Regression and Analysis of Variance	4 credits		
MATH 680 Computation Intensive Statistics	4 credits		

Ecosystems Stream

Quantitative Block		Life Sciences Block	
ENVB 506 Quantitative Methods in Ecology	3 credits	BIOL 509 Methods in Molecular Ecology	3 credits
MATH 523 Generalized Linear Models	4 credits	BIOL 510 Advances in Community Ecology	3 credits
MATH 525 Sampling Theory and Applications	4 credits	BIOL 594 Advanced Evolutionary Ecology	3 credits
MATH 533 Honours Regression and Analysis of Variance	4 credits	ENVR/BIOL 540 Ecology of Species Invasions	3 credits
MATH 537 Honours Mathematical Models in Biology	4 credits		
MATH 547 Stochastic Processes	4 credits		
MATH 556 Mathematical Statistics 1	4 credits		

Please see the attached QLS Program Executive Summary.

10.0 Approvals			
Routing Sequence	Name	Signature	Date
Department			
Curric/Acad Committee Chair	Celia Greenwood	<i>Celia Greenwood</i>	7 Dec 2016
Faculty 1/Program Executive Committee Chair	Peter Grutter	<i>PG</i>	8-12-2016
Faculty 2/Program Steering Committee Chair	Josephine Nalbantoglu	<i>JNalbantoglu</i>	Dec 7, 2016
Faculty 3	SCTP		
CGPS		CGPS Approval	Dec. 12, 2016
SCTP	APPROVED		JAN. 5, 2017
APC			
Senate			
Submitted By			
Name	Maggie Do Couto	To be completed by ARR:	
Phone	514-398-3050	CIP Code	
Email	maggie.docouto@mcgill.ca		
Submission Date	Nov. 28, 2016		

QUANTITATIVE LIFE SCIENCES PH.D. PROGRAM EXECUTIVE SUMMARY

We propose a novel inter-department and inter-faculty Ph.D. training program in Quantitative Life Sciences to produce the next generation of leaders in the rapidly changing world of biology, medicine and biotechnology. This program has been designed from the ground-up with close consultation with all stakeholders to produce graduates with the quantitative and interdisciplinary skills that Quebec and Canada need to maintain their positions as world-leaders in bio- and life-science research. It builds on, integrates and expands many currently loosely connected initiatives at McGill and will enable a stimulating, sustained and exciting interdisciplinary training environment.

The **Quantitative Life Sciences Program** (Figure 1) fits centrally into a rapidly expanding interdisciplinary field that includes ecology, physiology, genetics, systems biology, computational biology, bioinformatics, mathematical biology, evolutionary biology and biophysics among others. Overall, the goal of these research fields is to understand the *biological whole*: how the complex interactions among the individual components (e.g., molecules, genes, cells) underlie entire living systems (e.g., cells, organisms, environments). To achieve this goal, active research lies at the interface between biological processes and advanced mathematics, physics, statistics and computer science. Here we are proposing an interdisciplinary doctoral level program to support this endeavor.

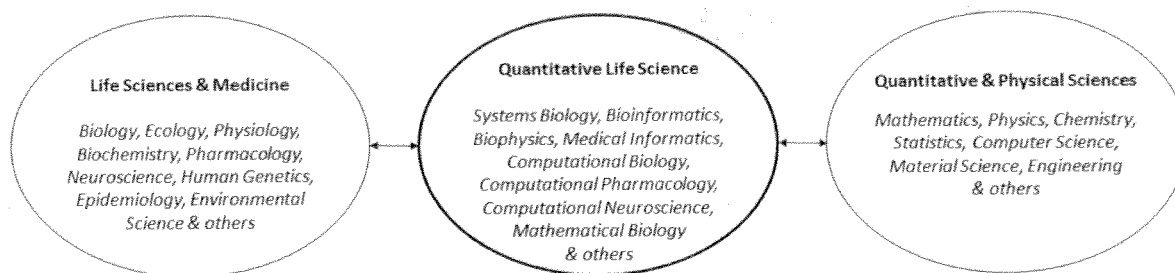


Figure 1. The Quantitative Life Science Program will train the next generation of multidisciplinary researchers needed to bridge the life and quantitative sciences. In addition, this new graduate program will facilitate collaborative life science research that cuts across departments and faculties at McGill University.

At the core of this proposal is a large multidisciplinary group of McGill researchers focused on quantitative approaches to understanding genetic, molecular & physiological systems, global ecosystems and disease interactions. McGill University has been very successful in hiring and bringing together interdisciplinary researchers to tackle the most important life science questions. The University has also taken first steps toward facilitating interdisciplinary training (e.g. through department specific graduate options and several research Centres or NSERC/CIHR funded training programs), but it still lacks a cohesive, cross-department and cross-faculty graduate program to train our students in this essential multidisciplinary field. We thus propose an interdisciplinary Ph.D. training program engaged in applied mathematical, statistical, physical and computational research that connects to all aspects of the life sciences, and capitalizes on the commonalities in quantitative methods in disparate fields.

Key elements of the proposed program have been designed to broaden the contextual knowledge of students, to encourage interactions between traditional fields of research and to create a sense of community. For example, a core course including a series of in-depth case studies will demonstrate links between quantitative methods and life sciences research in many different contexts. The depth of the proposed Ph.D. program is built around three different areas of research, or streams, defined by the type of biological questions being addressed and the quantitative approach being used (additional streams may be added later depending on the evolution of the field and demonstrated sufficient interest). Co-supervision of graduate students between life and quantitative researchers will be strongly encouraged. The program's streams are:

- **Computational and statistical molecular biology:** Quantitative methods in genetics/genomics and molecular biology
- **Biophysics:** Application of physical principles, development of tools and modeling approaches to quantitatively study biological systems, including biomolecules.
- **Ecosystems:** Mathematical and computational approaches in ecology and evolution.

The interest and the demand for interdisciplinary research in quantitative life sciences has led to the formation of new international graduate programs in the US and Europe, which emphasize quantitative research skills applied to the life sciences. Worldwide, governments and industry have begun to invest in quantitative life science and many top research universities worldwide have launched similar themed programs. This proposal is timely, and already in demand by McGill University students and researchers.