Science Curriculum Committee
Proposals for Approval (Full review)

November 15, 2018
1 New Course:

ANT337H1: Human Movement

**Contact Hours:**

- Lecture: 24  /  Practical: 24

**Description:**

This course will investigate human movement and physical activity patterns through the lens of evolutionary anthropology. The evolution of hominin physical behaviours, such as bipedalism and tool use, will be explored alongside the morphological traits associated with these behaviours. We will also examine social and cultural factors that may moderate physical activities among diverse human groups, including subsistence strategy variation and contemporary views on activity and exercise.

**Prerequisites:**

ANT203Y1

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**

**Breadth Requirements:**

- Living Things and Their Environment (4)

**Distribution Requirements:**

- Science

**Competencies:**

- Communication: slightly
- Critical and Creative Thinking: notably
- Information Literacy: notably
- Quantitative Reasoning: notably
- Social and Ethical Responsibility: slightly

**Experiential Learning:**

- Research: none
- Other: none

**Rationale:**

The evolution of human movement and the study of past and present activity patterns is a growing area of research. The content of this course may enrich students interested in a range of subjects, including human evolution and contemporary health. This course will also introduce students to a range of analytical and computational methods that are increasingly in demand, including digital modelling and data visualization.

**Consultation:**

This course should not affect other programs in terms of program requirements or prerequisites/exclusions. No specific consultation has been undertaken.

**Resources:**

Aside from regular classroom and laboratory needs, no exceptional resources are required.

**Budget Implications:**

The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:**
No current courses explore human movement from both evolutionary and cultural perspectives. The review of morphologies associated with diverse physical behaviours may complement content in ANT 335Y1. This course is distinct, however, as it also incorporates sociocultural influences on these morphologies and physical activity patterns.

**Programs of Study for Which This Course Might be Suitable:**  
Anthropology Major (General), Anthropology Major (Evolutionary), Anthropology Minor (General)

**Estimated Enrolment:**  
30-40

**Instructor:**  
Prof. Michelle Cameron

### 1 Retired Course:

**ANT432H1: The Evolving Human Skull**

**Rationale:**
1 New Course:

AST301H1: Observational Astronomy

Contact Hours:
Practical: 36

Description:
A hands-on introduction to telescopes and observational astronomy for students with little experience in the physical sciences. Through laboratory exercises and observations of the sky, students will learn the techniques that have enabled the major discoveries of modern astronomy, from the expansion of the universe to the existence of Earth-like planets orbiting other stars. Hands-on activities will teach how telescopes work and how we can measure the distances, motion, and chemical composition of celestial objects. Basic arithmetic is used, but no advanced mathematics.

Prerequisites:
AST101H1/AST201H1/AST251H1

Corequisites:

Exclusions:
AST121H1, AST221H1, CIV100H, CIV102H; Any 100- or higher-series CHM or PHY course, either previously or concurrently with this course, except PHY100H1, PHY101H1, PHY201H1, PHY202H1, PHY205H1, PHY207H1, CHM101H1, with the exception of AP, IB, CAPE, or GCE transfer credits.

Recommended Preparation:

Breadth Requirements:
The Physical and Mathematical Universes (5)

Distribution Requirements:
Science

Competencies:
Communication: notably; Critical and Creative Thinking: extensively; Information Literacy: notably
Quantitative Reasoning: extensively; Social and Ethical Responsibility: none

Experiential Learning:
Research: notably; Other: none

Rationale:
Astronomy courses for non-science majors attract a large and growing audience. For example, our AST 101 and 201 survey courses each attract 1500 students per year. Many of these students express an interest in additional astronomy courses; some would like to be able to obtain a Minor in Astronomy without needing to take additional physics and calculus courses which typically don't fit in their programs. The proposed course, AST 301, will allow the students to earn a Certificate in Astronomy and will be a step towards a Minor program for students whose majors are outside the physical sciences. The high level learning outcome is that students will be able to make astronomical observations on their own, and thereby to replicate some of the major achievements of modern astronomy.

Specifically, students will make measurements of the distances, sizes, masses, motions, and chemical composition of astronomical objects such as planets, stars, and galaxies. They will also develop a semi-quantitative appreciation for the uncertainties associated with these measurements. The course will culminate with a measurement of the expansion rate of the universe and a discussion of its meaning.
The course is at a third-year level, requiring a basic knowledge of the sky and some basic astrophysical concepts such as gravity, orbits, the inverse square law of light, planets, stars, and galaxies. This understanding can be obtained from any of the recommended prerequisites.

In keeping with modern best practices in physics and astronomy education (e.g. Hake 1998), the course will be interactive and hands-on. Each module will be introduced with an interactive discussion during which students will complete conceptual exercises with the assistance of faculty and teaching assistants. This portion of the course will follow a model developed in Adams, Prather, & Slater (2003). Approximately two thirds of the instructional hours will be spent engaged in hands-on activities in the lab, at our observatory on the roof of the McLennan Physics building, and using robotic observatories accessible via the Internet.

To encourage ongoing development of the course, the instructor will regularly attend the Robotic Telescopes, Student Research and Education Conference (https://rtsre.net/), which is the international forum for sharing pedagogical advances related to student use of telescopes. We will also consult with colleagues at other institutions who run similar courses (e.g. Physics 50 at Stanford). Some materials will be adapted from the Dunlap Institute’s highly successful Introduction to Astronomical Instrumentation summer school, which has a library of activities designed for upper-year undergraduates.

We envision this course being relevant to students in a wide variety of disciplines. It would be excellent preparation for those studying computer science who want to learn about applications of their discipline to the physical sciences, for students studying commerce who wish to enter the emerging private space industry, and for those in the humanities who wish to pursue careers in science journalism.

Sources

Consultation:
Vice Dean Mary Pugh offered advice on where the course could fit in our program.

Resources:
Ideally, we will teach this course in one of the Technology Enhanced Active Learning spaces in the Myhal Centre. However, other laboratory space can also be used. We will need to purchase a small new observatory which could be accommodated on the McLennan Physics 15th floor balcony, along with some experimental and demonstration equipment for the hands-on activities and demonstrations. Roughly $50k for the startup course with enrolment limited to about 50. We welcome Decanal support.

Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
This course represents a new offering at UofT and does not overlap with the content of other courses.

Programs of Study for Which This Course Might be Suitable:
This is a high-level breadth course, largely intended for students in A&S largely outside the sciences, such as economics, philosophy, history. Physical Science students will not be accepted. Life Science students will need the instructor’s permission.

Estimated Enrolment:
40 initially, growing to 100 over time

Instructor:
Michael Reid
7 Minor Program Modifications:

**Cell & Molecular Biology Major**

**Completion Requirements:**

(8 full courses or their equivalent)

First Year: BIO120H1, BIO130H1; (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1; JMB170Y1/ (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1/(PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)

Higher Years:
1. BIO220H1, BIO230H1/BIO255H1
2. BIO260H1/HMB265H1; BCH210H1
3. CSB349H1
4. 1.0 FCE from: CSB327H1, CSB328H1, CSB329H1, CSB331H1, CSB340H1, CSB353H1
5. 1.5 FCEs (at least 0.5 FCE at the 400-level) from: BCH422H1, BCH426H1, BCH440H1, BCH441H1, BCH444H1, BCH445H1, CJH332H1, CSB299Y1, CSB327H1, CSB328H1, CSB329H1, CSB330H1, CSB331H1, CSB340H1, CSB350H1, CSB351H1, CSB352H1, CSB353H1, CSB397Y0, CSB399Y1, CSB427H1, CSB428H1, CSB429H1, CSB430H1, CSB431H1, CSB435H1, CSB447H1, CSB450H1, CSB452H1, **CSB454H1**, CSB457H1, CSB458H1, CSB459H1, CSB460H1, **CSB471H1**, CSB472H1, CSB473H1, CSB474H1, CSB475H1, CSB483H1, CSB490H1, CSB491H1, CSB492H1, CSB497H1, CSB498Y1, CSB499Y1, HMB496Y1/HMB499Y1, MGY480Y1. No more than 0.5 FCE in BCH can be used towards this requirement.

The Cell & Molecular Biology Major Program has the additional option of a Disciplinary Focus.

**Description of Proposed Changes:**

**Rationale:**

**Impact:**

**Consultation:**

**Resource Implications:**

**Cell & Molecular Biology Major: Focus in Molecular Networks of the Cell**

**Completion Requirements:**

This Focus is part of the Cell and Molecular Biology Major and begins with the requirements of First Year and of lines 1-3 of Higher Years of the Cell and Molecular Biology Major Program.

4. 1.0 FCE from: CJH332H1, CSB327H1, CSB331H1, CSB353H1
5. 0.5 FCE from: CSB427H1, CSB428H1, CSB429H1, CSB435H1, **CSB454H1**, CSB457H1, CSB458H1, CSB459H1, CSB460H1, CSB475H1
6. 1.0 FCE from: BCH422H1, BCH426H1, BCH444H1, BCH445H1, CJH332H1, CSB299Y1, CSB327H1, CSB330H1, CSB331H1, CSB353H1, CSB397Y0, CSB399Y1, CSB427H1, CSB428H1, CSB429H1, CSB435H1, CSB450H1, CSB452H1, **CSB454H1**, CSB457H1, CSB458H1, CSB459H1, CSB460H1, CSB475H1, CSB490H1, CSB491H1,
Cell and Systems Biology (FAS), Department of

CSB497H1, CSB498Y1, CSB499Y1. No more than 0.5 FCE in BCH can be used towards this requirement.
7. Molecular Network Learning Community (each year of focus enrolment)

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

Cell & Molecular Biology Major: Focus in Plant Genomics and Biotechnology

Completion Requirements:

This Focus is part of the Cell and Molecular Biology Major and begins with the requirements of First Year and of lines 1-3 of Higher Years of the Cell and Molecular Biology Major Program.

4. 1.0 FCE from: CSB340H1, CSB350H1/CSB352H1, CSB353H1
5. 0.5 FCE from: CSB435H1, CSB450H1, CSB452H1, CSB454H1, CSB459H1, CSB460H1, CSB471H1, CSB472H1, CSB473H1, CSB474H1, CSB475H1
6. 1.0 FCE from: CSB299Y1, CSB330H1, CSB340H1, CSB350H1, CSB351Y1, CSB352H1, CSB353H1, CSB397Y0, CSB399Y1, CSB435H1, CSB450H1, CSB452H1, CSB454H1, CSB459H1, CSB460H1, CSB471H1, CSB472H1, CSB473H1, CSB474H1, CSB475H1, CSB490H1, CSB491H1, CSB497H1, CSB498Y1, CSB499Y1.
7. Plant Biotech Learning Community (each year of focus enrolment)

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

Cell & Molecular Biology Specialist

Completion Requirements:

(12.5 full courses or their equivalent, including at least one 400-series course)

First Year:
BIO120H1, BIO130H1; (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1; JMB170Y1/(MAT135H1,
Cell and Systems Biology (FAS), Department of MAT136H1/MAT137Y1/MAT157Y1.

Higher Years:
1. 1.0 FCE from: PHY131H1, PHY132H1, PHY151H1, PHY152H1
2. (BIO220H1, BIO230H1/BIO255H1), (BIO270H1, BIO271H1), BIO260H1/HMB265H1; BCH210H1
3. CSB330H1/CSB350H1/CSB352H1, CSB349H1
4. 1.0 FCE from: CJH332H1, CSB327H1, CSB328H1, CSB329H1, CSB331H1, CSB340H1, CSB353H1
5. 1.0 FCE from: BCH422H1, BCH426H1, BCH444H1, BCH445H1, CSB427H1, CSB428H1, CSB429H1, CSB430H1, CSB431H1, CSB435H1, CSB450H1, CSB452H1, CSB454H1, CSB457H1, CSB458H1, CSB459H1, CSB460H1, CSB471H1, CSB472H1, CSB473H1, CSB474H1, CSB475H1, CSB483H1
6. 2.5 FCEs from: BCH422H1, BCH426H1, BCH440H1, BCH441H1, BCH444H1, BCH445H1, CJH332H1, CSB299Y1, CSB327H1, CSB328H1, CSB329H1, CSB330H1, CSB331H1, CSB340H1, CSB350H1, CSB351Y1, CSB352H1, CSB353H1, CSB397Y0, CSB399Y1, CSB427H1, CSB428H1, CSB429H1, CSB430H1, CSB431H1, CSB435H1, CSB447H1, CSB450H1, CSB452H1, CSB454H1, CSB457H1, CSB458H1, CSB459H1, CSB460H1, CSB471H1, CSB472H1, CSB473H1, CSB474H1, CSB475H1, CSB483H1, CSB490H1, CSB491H1, CSB492H1, CSB497H1, CSB498Y1, CSB499Y1, HMB496Y1/HMB499Y1, MGY480Y1
NOTE: No more than 0.5 FCE in BCH can be used towards requirements 5. and 6.

The Cell & Molecular Biology Specialist Program has the additional option of a Disciplinary Focus.

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

Cell & Molecular Biology Specialist: Focus in Molecular Networks of the Cell

Completion Requirements:

This Focus is part of the Cell and Molecular Biology Specialist and begins with the requirements of First Year and of lines 1-3 of Higher Years of the Cell and Molecular Biology Specialist Program.

4. 1.0 FCE from: CJH332H1, CSB327H1, CSB331H1, CSB353H1
5. 1.0 FCE from: CSB427H1, CSB428H1, CSB429H1, CSB435H1, CSB454H1, CSB457H1, CSB458H1, CSB459H1, CSB460H1, CSB475H1
6. 2.5 FCEs from: BCH422H1, BCH426H1, BCH440H1, BCH441H1, BCH444H1, BCH445H1, CJH332H1, CSB299Y1, CSB327H1, CSB328H1, CSB329H1, CSB330H1, CSB331H1, CSB340H1, CSB350H1, CSB351Y1, CSB352H1, CSB353H1, CSB397Y0, CSB399Y1, CSB427H1, CSB428H1, CSB429H1, CSB430H1, CSB431H1, CSB435H1, CSB447H1, CSB450H1, CSB452H1, CSB454H1, CSB457H1, CSB458H1, CSB459H1, CSB460H1, CSB471H1, CSB472H1, CSB473H1, CSB474H1, CSB475H1, CSB483H1, CSB490H1, CSB491H1, CSB492H1, CSB497H1, CSB498Y1, CSB499Y1, HMB496Y1/HMB499Y1, MGY480Y1. No more than 0.5 FCE in BCH can be used towards this requirement.
7. Molecular Network Learning Community (each year of focus enrolment)

Description of Proposed Changes:

Rationale:
Cell and Systems Biology (FAS), Department of

Impact:

Consultation:

Resource Implications:

Cell & Molecular Biology Specialist: Focus in Plant Genomics and Biotechnology

Completion Requirements:

This Focus is part of the Cell and Molecular Biology Specialist and begins with the requirements of First Year and of lines 1-3 of Higher Years of the Cell and Molecular Biology Specialist Program.

4. 1.0 FCE from: CSB340H1, CSB350H1/CSB352H1, CSB353H1
5. 1.0 FCE from: CSB435H1, CSB450H1, CSB452H1, CSB454H1, CSB459H1, CSB460H1, CSB471H1, CSB472H1, CSB473H1, CSB474H1, CSB475H1
6. 2.5 FCEs from: BCH422H1, BCH426H1, BCH440H1, BCH441H1, BCH444H1, BCH445H1, CSB299Y1, CSB328H1, CSB329H1, CSB330H1, CSB331H1, CSB340H1, CSB350H1, CSB351Y1, CSB352H1, CSB353H1, CSB397Y0, CSB399Y1, CSB428H1, CSB431H1, CSB435H1, CSB450H1, CSB452H1, CSB454H1, CSB458H1, CSB459H1, CSB460H1, CSB471H1, CSB472H1, CSB473H1, CSB474H1, CSB475H1, CSB490H1, CSB491H1, CSB492H1, CSB497H1, CSB498Y1, CSB499Y1. No more than 0.5 FCE in BCH can be used towards this requirement.
7. Plant Biotech Learning Community (each year of focus enrolment)

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

Genome Biology Major

Completion Requirements:

This program is a joint program of the departments of Cell & Systems Biology, Ecology & Evolutionary Biology, and Molecular Genetics. It is administered through the Department of Cell & Systems Biology.

(8 full courses or their equivalent)

First year: BIO120H1, BIO130H1; (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1; (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1
Higher years:
1. BIO220H1, BIO230H1/BIO255H1; BIO260H1/HMB265H1; EEB225H1/STA220H1
2. Genomics fundamentals: BCH311H1/CSB349H1/MGY311Y1, CSB352H1; EEB323H1
3. 0.5 FCE laboratory course from: CSB472H1, CSB474H1; EEB460H1
4. 1.0 FCE genomics elective from: CSB330H1, CSB350H1, CSB397Y0, CSB427H1, CSB435H1, CSB450H1, CSB457H1, CSB458H1, CSB471H1, CSB473H1, CSB490H1, CSB491H1, CSB497H1/CSB498Y1/CSB499Y1; EEB362H1, EEB455H1, EEB459H1, EEB462H1, EEB497H1/EEB498Y1/EEB499Y1; EHJ352H1; MGY350H1, MGY360H1, MGY428H1, MGY470H1, MGY480Y1

NOTE: Students taking CSB397Y0, CSB490H1, CSB491H1, CSB497H1/CSB498Y1/CSB499Y1, EEB497H1/EEB498Y1/EEB499Y1 or MGY480Y1 are encouraged to conduct a genomics-related research project.

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

2 New Courses:

CSB454H1: Pathogenic Effector Biology

Impact on Programs:

This proposal triggers modifications in the unit's program(s)

Contact Hours:

Lecture: 12 / Seminar: 12

Description:

Microbial pathogens inject effector proteins into host cells in order to sabotage cellular systems and favor the infection process. This course explores the molecular details of how cellular systems (e.g., secretion, cytoskeleton and signaling) are manipulated by pathogenic effectors to promote the infection process, while emphasizing interesting structural and biochemical features of effector biology along the way. The course will also compare and contrast the strategies employed by plant versus animal pathogens, and how immune systems have evolved to cope with cellular hijacking by pathogenic effector molecules. The course will be based on the primary research literature and involve a combination of lectures and critical discussions of research papers.

Prerequisites:

BCH311H1/CSB349H1/MGY311Y1

Corequisites:

Exclusions:

Recommended Preparation:
Breadth Requirements:
Living Things and Their Environment (4)

Distribution Requirements:
Science

Competencies:

**Communication:** notably; **Critical and Creative Thinking:** extensively; **Information Literacy:** extensively

**Quantitative Reasoning:** slightly; **Social and Ethical Responsibility:** none

Experiential Learning:

**Research:** none; **Other:** none

Rationale:
Pathogens employ effector proteins to cause disease. As such, they represent keystone molecules for understanding and combating pathogenic infections. To date, a course focused on the molecule mechanisms of pathogenic effectors at the University of Toronto is lacking. This course will fill this niche and provide important background information for students interested in the molecular mechanisms of pathogenic diseases of eukaryotic organisms (plant and animal).

Consultation:
Below are the emails received from UofT Faculty with overlapping interests and/or courses in response to the following email:

“I am thinking of putting together a course on effector biology; below is a rough tentative outline. I think there is currently a niche for such a course at UofT, but I would like to enquire if you think there would be significant overlap with any other courses? Please let me know of any concerns.

Thank you.
Best,
Darrell”

Professor Dana Philpott (Dept of Immunology):
“hi Darrell
sounds like an interesting course - not so much overlap with Immunology but my partner, Steph Girardin, has a course on microbial pathogenesis that likely overlaps a bit.
I’ll let you two discuss!
Dana”

Professor Stephen Girardin (Dept of Laboratory Medicine and Pathobiology; Course instructor for LMP436H1):
“Hi Darrell, that sounds like a super exciting course. It is conceptually close to the course I teach (LMP436H1; see Syllabus 2018 attached). However, over the years I made this course much more article presentation-based and less so formal lectures. I used to teach the secretion systems, effectors (for mammalian pathogens), invasion mechanisms, etc…more extensively but I go through this more quickly now to give room to article presentations. I also have in general a bigger focus on the PRM systems (TLRs, NLRs, STING/cGAS, etc…) than bacterial effectors. Finally, I teach one lecture on non-mammalian models of innate immunity in which I overview innate immunity in C. elegans, Drosophila and plants. Because it is all done in 2h, it is just an introduction/global concepts for these systems.
Our topics and approaches are so complementary that I feel that If there was a way to somehow “link” our 2 courses, that would be so awesome. But I don’t know enough about the rules and usage at UofT about teaching, especially between different Departments…maybe you know better? If you want we could discuss more about this over a coffee if that could be useful, I’d be happy to do so.
Cheers,
Stephen”

Prof. John Brummel (Dept. of Molecular Genetics & Institute of Medical Science; Hospital for Sick Children)
“Hi Darrell,
Sounds cool. Not sure of overlap. I'm cc'ing Will Navarre to see what he thinks.
John”
Prof. William Navarre (Dept. of Molecular Genetics; course instructor for MGY377)

“Hi Darrell,

The course sounds great. It would fit best in second semester. They would not have taken the basic MGY377 microbiology class until 3rd year fall semester. We have one lecture on secretion systems and effectors...hardly enough to cover their diversity and impact. Your class would follow-up nicely and would go in much deeper.

Otherwise I would suggest, because it's a fairly specialized topic, that it be a fourth year course.

Also - perhaps us microbiologists in MGY, BCH and CSB/EEB may want to get together to discuss how our courses could build better on one-another. BCH just launched a course on antibiotics and another course on microbial genomics? Because there is no formal microbiology department our educational offerings are a bit fragmented.

My two cents,

Will”

Resources:
Instructor

Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
Some overlap with LMP436H1 (see below in consultation undertaken with Prof. Stephen Girardin). This course provides a brief introduction on secretion systems, effectors and invasion systems, but is more focused on immunity and the course is article presentation-based and less so on formal lectures.

Programs of Study for Which This Course Might be Suitable:
Biology, Health and Disease, Cell and Molecular Biology, Immunology, Molecular Genetics and Microbiology

Estimated Enrolment:
40

Instructor:
Prof. Darrell Desveaux

CSB471H1: Foundational Discoveries in Genome Biology and Bioinformatics

Contact Hours:
Seminar: 24

Description:
This course is based on the critical analysis of key research articles in genome biology and bioinformatics. The format is interactive and requires students to contribute actively during class meetings. Small student groups will be assigned to present context, figures, data, methods and impact from a number of research articles during the semester. Based on the readings, small student groups will propose new genome technologies or datasets and new bioinformatics software or databases.

Prerequisites:
BCB330Y1/BCH441H1/CSB352H1/CSB472H1/EHJ352H1/MGY428H1 or permission of instructor

Corequisites:

Exclusions:
**Recommended Preparation:**

**Breadth Requirements:**  
Living Things and Their Environment (4)

**Distribution Requirements:**  
Science

**Competencies:**  
- **Communication:** extensively;  
- **Critical and Creative Thinking:** extensively;  
- **Information Literacy:** extensively  
- **Quantitative Reasoning:** slightly;  
- **Social and Ethical Responsibility:** slightly

**Experiential Learning:**  
- **Research:** none;  
- **Other:** none

**Rationale:**  
Genome Biology and Bioinformatics are related disciplines and are relatively new. These fields are now mature enough that we can recognize key developments and "classic" readings from the past 15-20 years. To my knowledge, this is the first course at the University of Toronto to focus on these historical developments in the field and use them to understand the impact of Genome Biology and Bioinformatics within the greater context of life-sciences research.

**Consultation:**  
Consulted with Drs. Nicholas Provart, David Guttmann, Asher Cutter and Boris Steipe, the instructors for several of the currently offered genome biology and bioinformatics courses. They all approve of this course.

**Resources:**  
- **Instructor**

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:** None

**Programs of Study for Which This Course Might be Suitable:**  
Cell and Molecular Biology major and specialist, Bioinformatics and Computational Biology specialist, Genome Biology major

**Estimated Enrolment:** 14

**Instructor:**  
Prof. Alan Moses

### 2 Course Modifications:

**CSB428H1: Advanced Cell Biology II: Cell Polarity and Cytoskeletal Dynamics**

**Description:**

This advanced course covers cell polarity and cytoskeletal dynamics emphasizing current literature. For each topic, the course examines (1) the proteins involved, (2) their interactions and regulation, and (3) how they organize specific cellular structures. The coordination of these complexes required for orchestrating complex cellular processes is also addressed. These important topics of cell biology are pursued with question-driven lectures, and both round-table discussions and group presentations of research papers.

**Prerequisites:**  
Minimum grade of 73% in BCH311H1/CSB349H1/MGY311Y1, minimum grade of 73% in BCH340H1/CJH332H1/
CSB328H1/CSB329H1/CSB331H1/CSB340H1/CSB353H1/CSB397Y0

Rationale:

Consultation:

Resources:

CSB458H1: Epigenetics

Prerequisites:
BIO260H1/HMB265H1, BCH311H1/CSB349H1/MGY311Y1

Rationale:

Consultation:

Resources:
5 Minor Program Modifications:

Focus in Artificial Intelligence

Completion Requirements:

Required Courses:

1. 1.0 FCE from the following: CSC336H1, MAT235Y1/MAT237Y1/MAT257Y1, APM236H1, MAT224H1/MIE262H1/MAT247H1, STA248H1/STA261H1; CSC336H1, CSC310H1, CSC330H1, CSC348H1, STA302H1

2. CSC463H1

2.5 FCEs from the following, so that courses are from at least two of the four areas:

   a.  a) CSC401H1, CSC485H1
   b.  b) CSC320H1, CSC420H1
   c.  c) CSC413H1/CSC421H1/
   d.  d) CSC321H1, CSC311H1/CSC411H1, CSC412H1
   d.  d) CSC304H1,
   d) CSC384H1, CSC486H1

Suggested Related Courses:

ESC304H1; CSC324H1, COG250Y1, PSY270H1, PHL232H1, PHL342H1; STA414H1

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Discussed and approved by CS UGC October 2018.

Resource Implications:

Focus in Computational Linguistics and Natural Language Processing

Completion Requirements:

Required Courses:

1. CSC318H1
Focus in Computer Vision

**Completion Requirements:**

**Required Courses:**

1. ‡ MAT235Y1/MAT237Y1/MAT257Y1, CSC320H1, CSC336H1, **CSC311H1/CSC411H1, CSC420H1**
2. ‡ 0.5 FCE from the following: CSC412H1, CSC418H1, [CSC2503H](#) (Note: students must petition to take a graduate course.)

**Suggested Related Courses:**

The following are examples of topics and courses that fit naturally with a study of computational vision. The list is meant to be illustrative of the range of cognate topics, but is not necessarily complete. The ordering is alphabetical and not indicative of importance. Note: there are prerequisites for many of these courses that we do not list here.

APM462H1, COG250Y1, CSC384H1, CSC485H1, CSC486H1, ECE216H1, PHL232H1, PHY385H1, PSL440H1
Description of Proposed Changes:

Rationale:

Impact:

Consultation:
Discussed and approved by CS UGC October 2018.

Resource Implications:

Focus in Scientific Computing

Completion Requirements:

Required Courses:

1. MAT235Y1/MAT237Y1/MAT257Y1,
2. 1.5 FCEs from the following: CSC336H1, CSC436H1, CSC446H1, CSC456H1, CSC466H1
3. 1.0 FCE from the following: CSC320H1/CSC418H1, CSC311H1 CSC321H1/CSC411H1, CSC343H1, CSC384H1, CSC358H1/CSC458H1

Suggested Related Courses:

• CSC367H1
• MAT224H1/MAT240H1/MAT247H1, MAT244H1, MAT334H1/MAT354H1, MAT337H1/MAT357H1

It is also recommended that students in this focus consider taking a half-course or two from the basic sciences (such as physics, chemistry, biology), as these sciences are the source of many problems solved by numerical techniques.

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:
Focus in Web and Internet Technologies

Completion Requirements:

Required courses:

1. + STA248H1/STA261H1, CSC309H1, CSC343H1, CSC358H1, CSC458H1, **CSC311H1/CSC411H1**
2. ≥ 0.5 FCE from the following: **CSC367H1**, **CSC490H1**, CSC443H1, CSC469H1

Suggested Related Courses:

1. + Courses offered at UTM: **CSC347H5**, **CSC423H5**, **CSC427H5**
2. ≥ **ECE568H1**
3. ≥ **ENV281H1**, **ENV381H1**

Description of Proposed Changes:

Rationale:

Impact:

Consultation: Discussed and approved by CS UGC October 2018.

Resource Implications:

3 New Courses:

**CSC311H1: Introduction to Machine Learning**

**Impact on Programs:**
This proposal triggers modifications in the unit's program(s)

**Contact Hours:**
Lecture: 24 / Tutorial: 12

**Description:**
Computer Science (FAS), Department of

Prerequisites:
CSC207H1, MAT235Y1/MAT237Y1/MAT257Y1/(minimum of 77 in MAT135H1 and MAT136H1)/(minimum of 73 in MAT137Y1)/(minimum of 67 in MAT157Y1), MAT221H1/MAT223H1/MAT240H1, STA247H1/STA255H1/STA257H1

Corequisites:

Exclusions:
CSC411H1, STA314H1, ECE421H1

Recommended Preparation:
MAT235Y1/MAT237Y1/MAT257Y1

Breadth Requirements:
The Physical and Mathematical Universes (5)

Distribution Requirements:
Science

Competencies:

Communication: slightly; Critical and Creative Thinking: notably; Information Literacy: none
Quantitative Reasoning: extensively; Social and Ethical Responsibility: none

Experiential Learning:
Research: none; Other: none

Rationale:
This course is intended to replace our current fourth-year intro machine learning course, CSC411H1. The new course will have similar content to CSC411H1, but will cover slightly fewer topics, and the level of mathematical background will be eased.

Machine learning has grown in importance in recent years, and enrolment demand is high. Currently, our department offers three undergraduate ML courses: CSC411H1, CSC412H1, and CSC421H1. The latter two courses both have CSC411H1 as a prerequisite. By replacing CSC411H1 with a third-year course, we will make it easier for students to take all the ML courses without having to cram them all into their fourth year. This change will also make it easier for our top students to get started with ML research during their third year.

Consultation:
This course has been developed in consultation with faculty from the Department of Statistical Sciences to ensure consistency with STA314H1 (which, in turn, was developed in consultation with the Department of Computer Science).

Resources:
Similar to resources currently in play for CSC411H1.
Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
Two other departments have courses similar to the proposed course: STA314H1, taught by the Department of Statistical Sciences, and ECE421H1, taught by the Department of Electrical and Computer Engineering. Each of these courses involves a similar set of topics, though with differing emphases and assumed background.

Programs of Study for Which This Course Might be Suitable:
Computer Science, Statistical Sciences

Estimated Enrolment:
600

Instructor:
Roger Grosse, Richard Zemel, Raquel Urtasun, Murat Erdogdu
# CSC413H1: Neural Networks and Deep Learning

**Impact on Programs:**
This proposal triggers modifications in the unit's program(s)

**Contact Hours:**
- **Lecture:** 24  /  **Tutorial:** 12

**Description:**

**Prerequisites:**
- CSC311H1/CSC411H1/STA314H1, MAT235Y1/MAT237Y1/MAT257Y1, MAT221H1/MAT223H1/MAT240H1

**Corequisites:**

**Exclusions:**
- CSC321H1/CSC421H1

**Recommended Preparation:**

**Breadth Requirements:**
The Physical and Mathematical Universes (5)

**Distribution Requirements:**
Science

**Competencies:**
- **Communication:** none; **Critical and Creative Thinking:** notably; **Information Literacy:** none
- **Quantitative Reasoning:** extensively; **Social and Ethical Responsibility:** none

**Experiential Learning:**
- **Research:** none; **Other:** none

**Rationale:**
ECE simultaneously created their own version of CSC311H1 (formerly CSC411H1), which they numbered ECE421H1. This can become confusing, since a lot of EngSci students will go on to take CSC421H1 after ECE421H1. ECE has good reason to use 421, since their more advance machine learning course is ECE521H1. Therefore, it would be simpler if we do the re-numbering. That way, we would have CSC311H1/CSC411H1, CSC412H1, and CSC413H1 (formerly CSC421H1, formerly CSC321H1) as machine learning courses.

**Consultation:**
Discussed and approved by CS UGC October 11, 2018.

**Resources:**

**Overlap with Existing Courses:**

**Programs of Study for Which This Course Might be Suitable:**

**Estimated Enrolment:**
## Instructor:

### CSC419H1: Geometry Processing

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<thead>
<tr>
<th>Contact Hours:</th>
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<tr>
<td><strong>Lecture:</strong> 24 / <strong>Tutorial:</strong> 12</td>
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</table>

### Description:

Extending traditional signal processing, geometry processing interprets three-dimensional curves and surfaces as signals. Just as audio and image signal data can be filtered, denoised and decomposed spectrally, so can the geometry of a three-dimensional curve or surface.

The course covers algorithms and mathematics behind fundamental operations for interpreting and manipulating geometric data. These essential tools enable: geometric modeling for computer aided design, life-like animations for computer graphics, reliable physical simulations, and robust scene representations for computer vision. Topics include: discrete curves and surfaces, curvature computation, surface reconstruction from point clouds, surface smoothing and denoising, parameterization, symmetry detection, and animation.

### Prerequisites:

- CSC209H1/demonstrated proficiency in C or C++
- MAT235Y1/MAT237Y1/MAT257Y1
- MAT221H1/MAT223H1/MAT240H1

### Corequisites:

### Exclusions:

### Recommended Preparation:

- CSC418H1

### Breadth Requirements:

- The Physical and Mathematical Universes (5)

### Distribution Requirements:

- Science

### Competencies:

- **Communication:** slightly; **Critical and Creative Thinking:** notably; **Information Literacy:** none
- **Quantitative Reasoning:** extensively; **Social and Ethical Responsibility:** none

### Experiential Learning:

- **Research:** none; **Other:** none

### Rationale:

This course provides background knowledge to conduct top-tier research in Geometry Processing and to excel as a geometry software developer in related industries. Geometry is pervasive across sub-disciplines of computer science: scientific computing, machine learning, computer graphics, engineering, and even optimization and theory. While this course will be essential for students planning to conduct research in Geometry Processing, students of other disciplines will also learn how efficient algorithms and representations of geometry on the computer can impact their work and research.

After completion of this course, students will not only be familiar with the fundamentals of geometry processing, but through weekly assignments they will also have hands-on experience programming these techniques.

### Consultation:

Discussions in Computer Science Undergraduate Committee in September and October 2018.
**Computer Science (FAS), Department of**

<table>
<thead>
<tr>
<th>Resources:</th>
<th>Access to DCS Teaching Labs, classroom with black/white-board, digital projector, standard TA support.</th>
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<tr>
<td><strong>Budget Implications:</strong></td>
<td>The academic unit will provide the resources required for this course from existing budget.</td>
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</table>

| Overlap with Existing Courses: | The first lecture of this course will cover background material on basic representations of curves and surfaces used in Computer Graphics (CSC418H1/CSC2504H1). This is to ensure that a previous course in Computer Graphics is not required as a prerequisite. |

<table>
<thead>
<tr>
<th>Programs of Study for Which This Course Might be Suitable:</th>
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<tbody>
<tr>
<td>Computer Science</td>
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<tr>
<th>Estimated Enrolment:</th>
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<tr>
<td>40</td>
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<tr>
<th>Instructor:</th>
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<tbody>
<tr>
<td>Alec Jacobson</td>
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### 4 Course Modifications:

#### COG260H1: Data, Computation, and the Mind

<table>
<thead>
<tr>
<th>Prerequisites:</th>
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<tbody>
<tr>
<td>Previous:</td>
<td>CSC108H1/CSC148H1</td>
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<tr>
<th>Breadth Requirements:</th>
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<tr>
<td>The Physical Society and Mathematical Universes its Institutions</td>
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<th>Rationale:</th>
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<td>Consultation:</td>
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<th>Resources:</th>
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#### CSC165H1: Mathematical Expression and Reasoning for Computer Science

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<thead>
<tr>
<th>Contact Hours:</th>
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<tbody>
<tr>
<td>Previous: Lecture: 36 / Tutorial: 24</td>
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<tr>
<td>New: Lecture: 36 / Tutorial: 12</td>
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<tr>
<th>Prerequisites:</th>
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<tbody>
<tr>
<td>Previous:</td>
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<tr>
<td>New: Prior programming experience, or be currently enrolled in CSC108H1/CSC120H1</td>
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<tr>
<th>Corequisites:</th>
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<tbody>
<tr>
<td>Previous: CSC148H1/ (CSC108H1/CSC120H1/CSC121H1, MAT137Y1/MAT157Y1)</td>
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<tr>
<td>New:</td>
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<th>Rationale:</th>
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<td>Consultation:</td>
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<td>Discussed and approved by CS UGC October 2018.</td>
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<tr>
<th>Resources:</th>
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</table>
CSC418H1: Computer Graphics

**Prerequisites:**
- CSC209H1/CSC336H1/CSC350H1/CSC351H1
- CSC373H1, (MAT135H1, MAT235Y1, MAT136H1)
- CSC350H1/CSC351H1, MAT237Y1/MAT137Y1/MAT257Y1, MAT221H1/MAT223H1/MAT240H1
- PROFICIENCY IN C or C++
- CSC209H1/PROFICIENCY IN C or C++.
- Prerequisite for Engineering students only: ECE345H1 or ECE352H1

**Recommended Preparation:**
- MAT237Y1, MAT244H1

**Rationale:**
Students really need multivariate calculus because the course uses gradients right from the start. The 300-level CSC prerequisites have not been required for a few years; students can (and should) take this course as early as their third year.

**Consultation:**
DScussions at the Computer Science Undergraduate Committee in September and October 2018.

**Resources:**

CSC446H1: Computational Methods for Partial Differential Equations

**Description:**

**Prerequisites:**
- CSC351H1/CSC336H1(75%)/equivalent mathematical background; MAT237Y1/MAT257Y1; APM346H1/MAT351Y1
- APM351Y1/(MAT244H1/MAT267H1 and exposure to PDEs)

**Rationale:**
APM351H1 does not exist. Confirmed with MAT that MAT351H1 is correct substitution.

**Consultation:**

**Resources:**

3 Retired Courses:

CSC310H1: Information Theory

**Rationale:**
Course has not been offered in 3+ years.

**Consultation:**
Discussed and approved by CS UGC October 2018.
CSC411H1: Machine Learning and Data Mining

Rationale:

CSC421H1: Neural Networks and Deep Learning

Rationale:
ECE simultaneously created their own version of CSC411, which they numbered ECE421. This will get really confusing, since a lot of EngSci students will go on to take CSC421 after ECE421. ECE has good reason to use 421, since their more advanced machine learning course is ECE521. Therefore, it would be simpler if we do the re-numbering. This way we will have CSC311H1, CSC412H1, and CSC413H1 as machine learning courses.

Consultation:
Discussed and approved by CS UGC October 11, 2018.
1 Minor Program Modification:

Pathobiology Specialist

Completion Requirements:

(13.5 full courses or their equivalent, including at least two 400-series courses)

First Year:
(BIO120H1, BIO130H1); (CHM135H1, CHM136H1)/CHM151Y1; (MAT135H1, MAT136H1)/MAT137Y1/
MAT157Y1
First or Second Year:
(PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)
Second Year:
BCH210H1; BIO230H1; BIO260H1/HMB265H1; CHM220H1; CHM247H1/CHM249H1; PSL300H1; PSL301H1;
STA220H1/BIO220H1
Third Year:
BCH370H1; BCH311H1/CSB349H1; (IMM340H1, IMM350H1)/(IMM341H1, IMM351H1)/(MGY377H1,
MGY378H1); LMP300Y1/(LMP340H1, LMP350H1); LMP365H1
Fourth Year:
At least 4 of LMP402H1, LMP403H1, LMP405Y1, LMP406H1, LMP408H1, LMP410H1, LMP415H1, LMP436H1
(Note: If the research project LMP405Y1 is taken, three additional courses from the list are still required.)

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

2 New Courses:

LMP340H1: Introduction to Pathobiology I

Impact on Programs:
This proposal triggers modifications in the unit's program(s)

Contact Hours:
Lecture: 18 / Practical: 6 / Tutorial: 12

Description:

Concepts in pathogenesis, cell injury, adaptation and death; oxidative stress, ion channels and pumps, calcium
homeostasis. Molecular basis of diseases affecting iron, blood and the cardiovascular system. The laboratory examines
anatomical and histopathological specimens in cardiac disease.
Prerequisites:
Enterrolment is limited to students specializing in Pathobiology who have completed, or are completing, the first and second year requirements of the program.

Corequisites:

Exclusions:
LMP300Y1, LMP301H1, LMP363H1

Recommended Preparation:
Second Year required courses for the Pathobiology Specialist Program

Breadth Requirements:
Living Things and Their Environment (4)

Distribution Requirements:
Science

Competencies:
Communication: extensively; Critical and Creative Thinking: extensively; Information Literacy: extensively
Quantitative Reasoning: extensively; Social and Ethical Responsibility: notably

Experiential Learning:
Research: none; Other: none

Rationale:
LMP300Y, Introduction to Pathobiology, is the core course in Pathobiology required by, and restricted to, Third Year students in the Pathobiology Specialist. We are cancelling this course and delivering its content, in its entirety, as two half courses, LMP340H (Introduction to Pathobiology I) and LMP350H (Introduction to Pathobiology II). Material in the Fall term of LMP300Y will now be offered as LMP340H, and material from the winter term will be given as LMP350H. This will give the students greater flexibility in scheduling and avoid issues of finding a full 1.0 FCE time slot in 3rd Year. It also allows better evaluation of students throughout a course that is presently designed as a transition from a more didactic approach to text book material for students entering the course from 2nd Year, to more emphasis on contemporary research papers as students complete the course and proceed to our 4th Year program. Thus, in LMP340H, the approach will continue to be teaching of foundation material (with a three-week practical component), term tests, a final exam, and an essay-format term paper.

Consultation:
The proposal to split LMP300Y into LMP340H/LMP350H has been raised with the Faculty of Medicine Life Sciences Curriculum Committee and will be discussed further at our next meeting.

Resources:
The lecturers in this course will be the same as those presently giving the first term of LMP300Y. The TA is currently assigned to give a weekly tutorial throughout the Fall term in LMP300Y will instead provide the tutorial for LMP340H. Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
LMP300Y has been offered for 18 years, and no significant overlap of its content, unique to the Pathobiology Specialist program and restricted to our students, has been identified. With the cancellation of LMP300Y, the first half of its content will be delivered as LMP340H.

Programs of Study for Which This Course Might be Suitable:
Pathobiology Specialist

Estimated Enrolment:
20-30

Instructor:
Prof. Doug Templeton
# LMP350H1: Introduction to Pathobiology II

**Impact on Programs:**
This proposal triggers modifications in the unit's program(s)

<table>
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<th>Contact Hours:</th>
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<tr>
<td>Lecture: 24 / Tutorial: 12</td>
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**Description:**
Molecular basis of tissue repair and fibrosis, endocrine and signaling disorders, introduction to neurodegenerative diseases. Animal models and genetic basis of disease. Mechanisms infection by virus, bacteria and parasites. Topics are chosen to complement LMP340H and introduce areas that may be explored in more depth in 400-level LMP courses. Enrolment is limited to students specializing in Pathobiology who have completed LMP340H.

**Prerequisites:**
LMP340H1

**Corequisites:**

**Exclusions:**
LMP300Y1, LMP301H1, LMP363H1

**Recommended Preparation:**
Second Year required courses for the Pathobiology Specialist Program

**Breadth Requirements:**
Living Things and Their Environment (4)

**Distribution Requirements:**
Science

**Competencies:**
- Communication: extensively;
- Critical and Creative Thinking: extensively;
- Information Literacy: extensively;
- Quantitative Reasoning: notably;
- Social and Ethical Responsibility: notably

**Experiential Learning:**
- Research: none;
- Other: none

**Rationale:**
LMP300Y, Introduction to Pathobiology, is the core course in Pathobiology required by, and restricted to, Third Year students in the Pathobiology Specialist. We are cancelling this course and delivering its content, in its entirety, as two half courses, LMP340H (Introduction to Pathobiology I) and LMP350H (Introduction to Pathobiology II). Material in the Fall term of LMP300Y will now be offered as LMP340H, and material from the winter term will be given as LMP350H. This will give the students greater flexibility in scheduling and avoid issues of finding a full 1.0 FCE time slot in 3rd Year. It also allows better evaluation of students throughout a course that is presently designed as a transition from a more didactic approach to text book material for students entering the course from 2nd Year, to more emphasis on contemporary research papers as students complete the course and proceed to our 4th Year program. Thus, in LMP350H, the approach will continue to be presentation of current research in several areas of molecular pathobiology (e.g., tissue repair, neurodegenerative disease), that often serve as an introduction to topics dealt with as complete half-course offerings in 4th Year of our program. Evaluation will be by term test, a final exam, and a term paper requirement of a critique of a recent journal article in a field closely related to one of the course topics.

**Consultation:**
The proposal to split LMP300Y into LMP340H/LMP350H has been raised with the Faculty of Medicine Life Sciences Curriculum Committee and will be discussed further at our next meeting.

**Resources:**

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27
The lecturers in this course will be the same as those presently giving the first term of LMP300Y. The TA is currently assigned to give a weekly tutorial throughout the Winter term in LMP300Y will instead provide the tutorial for LMP350H.

**Overlap with Existing Courses:**

LMP300Y has been offered for 18 years, and no significant overlap of its content, unique to the Pathobiology Specialist program and restricted to our students, has been identified. With the cancellation of LMP300Y, the second half of its content will be delivered as LMP350H.

**Programs of Study for Which This Course Might be Suitable:**

Pathobiology Specialist

**Estimated Enrolment:**

20-30

**Instructor:**

Prof. Doug Templeton

3 Course Modifications:

**LMP405Y1: Project in Pathobiology**

**Prerequisites:**

BCH210H1/BCH242Y1, LMP300Y1/(LMP340H1, LMP350H1)/LMP363H1/LMP365H1 and permission of department

**Rationale:**

Consultation:

Resources:

**LMP408H1: Genetic modelling of human development and disease**

**Prerequisites:**

LMP300Y1/(LMP340H1, LMP350H1)/BIO260H1/HMB265H1

**Rationale:**

Consultation:

Resources:

**LMP415H1: Forensic Pathobiology**

**Description:**

A thematic review of the major scientific areas and research controversies in forensic medicine. The approach is mechanistic analysis and evidence-based medicine. Classical forensic medicine is critically analyzed with emphasis on experimental methods to resolve controversies. We also explore how the justice system utilizes medical and scientific data.
**Laboratory Medicine and Pathobiology (MED), Department of**

<table>
<thead>
<tr>
<th>Prerequisites:</th>
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<tbody>
<tr>
<td>LMP300Y1/(LMP340H1, LMP350H1)/permission of department</td>
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<th>Rationale:</th>
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<tr>
<td>Consultation:</td>
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<th>Resources:</th>
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### 1 Retired Course:

**LMP300Y1: Introduction to Pathobiology**

<table>
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<tr>
<th>Rationale:</th>
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<tr>
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<tr>
<th>Consultation:</th>
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<tbody>
<tr>
<td>The proposal to split LMP300Y into LMP340H/LMP350H has been raised with the Faculty of Medicine Life Sciences Curriculum Committee and will be discussed further at our next meeting.</td>
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</table>
5 Minor Program Modifications:

Biomedical Toxicology Major

Completion Requirements:

Students will follow the calendar year in which they initially enter one of our programs (ie for the majority of students that will be ASMAJ2675).

(8 full courses or their equivalent)

First Year: BIO120H1; BIO130H1; (CHM135H1, CHM136H1)/(CHM138H, CHM139H)/CHM151Y1

Second Year: BCH210H1; BIO230H1/BIO255H1 (BIO240H, BIO241H); PCL201H1; CHM247H1/CHM249H1; (PSL300H1, PSL301H1)/PSL302Y (NOTE: PSL201Y1 is not acceptable).

Third Year: PCL302H1; PCL362H1. (See NOTE 1)

Third or Fourth Year: 1.0 full-credit equivalent with at least one-half credit equivalent from PCL courses: JPM300H1/ JPM400Y1/PCL345H1/PCL367H1/PCL368H1/PCL389H1/PCL402H1/PCL475Y1/PCL477H1/PCL481H1/PCL484H1/ PCL486H1/PCL490H1/ANA301H1/BCH370H1/LMP301H1/LMP363H1.

Fourth Year: (PCL482H1, PCL483H1)/PCL473Y1

NOTES
1. Although LMP301H1 (Introduction to the Biochemistry of Human Disease) and LMP363H1 (Principles of Pathobiology) are not prerequisites to enroll in PCL473Y1, students are recommended to enroll in at least one of these courses:

   1 2. Students are not allowed to enroll concurrently in the Major Program in Pharmacology and the Major Program in Toxicology

   2 3. Students are not allowed to enroll concurrently in the Major Program in Pharmacology and a Specialist Program in Toxicology.

   3 4. Students are not permitted to take PCL472Y1 or PCL474Y1.

Description of Proposed Changes:

   Adding courses to electives: JPM300H1, JPM400Y1, PCL367H1, PCL368H1

   Reflecting split in PCL473Y1 to two half courses: PCL483H1 and PCL484H1

   Removing BCH370H1 as potential elective as our MAJ can now take our own lab courses as electives (PCL367H1, PCL368H1)

Rationale:

Impact:

Consultation:

Resource Implications:
Biomedical Toxicology Specialist

Enrolment Requirements:

This is a limited enrolment program that can only accommodate a limited number of students. Eligibility will be competitive and based on a student’s marks in the 3.0 required first-year courses:

BIO120H1, BIO130H1, (CHM135H1, CHM136H1) / (CHM138H, CHM139H)/CHM151Y1, and 1.0 FCE from (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1/(PHY131H1, PHY132H1)/(PHY151H1, PHY152H1) with an average of at least 70% on these 3.0 full-course equivalents (FCEs) and a final mark of at least 60% in each course.

Achieving these estimated marks does not guarantee admission to the program in any given year.

While it is difficult to predict what will be competitive course marks and average in a given year, based on previous years, the estimate is: course marks = mid 80s; average = mid 80s.

Students must apply to this program on the Arts & Science Faculty Registrar’s Office website (see the Arts & Science Program Enrolment website for application procedures). Students wishing to enroll in the Biomedical Toxicology Specialist will initially apply to the Specialist in Pharmacology and Biomedical Toxicology (ASSPE2340). After completion of first year pre-requisite courses and during the spring of their second year of study (and completion of PCL201H1) students can then choose to apply to the Biomedical Toxicology Specialist. First and second year courses are the same for all Specialist programs within the Department (ASSPE2082/ASSPE2340/ASSPE2573). Students will follow the calendar year in which they initially enter one of our programs (students who are enrolled in the Biomedical Toxicology or the Pharmacology Specialist will follow the requirements for the calendar year in which they first enrolled in the Specialist in Pharmacology and Biomedical Toxicology (ASSPE2340)).

Students cannot combine the Biomedical Toxicology Specialist with either departmental Major programs (Biomedical Toxicology or Pharmacology).

Students wishing to enrol after their second year who have taken PCL201H1 will be considered on a case by case basis. Successful completion of required pre-requisite courses is required to further enroll in upper level program courses. Students may not transfer to the Major program from the Specialist after completion of PCL465H1, PCL474Y1 courses or PEY.

Completion Requirements:

Students will follow the calendar year in which they initially enter one of our programs (ie for the majority of students that will be ASSPE2340).

(14.5 full courses or their equivalent)

First Year: BIO120H1; BIO130H1; (CHM135H1, CHM136H1)/(CHM138H, CHM139H)/CHM151Y1; and 1 FCE from any combination of (MAT135H1, MAT136H1); PHY131H1/PHY151H1; PHY132H1/PHY152H1 (see NOTE 1)

Second Year: BCH210H1; BIO230H1/BIO255H1 (BIO240H, BIO241H); BIO260H1/HMB265H1; CHM247H1/CHM249H1; STA288H1; PCL201H1; (PSL300H1, PSL301H1)/PSL302Y (NOTE: PSL201Y1 is not acceptable).

Third Year: PCL302H1; PCL362H1; at least 0.5 FCE from PCL367H1 or PCL368H1 PCL366H1

Third or Fourth Year: LMP363H1 and two and a half (2.5 FCE) full-credit equivalent with at least 1.5 full credit equivalent from PCL courses: JPM300H1/PCL345H1/PCL367H1 or PCL368H1 (see NOTE 2) PCL389H1/PCL389H1
PCL46H1/PCL475Y1/PCL477H1/PCL484H1/PCL486H1/PCL490H1/JPM400Y1 PCL491H1/ANA301H1/BCH370H1/CHM310H1/ESS463H1/LMP301H1.

Fourth Year: PCL402H1; (PCL482H1, PCL483H1)/PCL473Y1; PCL474Y1/JPM400Y1 (see NOTE 3 2); PCL481H1.
An Integrative, Inquiry-Based Activity Requirement must be satisfied.

The requirement for an integrative, inquiry-based and/or experiential activity must be met by completing at least one of the following: PCL297H1, PCL389H1, PCL397Y0, PCL472Y1, PCL474Y1, JPM400Y1, Professional Experience Year

NOTES
1. Any PHY/MAT courses should be completed during the first year and included for program enrollment.

2. At least 0.5 FCE from PCL367H1 or PCL368H1 is required for the program, however if desired the alternative course can be taken as a program elective.

3. Enrollment in any of the Research Project Course (PCL474Y1 or JPM400Y1) is limited and requires permission from the Department of Pharmacology and Toxicology. Students must receive prior consent from the course coordinator of an approved supervisor according to Departmental guidelines before the Department of Pharmacology and Toxicology will register them in the course. Students can take either course as their required independent project, or may take JPM400Y1 as an additional elective. It is the student’s responsibility to make initiate all necessary preparations before the session starts (see course description).

Professional Experience Year:

The Professional Experience Year (PEY) internship program is a 12-16 month paid employment placement within pharmaceutical/biotechnology/chemical companies, university research laboratories, university-affiliated organizations, consulting companies or government research agencies. The PEY takes place between the 3rd and 4th years of undergraduate study and is open to Specialists in Biomedical Toxicology who have a cGPA of at least 3.0. Students who participate in this program agree to return to their SPE program in the Department to complete their 4th year and their degree. The PEY internship provides an excellent opportunity for real-world experience in drug development, project management, client relations, basic and clinical research, information management and regulatory affairs.

Description of Proposed Changes:

- PCL367H1 and PCL368H1 will replace PCL366H, PCL461H and PCL491H
- BCH370H1 is replaced by our own elective lab options (PCL367/368)
- PCL473Y1 is being broken into two 0.5 FCE courses- PCL482H1 and PCL483H1
- New courses JPM300H1 and JPM400Y1 being introduced as elective options

Rationale:

Impact:

Consultation:

Resource Implications:

Pharmacology Major

Completion Requirements:

Students will follow the calendar year in which they initially enter one of our programs (ie for the majority of students that will be ASMAJ2675).

(8 full courses or their equivalent)

First Year: BIO120H1; BIO130H1; (CHM135H1, CHM136H1)/(CHM138H, CHM139H)/CHM151Y1
Pharmacology & Toxicology (MED), Department of

Second Year: BCH210H1; BIO230H1/BIO255H1; PCL201H1; CHM247H1/CHM249H1; (PSL300H1, PSL301H1)/PSL302Y (NOTE: PSL201Y1 is not acceptable).

Third Year: PCL302H1; BCH311H1/PSL350H1

Third or Fourth Year: PCL469H1 and 1.0 full course equivalent from: JPM300H1/JPM400Y1/PCL345H1/PCL367H1/PCL368H1/PCL389H1/PCL402H1/PCL475Y1/PCL477H1/PCL484H1/PCL486H1/PCL490H1/BCH370H1

Fourth Year: PCL470H1/PCL470Y1

NOTES
1. Students are not allowed to enroll concurrently in the Major Program in Pharmacology and the Major Program in Toxicology.
2. Students are not allowed to enroll concurrently in the Major Program in Pharmacology and a Specialist Program in Toxicology.
3. Students are not permitted to take PCL472Y1 or PCL474Y1.

Description of Proposed Changes:
- Adding courses as elective to the program: JPM300H1, JPM400Y1, PCL367H1, PCL368H1
- BCH370H1 replaced with our own lab courses (PCL367H1, PCL368H1)
- Accept either PSL350H1 or BCH311H1 which are exclusions to one another.

Rationale:

Impact:

Consultation:
- Changes approved by our UEC

Resource Implications:

Pharmacology Specialist

Enrolment Requirements:

This is a limited enrolment program that can only accommodate a limited number of students. Eligibility will be competitive and based on a student’s marks in the 3.0 required first-year courses:

BIO120H1, BIO130H1, (CHM135H1, CHM136H1)/ (CHM138H, CHM139H)/CHM151Y1, and 1.0 FCE from (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1/(PHY131H1, PHY132H1)/(PHY151H1, PHY152H1) with an average of at least 70% on these 3.0 full-course equivalents (FCEs) and a final mark of at least 60% in each course.

Achieving these estimated marks does not guarantee admission to the program in any given year.

While it is difficult to predict what will be competitive course marks and average in a given year, based on previous years, the estimate is: course marks = mid 80s; average = mid 80s.

Students must apply to this program on the Arts & Science Faculty Registrar's Office website (see the Arts & Science Program Enrolment website for application procedures). Students wishing to enroll in the Pharmacology Specialist will initially apply to the Specialist in Pharmacology and Biomedical Toxicology (ASSPE2340). After completion of first year pre-requisite courses and during the spring of their second year of study (and completion of PCL201H1) students can then choose to apply to the Pharmacology Specialist. First and second year courses are the same for all Specialist programs within the Department (ASSPE2082/ASSPE2340/ASSPE2573).

Students will follow the calendar year in which they initially enter one of our programs (students who are enrolled in the
Pharmacology & Toxicology (MED), Department of

Biomedical Toxicology or the Pharmacology Specialist will follow the requirements for the calendar year in which they first enrolled in the Specialist in Pharmacology and Biomedical Toxicology (ASSPE2340). Students cannot combine the Biomedical Toxicology Specialist with either departmental Major programs (Biomedical Toxicology or Pharmacology).

Students wishing to enroll after their second year who have taken PCL201H1 will be considered on a case by case basis. Successful completion of required pre-requisite courses is required to further enroll in upper level program courses. Students may not transfer to the Major program from the Specialist after completion of PCL461H1 courses or PEY.

Completion Requirements:

Students will follow the calendar year in which they initially enter one of our programs (ie for the majority of students that will be ASMAJ2675/ASSPE2340).

(14.5 full courses or their equivalent)

First Year: BIO120H1; BIO130H1; (CHM135H1, CHM136H1)/(CHM138H, CHM139H)/CHM151Y1; and 1 FCE from any combination of (MAT135H1, MAT136H1); PHY131H1/PHY151H1; PHY132H1/PHY152H1 (see NOTE 1)

Second Year: BCH210H1; BIO230H1/BIO255H1 (BIO240H; BIO241H); BIO260H1/HMB265H1; CHM247H1/CHM249H1; STA288H1; PCL201H1; (PSL300H1, PSL301H1)/PSL302Y (NOTE: PSL201Y1 is not acceptable).

Third Year: BCH311H1/PSL350H1; PCL302H1; at least 0.5 FCE from PCL367H1 or PCL368H1 PCL366H1

Third or Fourth Year: PCL469H1 and 3.5 full-course equivalents with at least 1.5 full credit equivalents from PCL courses: JPM300H1/PCL345H1/PCL367H1 or PCL368H1 (see NOTE 2) PCL389H1/PCL389H1 PCL461H1/PCL475Y1/PCL477H1/PCL484H1/PCL486H1/PCL490H1/JPM400Y1 PCL491H1/ANA300Y1/BCH340H1/BCH350H1/BCH370H1/CBE328H1 (See NOTE 2)/PSL372H1.

Fourth Year: PCL402H1; PCL470H1/PCL470Y1; PCL472Y1/JPM400Y1 (see NOTE 3)

An Integrative, Inquiry-Based Activity Requirement must be satisfied.

The requirement for an integrative, inquiry-based and/or experiential activity must be met by completing at least one of the following: PCL297H1, PCL389H1, PCL397Y0, PCL472Y1, PCL474Y1, JPM400Y1, Professional Experience Year

Notes

1. Any PHY/MAT courses should be completed during the first year and included for program enrollment.

2. At least 0.5 FCE from PCL367H1 Some of the choices listed above are only available to students who are enrolled in a POSit sponsored by the department or PCL368H1 is required for unit offering the program course, however if desired the alternative course can be taken as a program elective and/or who have completed specified prerequisites

3. Enrollment in either the Research Project Course (PCL472Y1 or JPM400Y1) is limited and requires permission from the Department of Pharmacology and Toxicology. Students must receive prior consent from course coordinator of an approved supervisor according to Departmental guidelines before the Department will register them in the course. Students can take either course as their required independent project, or may take JPM400Y1 as an additional elective. It is the student’s responsibility to make all necessary preparations before the session starts (see course description).

Professional Experience Year:

The Professional Experience Year (PEY) internship program is a 12-16 month paid employment placement within pharmaceutical/biotechnology/chemical companies, university research laboratories, university-affiliated organizations, consulting companies or government research agencies. The PEY takes place between the 3rd and 4th years of undergraduate study and is open to Specialists in Pharmacology who have a cGPA of at least 3.0. Students who participate
in this program agree to return to their SPE program in the Department to complete their 4th year and their degree. The PEY internship provides an excellent opportunity for real-world experience in drug development, project management, client relations, basic and clinical research, information management and regulatory affairs.

**Description of Proposed Changes:**

- PSL350H1 is accepted as alternative to BCH311H1, which are exclusions for one another
- PCL367H1 and PCL368H1 will replace PCL366H1, PCL461H1 and PCL491H1
- BCH370H1 and PSL372H1 are also replaced by our own elective lab options (PCL367/368)
- New courses JPM300H1 and JPM400Y1 being introduced as elective option and/or alternative to PCL472Y1 respectively.

**Rationale:**

**Impact:**

**Consultation:**

**Resource Implications:**

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**Specialist in Pharmacology and Biomedical Toxicology**

**Enrolment Requirements:**

This is a limited enrolment program that can only accommodate a limited number of students. Eligibility will be competitive and based on a student’s marks in the 3.0 required first-year courses:

BIO120H1, BIO130H1, (CHM135H1, CHM136H1)/(CHM138H, CHM139H)/CHM151Y1, and 1.0 FCE from (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1/(PHY131H1, PHY132H1)/(PHY151H1, PHY152H1) with an average of at least 70% on these 3.0 full-course equivalents (FCEs) and a final mark of at least 60% in each course.

Achieving these estimated marks does not guarantee admission to the program in any given year.

While it is difficult to predict what will be competitive course marks and average in a given year, based on previous years, the estimate is: course marks = mid 80s; average = mid 80s.

Students must apply to this program on the Arts & Science Faculty Registrar’s Office website (see the Arts & Science Program Enrolment website for application procedures). Students will follow the calendar year in which they initially enter one of our programs.

Students cannot combine the Biomedical Toxicology Specialist with either departmental Major programs (Biomedical Toxicology or Pharmacology).

Students wishing to enroll after their second year who have taken PCL201H1 will be considered on a case by case basis. Successful completion of required pre-requisite courses is required to further enroll in upper level program courses. Students may not transfer to the Major program from the Specialist after completion of PCL461H1 or PCL472Y1/PCL474Y1 courses or PEY.

**Completion Requirements:**

Students will follow the calendar year in which they initially enter one of our programs (ie for the majority of students that will be ASSPE2340).
Pharmacology & Toxicology (MED), Department of

(15 full courses or their equivalent)

First Year: BIO120H1; BIO130H1; (CHM135H1, CHM136H1)/(CHM138, CHM139H)/CHM151Y1; and 1 FCE from any combination of (MAT135H1, MAT136H1); PHY131H1/PHY151H1; PHY132H1/PHY152H1 (see NOTE 1)

Second Year: BCH210H1; BIO230H1/BIO255H1 (BIO240H, BIO241H); BIO260H1/HMB265H1; CHM247H1/CHM249H1; STA288H1; PCL201H1; (PSL300H1, PSL301H1)/PSL302Y (NOTE: PSL201Y1 is not acceptable).

Third Year: BCH311H1/PSL350H1; PCL302H1; PCL362H1; at least 0.5 FCE from PCL367H1 or PCL368H1 (see NOTE 2)

Third or Fourth Year: LMP363H1, PCL469H1, and a one and half (1.5 FCE) full-credit equivalent from the following courses: JPM300H1/PCL345H1/PCL367H1 or PCL368H1 (see NOTE 2) PCL389H1/PCL389H1 PCL461H1/PCL475Y1/PCL477H1/PCL482H1/PCL483H1/PCL486H1/PCL490H1/JPM400Y1 PCL491H1/LMP301H1. Additional courses that may strengthen your background in this program can be taken, but will not count towards your program: ANA300Y1/ANA301H1/BCH340H1/BCH370H1/CHM310H1/CNB328H1 (see NOTE 3)/ESS463H1/PSL372H1.

Fourth Year: PCL402H1; PCL470H1/PCL470Y1; (PCL482H1, PCL483H1)/PCL473Y1; PCL472Y1/PCL474Y1/JPM400Y1 (see NOTE 3) PCL481H1.

An Integrative, Inquiry-Based Activity Requirement must be satisfied.

The requirement for an integrative, inquiry-based and/or experiential activity must be met by completing at least one of the following: PCL297H1, PCL389H1, PCL397Y0, PCL472Y1, PCL474Y1, JPM400Y1, Professional Experience Year.

NOTES
1. Any PHY/MAT courses should be completed during the first year and included for program enrollment.

2. At least 0.5 FCE from PCL367H1 or PCL368H1 is required for the program, however if desired the alternative course can be taken as a program elective.

3. Enrollment in any of the Research Project Course (PCL472Y1/PCL474Y1 or JPM400Y1) is limited and requires permission from the Department of Pharmacology and Toxicology. Students must receive prior consent from the course coordinator of an approved supervisor according to Departmental guidelines before the Department will register them in the course. Students can take either course as their required independent project, or may take JPM400Y1 as an additional elective. It is the student’s responsibility to make all necessary preparations before the session starts (see course description).

4. Some of the choices listed above are only available to students who are enrolled in a POS program sponsored by the department or unit offering the course, and/or who have completed specified prerequisites.

Professional Experience Year:

The Professional Experience Year (PEY) internship program is a 12-16 month paid employment placement within pharmaceutical/biotechnology/chemical companies, university research laboratories, university-affiliated organizations, consulting companies or government research agencies. The PEY takes place between the 3rd and 4th years of undergraduate study and is open to Specialists in Pharmacology and Biomedical Toxicology who have a cGPA of at least 3.0. Students who participate in this program agree to return to their SPE program in the Department to complete their 4th year and their degree. The PEY internship provides an excellent opportunity for real-world experience in drug development, project management, client relations, basic and clinical research, information management and regulatory affairs.

Description of Proposed Changes:
PSL350H1 is accepted as alternative to BCH311H1, which are exclusions for one another. PCL367H1 and PCL368H1 will replace PCL366H1, PCL461H1 and PCL491H1. BCH370H1 and PSL372H1 are also replaced by our own elective lab options (PCL367/368). PCL473Y1 moving to 2 courses, which will be 0.5 FCE each, PCL482H1 and PCL483H1. New courses JPM300H1 and JPM400Y1 being introduced as elective options.
6 New Courses:

**JPM300H1: Research Readiness and Advancing Biomedical Discoveries**

<table>
<thead>
<tr>
<th>Impact on Programs:</th>
<th>This proposal triggers modifications in the unit's program(s)</th>
</tr>
</thead>
</table>

**Contact Hours:**

| Lecture: 12          | Tutorial: 24 |

**Description:**

Explore how scientists leverage their knowledge and skills to advance academic biomedical discoveries from the laboratory to improve patient health through either commercialization or not-for-profit approaches. Students will learn about innovation and develop key research and industry skills including intellectual property, ethics, budget and project management; learn how to critically evaluate scientific evidence and effectively communicate to a wide audience. This hybrid student-centered course will include interactive online modules and in-class group work. Course work will focus on developing skills and knowledge to help you be successful in diverse research courses and future careers.

**Prerequisites:**

10.0 FCE completed; BCH210H1/BCH242Y1

**Corequisites:**

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**Exclusions:**

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**Recommended Preparation:**

PSL300H1, PSL301H1

**Breadth Requirements:**

Living Things and Their Environment (4)

**Distribution Requirements:**

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**Competencies:**

- Communication: extensively;
- Critical and Creative Thinking: notably;
- Information Literacy: extensively
- Quantitative Reasoning: slightly;
- Social and Ethical Responsibility: notably

**Experiential Learning:**

- Research: notably;
- Other: none

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The purpose for the creation of JPM300H: Research Readiness and Advancing Biomedical Discoveries is to expose students to detailed knowledge and understanding of the scientific enterprise, including (but not limited to) drug discovery and development, intellectual property and open science, biomedical and business ethics, and project management. This directly aligns with the strategic mandate of the University of Toronto and Government of Ontario in terms of exposing students to entrepreneurship and providing knowledge required for success in work-integrated learning (see SMA2 https://www.ontario.ca/page/college-and-university-strategic-mandate-agreements-2017-2020). JPM300H will promote understanding of what is required to be successful in research and the business behind science. Modules topics will include: developing hypotheses and good laboratory practice, drug discovery, intellectual property and open science, biomedical and business ethics, and project management. To foster student learning and engagement, JPM300H will focus on inquiry-based approaches that will include: online learning modules, in-class small-group discussions, individual written assignments (including reflections), participation in Q&A session, and oral presentations. Tutorials and assignments will evaluate higher-order learning including application, analysis and synthesis. Furthermore, this course will provide multiple opportunities for developing lifelong skills by integrating communication skills into learning and assignments (e.g. information literacy, data analysis, and verbal and written communication).

Of critical importance, this new course will also serve as the platform for entry into JPM400Y: Biomedical Incubator Capstone Project course. In JPM400Y, students further develop a research proposal and become part of a biomedical innovation team tasked with conducting hands-on research to implement the project in a simulated small business/incubator setting under the guidance of a faculty mentor.

The online modules created for JPM300H will also serve as resources for students in other applicable Life Sciences courses that align broadly with topics focusing on research project management, setting milestones and working with budgets and timelines. These modules will be appropriately housed for faculty use outside of this course.

Consultation:
Discussed with BMS Curriculum Committee (meeting Oct 5), in collaboration with Physiology, Biochemistry. Discussed with FAS Deans Office.

Resources:
Funds already provided by OUCI and FAS CRF monies. Application outstanding for further support. Instructor, TAs

Budget Implications: The academic unit has received Decanal approval for additional resources required for this course.

Overlap with Existing Courses:
Drug Development is covered in other courses in Pharmacology and Toxicology; introduced in PCL201H and then pre-clinical development in detail in PCL402H. The goal of this module will be to ensure all students are aware of the process and the active learning sessions will focus on content distinct from other courses.

Programs of Study for Which This Course Might be Suitable:
Specifically focused for students in the SPE streams in Pharmacology and Biomedical Toxicology, Physiology and Biochemistry but will also be open to MAJORS in these programs. Other students in the Basic Medical Sciences may also be interested

Estimated Enrolment:
100

Instructor:
TBA

JPM400Y1: Biomedical Incubator Capstone Project

Impact on Programs:
This proposal triggers modifications in the unit’s program(s)

Contact Hours:
Practical: 240  /  Seminar: 16

Description:
Pharmacology & Toxicology (MED), Department of

Discover what it is like to be part of a biomedical innovation team. Develop and engage in biomedical research in a simulated small business/incubator setting under the guidance of a faculty mentor. Bring your proposed JPM300H1 project to life, while acquiring budget management, research, business and communication workplace skills for future careers.

*Students will form teams and develop a research proposal based on either*

1. Faculty led concept requiring further development and testing, which would not normally be funded grants and would be tangential to ongoing research in the lab.

2. Student developed innovative idea that requires further development and testing. *This should be a project that is not being investigated in a UofT research lab*

**Prerequisites:**
A minimum of 75% in JPM300H1; completion of any of PCL367H1/PCL368H1/PSL372H1/BCH370H1/BCH377H1

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**

**Breadth Requirements:**
Living Things and Their Environment (4)

**Distribution Requirements:**

**Competencies:**
*Communication:* extensively; *Critical and Creative Thinking:* extensively; *Information Literacy:* extensively
*Quantitative Reasoning:* notably; *Social and Ethical Responsibility:* notably

**Experiential Learning:**
*Research:* extensively; *Other:* none

**Rationale:**
Our overall project goal is to prepare students for traditional and non-traditional careers in research, industry and related fields by expanding the availability of learning opportunities in real-world contexts. Within the Biomedical Incubator Capstone Project (JPM400Y) students will become part of a biomedical innovation team tasked with developing and conducting a research and development project in a simulated small business/incubator setting under the guidance of a mentor.

Policy makers and educators recognize the benefits of integrating authentic learning opportunities into the undergraduate curriculum to better prepare students both academically and professionally. While U of T students have long had access to these types of experiences, the new Strategic Mandate Agreement between U of T and the Government of Ontario is calling for the "expansion of high-quality, pedagogically-sound work-integrated learning and experiential learning opportunities across undergraduate . . . programs". As well, the influential Vision and Change: A Call to Action report on biology education emphasizes the need to provide “authentic opportunities [for students] to experience the processes, nature, and limits of science”, and calls for a student-centered approach to teaching by
Pharmacology & Toxicology (MED), Department of

engaging “students as active participants, not passive recipients” and facilitating “student learning within a cooperative context”. Indeed, the benefits of active learning approaches in science teaching are well documented. The independent research courses and field courses offered by the Departments of Pharmacology & Toxicology, Biochemistry, and Physiology (e.g. PCL472Y, BCH473Y, PSL498Y etc) are examples of high-quality authentic and active learning experiences that teach transferrable life-long skills to prepare students for future careers, especially in academia. Recent student reflections in the courses have indicated that there is a need to establish “the opportunity to apply the knowledge learnt in the classroom to a workplace that is not a laboratory.” The creation of “research/lab experiences aside from lab courses” and being able to assist students to “build upon their collaboration skills” are some of the driving forces behind this proposal. Indeed, students in these courses have asked for exposure to project management, working as a team, and setting budgets in order to better prepare them for the workforce. With the exception of the PEY program in the Department of Pharmacology and Toxicology, there are few opportunities in our programs for students to learn about science innovation and how biomedical discoveries are translated to new services and products. Our project provides this opportunity.

Innovation is a way to future-proof students and the economy. Stanford University, for example, has developed a summer undergraduate credit course entitled: Silicon Valley Innovation Academy and MIT offers a one-week Healthcare Innovation Bootcamp for undergraduate students. U of T’s Institute of Biomaterial and Biomedical Engineering and Sick Kids have formed the Innovation, Hammer and Nails Initiative that allows undergraduate and graduate students to design solutions for challenges identified by healthcare providers. While Toronto is home to several innovation hubs including MaRS and U of T’s Health Innovation Hub (H2i), students in our and other life science programs rarely take advantage of the training in entrepreneurship and networking opportunities that these hubs provide.

Consultation:
Presented to BMS Curriculum Meeting, discussed with FAS Deans. Developed in consultation with FOM Vice Dean, Health Innovations Hub (H2i), Division of Teaching Labs as a collaborative effort between Pharmacology and Toxicology, Physiology and Biochemistry

Resources:
TA, Instructor, support of student projects through mentors, DTL

Overlap with Existing Courses:
None

Programs of Study for Which This Course Might be Suitable:
Students enrolled in Major or Specialist streams within Pharmacology and Biomedical Toxicology, Physiology and Biochemistry and other interested basic medical sciences

Estimated Enrolment:
20, working in groups of 2-3

Instructor:
TBA

PCL367H1: Drug Development Pipeline I: In vitro

Impact on Programs:
This proposal triggers modifications in the unit's program(s)

Contact Hours:
Practical: 40 / Tutorial: 8

Description:
This course will provide a learning experience that simulates the process, techniques, analysis and evaluation methods used for early-stage in vitro drug development. Modules will build on the student’s fundamental knowledge and will simulate and illustrate the thought processes and techniques that are used during new drug development in academic research institutes, clinical research organizations and pharmaceutical and biotechnology companies worldwide. Modules include target screening, cytotoxicity assays, transcriptional activation testing and metabolizing enzyme
identification experiments. This experience will allow students to leverage their learned knowledge to improve their employability in this area, while honing their critical thinking and analytical skills

Prerequisites:
PCL300H1, PSL301H1

Corequisites:
PCL302H1

Exclusions:

Recommended Preparation:
PCL201H1

Breadth Requirements:
Living Things and Their Environment (4)

Distribution Requirements:

Competencies:
Communication: notably; Critical and Creative Thinking: extensively; Information Literacy: notably
Quantitative Reasoning: notably; Social and Ethical Responsibility: slightly

Experiential Learning:
Research: notably; Other: none

Rationale:
Laboratory courses provide an opportunity for hands-on application of theories and concepts from a student’s discipline and allow students to improve their understanding of these concepts. However, students often miss the “applicability” of these techniques and procedures outside of academia. These newly designed Pharmacology and Biomedical Toxicology laboratory courses will allow us to improve the integration and application of theoretical course knowledge and to align these courses with the “real-world” Drug Development Pipeline process that is vitally important to the pharmaceutical industry. Students will work as part of a team to generate, analyze and communicate their experimental data, while developing logical and critical thinking skills through trouble-shooting methods and interpreting data. This laboratory experience will also directly benefit our students who proceed into our Professional Experience Year, which often involves paid placements in industry and research institutes where students contribute to new target identification and validation, pharmacokinetic assays and analysis, clinical trials and post-marketing pharmacovigilance.

Many Pharmacology and/or Biomedical Toxicology graduates will proceed to careers associated with some aspect of the drug development pipeline. Most often, this will involve employment with research institutes, small clinical trial organizations, hospital centres and larger pharmaceutical and biotechnology companies. For every single marketed compound, the pre-clinical stages of the drug development pipeline screens and evaluates tens of thousands of new chemical entities. By linking student learning through our redesigned laboratory courses, students will gain an appreciation of the thought processes as well as the techniques and methods used during specific key stages of drug development.

These innovative modules will replace our current laboratory course offerings. The modules within this course will directly reflect and strategically align with material taught in our core courses (PCL201, PCL302, PCL362H, PCL402H, PCL469H, PCL470H, PCL481H and PCL473Y). See attached “student facing” example of how we plan to structure topics associated with development of a “new chemical entity” (NCE).

Consultation:
Development, design and oversight via Departmental committee. Presented to the Basic Medical Sciences Curriculum Meeting. Communication with FAS Deans. ATLAS grant awarded
Resources:
Instructor, TAs, Lab Equipment (via Division of Teaching Labs, FOM)

Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
Some techniques taught may be similar across the sciences but the application and evaluation process involved with examining the pharmacology and toxicological aspects of data created are unique.

Programs of Study for Which This Course Might be Suitable:
Students in Pharmacology and Biomedical Toxicology Specialist and Major programs

Estimated Enrolment:
70

Instructor:
Dr A. Hamadanizedeh

PCL368H1: Drug Development Pipeline II: In vivo

Impact on Programs:
This proposal triggers modifications in the unit's program(s)

Contact Hours:
Practical: 40 / Tutorial: 8

Description:
This course will provide a learning experience that parallels and simulates the process, protocols, methods and evaluation tools used for later-stage in vivo drug development. Modules will build on the student’s fundamental knowledge and simulate the thought processes and techniques used during drug development in research institutes, clinical research organizations and pharmaceutical and biotechnology companies worldwide. Modules will include pharmacokinetic and pharmacodynamic analyses and pharmacogenetic screening approaches in model systems and humans. This experience will allow students to leverage their learned skills and knowledge to improve their comprehension and employability in this area, while honing critical thinking and analytical skills.

Prerequisites:
PSL300H1, PSL301H1, PCL201H1, PCL302H1

Corequisites:

Exclusions:

Recommended Preparation:

Breadth Requirements:
Living Things and Their Environment (4)

Distribution Requirements:

Competencies:
Communication: notably; Critical and Creative Thinking: notably; Information Literacy: notably
Quantitative Reasoning: notably; Social and Ethical Responsibility: slightly

Experiential Learning:
Research: notably; Other: none
### Rationale:

This course and the proposed PCL367H will replace our currently offered PCL366H1 and PCL491H1 courses.

Laboratory courses provide an opportunity for hands-on application of theories and concepts from a student’s discipline and allow students to improve their understanding of these concepts. However, students often miss the “applicability” of these techniques and procedures outside of academia. These newly designed Pharmacology and Biomedical Toxicology laboratory courses will allow us to improve the integration and application of theoretical course knowledge and to align these courses with the “real-world” Drug Development Pipeline process that is vitally important to the pharmaceutical industry. Students will work as part of a team to generate, analyze and communicate their experimental data, while developing logical and critical thinking skills through trouble-shooting methods and interpreting data. This laboratory experience will also directly benefit our students who proceed into our Professional Experience Year, which often involves paid placements in industry and research institutes where students contribute to new target identification and validation, pharmacokinetic assays and analysis, clinical trials and post-marketing pharmacovigilance.

Many Pharmacology and/or Biomedical Toxicology graduates will proceed to careers associated with some aspect of the drug development pipeline. Most often, this will involve employment with research institutes, small clinical trial organizations, hospital centres and larger pharmaceutical and biotechnology companies. For every single marketed compound, the pre-clinical stages of the drug development pipeline screens and evaluates tens of thousands of new chemical entities. By linking student learning through our redesigned laboratory courses, students will gain an appreciation of the thought processes as well as the techniques and methods used during specific key stages of drug development.

These innovative modules will replace our current laboratory course offerings. The modules within this course will directly reflect and strategically align with material taught in our core courses (PCL201, PCL302, PCL362H, PCL402H, PCL469H, PCL470H, PCL481H and PCL473Y).

### Consultation:

Presented to the Basic Medical Sciences Curriculum Meeting. Communication with FAS Deans regarding ATLAS grant application.

### Resources:

Redevelopment of our laboratory courses is supported by an ATLAS grant from FAS and through Departmental monies for faculty and TA support, as well as Division of Teaching Laboratories.

**Budget Implications:** The academic unit has received Decanal approval for additional resources required for this course.

### Overlap with Existing Courses:

Some techniques taught may be similar across the sciences but the application and evaluation process involved with examining the pharmacology and toxicological aspects of data created are unique.

### Programs of Study for Which This Course Might be Suitable:

Students enrolled in the Specialist and Major programs associated with the Department of Pharmacology and Toxicology.

### Estimated Enrolment:

70

### Instructor:

Dr. A. Hamidanizedeh
PCL482H1: Biomedical Toxicology

**Impact on Programs:**
This proposal triggers modifications in the unit's program(s)

**Contact Hours:**
- Lecture: 24

**Description:**
This course explores several contemporary topics in biomedical toxicology with emphasis on how chemicals affect human health. Lectures cover principles of toxicology, the mechanisms of toxicity of a wide variety of toxic agents and the associated toxicities, methodologies used to examine chemical toxicities, risk assessment, and the applications of toxicology.

**Prerequisites:**
(PCL201H1, PCL302H1, PCL362H1) or Permission of the Course Coordinator

**Corequisites:**

**Exclusions:**
PCL473Y1

**Recommended Preparation:**
BCH210H1 + BCH311H1

**Breadth Requirements:**
Living Things and Their Environment (4)

**Distribution Requirements:**
Science

**Competencies:**
- Communication: notably; Critical and Creative Thinking: notably; Information Literacy: notably
- Quantitative Reasoning: slightly; Social and Ethical Responsibility: slightly

**Experiential Learning:**
- Research: none; Other: none

**Rationale:**
This course results from the splitting of PCL473Y1 into two half courses. This allows for alignment of academic material within a particular term and provides flexibility for students in program scheduling.

**Consultation:**
Presented to Pharmacology Undergraduate Committee and to the Basic Medical Sciences Curriculum group

**Resources:**
As in the past- Instructor and TA from Department
- Budget Implications: The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:**

**Programs of Study for Which This Course Might be Suitable:**

**Estimated Enrolment:**
60
### PCL483H1: Interdisciplinary Toxicology

**Impact on Programs:**
This proposal triggers modifications in the unit's program(s)

**Contact Hours:**

- **Lecture:** 24

**Description:**
This course explores several contemporary topics in biomedical and environmental toxicology with emphasis on how chemicals affect human health. Lectures cover principles of toxicology, the mechanisms of toxicity of a wide variety of toxic agents and the associated toxicities, methodologies used to examine chemical toxicities, risk assessment, and the applications of toxicology.

**Prerequisites:**
(PCL201H1, PCL302H1, PCL362H1) or Permission of the Course Coordinator

**Corequisites:**

**Exclusions:**
PCL473Y1

**Recommended Preparation:**
BCH210H1 + BCH311H1

**Breadth Requirements:**
Living Things and Their Environment (4)

**Distribution Requirements:**
Science

**Competencies:**
- **Communication:** extensively; **Critical and Creative Thinking:** notably; **Information Literacy:** notably
- **Quantitative Reasoning:** slightly; **Social and Ethical Responsibility:** slightly

**Experiential Learning:**
- **Research:** none; **Other:** none

**Rationale:**
This course results from splitting PCL473Y1 into two half credit courses. This allows better academic alignment of content and provides students flexibility in program scheduling.

**Consultation:**
Discussed at Pharm & Tox Undergraduate Committee and presented at the Basic medical sciences curriculum meeting

**Resources:**
Instructor and TA as previous course

**Budget Implications:**
The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:**
PCL473Y1

**Programs of Study for Which This Course Might be Suitable:**
**Pharmacology & Toxicology (MED), Department of**

Biomedical Toxicology Major or Specialist, and our joint Pharmacology & Biomedical Toxicology Specialist, and in the Environment and Toxicology Specialist streams

**Estimated Enrolment:**
60

**Instructor:**
J.P. McPherson

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### 8 Course Modifications:

**PCL201H1: Introduction to Pharmacology and Pharmacokinetic Principles**

**Prerequisites:**
- **Previous:** BIO120H1, BIO130H1, CHM135H1, CHM136H1
- **New:** BIO130H1

**Corequisites:**
Recommended Co-requisites: BIO230H1/(BIO240H1, BIO241H1), CHM247H1/BIO255H1, CHM249H1, PSL300H1/PSL301H1

**Rationale:**
During course enrollment periods exceptions are often made for a variety of course pre-requisites, and many of our faculty make exceptions on these non-essential courses. As such, we have reviewed course pre-requisites and clarified what advanced preparation is required versus what preparation is recommended (or in some cases not even needed). It was perhaps a mistake I made confusing what is important for the program versus what is important for our courses. Although students graduating from the program need to have a strong comprehension in other basic and life sciences, successful completion of specific courses within our programs do NOT rely or require many of these additional courses. Pre-requisites are now focused on what is minimally required and what other courses lay the foundations of knowledge to be successful.

**Consultation:**
Discussed and agreed upon by our Undergrad Education Committee and with Dean Undergrad FAS (Pugh) and Curriculum Services

**Resources:**

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.

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**PCL302H1: Pharmacodynamic Principles**

**Prerequisites:**
BIO230H1/(BIO240H1, BIO241H1), CHM247H1/CHM249H1, (PSL300H1, PSL301H1)/PSL302Y1

**Recommended Preparation:**
- **Previous:**
- **New:** PCL201H1

**Rationale:**
During course enrollment periods exceptions are often made for a variety of course pre-requisites, and many of our faculty make exceptions on these non-essential courses. As such, we have reviewed course pre-requisites and clarified what advanced preparation is required versus what preparation is recommended (or in some cases not even needed). It was perhaps a mistake I made confusing what is important for the program versus what is important for our courses. Although students graduating from the program need to have a strong comprehension in other basic and life sciences, successful completion of specific courses within our programs do NOT rely or require many of these additional courses. Pre-requisites are now focused on what is minimally required and what other courses lay the foundations of knowledge to be successful.

**Consultation:**
**PCL345H1: Experimental Approaches in Drug Discovery**

**Prerequisites:**
- One of PSL300H1/PSL301H1/BIO270H1/BIO271H1, and **BCH210H1**: completion of at least 10.0 ±0 FCE, or permission of Department

**Recommended Preparation:**
- **Previous**: PSL300H1 / PSL301H1 or BIO270H1/BIO271H1
- **New**: BCH210H1, PCL201H1, PCL302H1

**Rationale:**
During course enrollment periods exceptions are often made for a variety of course pre-requisites, and many of our faculty make exceptions on these non-essential courses. As such, we have reviewed course pre-requisites and clarified what advanced preparation is required versus what preparation is recommended (or in some cases not even needed). It was perhaps a mistake I made confusing what is important for the program versus what is important for our courses. Although students graduating from the program need to have a strong comprehension in other basic and life sciences, successful completion of specific courses within our programs do NOT rely or require many of these additional courses. Pre-requisites are now focused on what is minimally required and what other courses lay the foundations of knowledge to be successful.

**Consultation:**
Discussed with our UG committee and FAS UG Dean (Pugh) and Curriculum Services

**Resources:**

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**PCL362H1: Introductory Toxicology**

**Prerequisites:**
- **Previous**: BCH210H1, BIO230H1 / (BIO240H1, BIO241H1), CHM247H1/CHM249H1, PCL201H1 or Permission of the Course Coordinator
- **New**: BIO130H1, PCL201H1 or Permission of the Department

**Recommended Preparation:**
- **Previous**: BCH210H1, CHM247H1

**Rationale:**
During course enrollment periods exceptions are often made for a variety of course pre-requisites, and many of our faculty make exceptions on these non-essential courses. As such, we have reviewed course pre-requisites and clarified what advanced preparation is required versus what preparation is recommended (or in some cases not even needed). It was perhaps a mistake I made confusing what is important for the program versus what is important for our courses. Although students graduating from the program need to have a strong comprehension in other basic and life sciences, successful completion of specific courses within our programs do NOT rely or require many of these additional courses. Pre-requisites are now focused on what is minimally required and what other courses lay the foundations of knowledge to be successful.

**Consultation:**
Discussed with our UG committee and FAS UG Dean (Pugh) and Curriculum Services

**Resources:**

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PCL469H1: Systems Pharmacology I

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PCL470H1: Systems Pharmacology II

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PCL481H1: The Molecular and Biochemical Basis of Toxicology

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Consultation:
Agreed upon by Undergraduate Education Committee and presented to FAS Dean of UG Education (Pugh) and Curriculum Services

Resources:

**PCL486H1: Pharmacology of Cancer Signaling**

**Description:**

This course will expand on both classical and cutting edge pharmacological strategies proposed to mitigate the consequences of altered signal transduction in cancer. Students will have the opportunity to develop knowledge on these molecular events and how they can be targeted to improve clinical outcomes. Students will integrate lecture material with assigned readings and assignments.

**Prerequisites:**

Previous: BCH210H1 / BCH242Y1, PCL302H1  
New: PCL302H1

**Recommended Preparation:**

Previous:  
New: BCH210H1/BCH242Y1

**Rationale:**

Consultation:  
DPT UG Education Committte, FAS UG Dean Pugh, Curriculum Services

**Resources:**

2 Retired Courses:

**PCL473Y1: Interdisciplinary Toxicology**

**Rationale:**

Course is being split into PCL482H1F and PCL483H1S. This split will create courses that are more highly aligned with academic content in a given "semester" and allows for more flexibility for students in regards to planning.

**PCL491H1: Clinical Pharmacology Principles and Practice**

**Rationale:**

being replaced by our new laboratory courses PCL367H and PCL368H
2 New Courses:

**JPM300H1: Research Readiness and Advancing Biomedical Discoveries**

**Impact on Programs:**
This proposal triggers modifications in the unit's program(s)

**Contact Hours:**

*Lecture: 12* / *Tutorial: 24*

**Description:**
Explore how scientists leverage their knowledge and skills to advance academic biomedical discoveries from the laboratory to improve patient health through either commercialization or not-for-profit approaches. Students will learn about innovation and develop key research and industry skills including intellectual property, ethics, budget and project management; learn how to critically evaluate scientific evidence and effectively communicate to a wide audience. This hybrid student-centered course will include interactive online modules and in-class group work. Course work will focus on developing skills and knowledge to help you be successful in diverse research courses and future careers.

**Prerequisites:**
10.0 FCE completed; BCH210H1/BCH242Y1

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**
PSL300H1, PSL301H1

**Breadth Requirements:**

Living Things and Their Environment (4)

**Distribution Requirements:**

**Competencies:**
- *Communication:* extensively; *Critical and Creative Thinking:* notably; *Information Literacy:* extensively
- *Quantitative Reasoning:* slightly; *Social and Ethical Responsibility:* notably

**Experiential Learning:**
- *Research:* notably; *Other:* none

**Rationale:**
The purpose for the creation of JPM300H: Research Readiness and Advancing Biomedical Discoveries is to expose students to detailed knowledge and understanding of the scientific enterprise, including (but not limited to) drug discovery and development, intellectual property and open science, biomedical and business ethics, and project management. This directly aligns with the strategic mandate of the University of Toronto and Government of Ontario in terms of exposing students to entrepreneurship and providing knowledge required for success in work-integrated learning (see SMA2 https://www.ontario.ca/page/college-and-university-strategic-mandate-agreements-2017-2020). JPM300H will promote understanding of what is required to be successful in research and the business behind science. Modules topics will include: developing hypotheses and good laboratory practice, drug discovery, intellectual property and open science, biomedical and business ethics, and project management. To foster student learning and engagement, JPM300H will focus on inquiry-based approaches that will include: online learning modules, in-class small-group discussions, individual written assignments (including reflections), participation in Q&A session, and oral
presentations. Tutorials and assignments will evaluate higher-order learning including application, analysis and synthesis. Furthermore, this course will provide multiple opportunities for developing lifelong skills by integrating communication skills into learning and assignments (e.g. information literacy, data analysis, and verbal and written communication).

Of critical importance, this new course will also serve as the platform for entry into JPM400Y: Biomedical Incubator Capstone Project course. In JPM400Y, students further develop a research proposal and become part of a biomedical innovation team tasked with conducting hands-on research to implement the project in a simulated small business/incubator setting under the guidance of a faculty mentor.

The online modules created for JPM300H will also serve as resources for students in other applicable Life Sciences courses that align broadly with topics focusing on research project management, setting milestones and working with budgets and timelines. These modules will be appropriately housed for faculty use outside of this course.

Consultation:
Discussed with BMS Curriculum Committee (meeting Oct 5), in collaboration with Physiology, Biochemistry.
Discussed with FAS Deans Office.

Resources:
Funds already provided by OUCI and FAS CRF monies. Application outstanding for further support. Instructor, TAs

Budget Implications: The academic unit has received Decanal approval for additional resources required for this course.

Overlap with Existing Courses:
Drug Development is covered in other courses in Pharmacology and Toxicology; introduced in PCL201H and then pre-clinical development in detail in PCL402H. The goal of this module will be to ensure all students are aware of the process and the active learning sessions will focus on content distinct from other courses.

Programs of Study for Which This Course Might be Suitable:
Specifically focused for students in the SPE streams in Pharmacology and Biomedical Toxicology, Physiology and Biochemistry but will also be open to MAJORS in these programs. Other students in the Basic Medical Sciences may also be interested

Estimated Enrolment:
100

Instructor:
TBA

JPM400Y1: Biomedical Incubator Capstone Project

Impact on Programs:
This proposal triggers modifications in the unit's program(s)

Contact Hours:
Practical: 240 / Seminar: 16

Description:
Discover what it is like to be part of a biomedical innovation team. Develop and engage in biomedical research in a simulated small business/incubator setting under the guidance of a faculty mentor. Bring your proposed JPM300H1 project to life, while acquiring budget management, research, business and communication workplace skills for future careers.

Students will form teams and develop a research proposal based on either
1. Faculty led concept requiring further development and testing, which would not normally be funded grants and would be tangential to ongoing research in the lab.

2. Student developed innovative idea that requires further development and testing. This should be a project that is not being investigated in a UofT research lab

Prerequisites:
A minimum of 75% in JPM300H1; completion of any of PCL367H1/PCL368H1/PSL372H1/BCH370H1/BCH377H1

Corequisites:

Exclusions:

Recommended Preparation:

Breadth Requirements:
Living Things and Their Environment (4)

Distribution Requirements:

Competencies:

Communication: extensively; Critical and Creative Thinking: extensively; Information Literacy: extensively

Quantitative Reasoning: notably; Social and Ethical Responsibility: notably

Experiential Learning:
Research: extensively; Other: none

Rationale:
Our overall project goal is to prepare students for traditional and non-traditional careers in research, industry and related fields by expanding the availability of learning opportunities in real-world contexts. Within the Biomedical Incubator Capstone Project (JPM400Y) students will become part of a biomedical innovation team tasked with developing and conducting a research and development project in a simulated small business/incubator setting under the guidance of a mentor.

Policy makers and educators recognize the benefits of integrating authentic learning opportunities into the undergraduate curriculum to better prepare students both academically and professionally. While U of T students have long had access to these types of experiences, the new Strategic Mandate Agreement between U of T and the Government of Ontario is calling for the “expansion of high-quality, pedagogically-sound work-integrated learning and experiential learning opportunities across undergraduate . . . programs”. As well, the influential Vision and Change: A Call to Action report on biology education emphasizes the need to provide “authentic opportunities [for students] to experience the processes, nature, and limits of science”, and calls for a student-centered approach to teaching by engaging “students as active participants, not passive recipients” and facilitating “student learning within a cooperative context”. Indeed, the benefits of active learning approaches in science teaching are well documented.

The independent research courses and field courses offered by the Departments of Pharmacology & Toxicology, Biochemistry, and Physiology (e.g. PCL472Y, BCH473Y, PSL498Y etc) are examples of high-quality authentic and active learning experiences that teach transferrable life-long skills to prepare students for future careers, especially in academia. Recent student reflections in the courses have indicated that there is a need to establish “the opportunity to apply the knowledge learnt in the classroom to a workplace that is not a laboratory.” The creation of “research/lab experiences aside from lab courses” and being able to assist students to “build upon their collaboration skills” are some of the driving forces behind this proposal. Indeed, students in these courses have asked for exposure to project management, working as a team, and setting budgets in order to better prepare them for the workforce. With the exception of the PEY program in the Department of Pharmacology and Toxicology, there are few opportunities in our programs for students to learn about science innovation and how biomedical discoveries are translated to new services
Innovation is a way to future-proof students and the economy. Stanford University, for example, has developed a summer undergraduate credit course entitled: Silicon Valley Innovation Academy and MIT offers a one-week Healthcare Innovation Bootcamp for undergraduate students. U of T’s Institute of Biomaterial and Biomedical Engineering and Sick Kids have formed the Innovation, Hammer and Nails Initiative that allows undergraduate and graduate students to design solutions for challenges identified by healthcare providers. While Toronto is home to several innovation hubs including MaRS and U of T’s Health Innovation Hub (H2i), students in our and other life science programs rarely take advantage of the training in entrepreneurship and networking opportunities that these hubs provide.

**Consultation:**
Presented to BMS Curriculum Meeting, discussed with FAS Deans. Developed in consultation with FOM Vice Dean, Health Innovations Hub (H2i), Division of Teaching Labs as a collaborative effort between Pharmacology and Toxicology, Physiology and Biochemistry

**Resources:**
TA, Instructor, support of student projects through mentors, DTL

**Overlap with Existing Courses:**
None

**Programs of Study for Which This Course Might be Suitable:**
Students enrolled in Major or Specialist streams within Pharmacology and Biomedical Toxicology, Physiology and Biochemistry and other interested basic medical sciences

**Estimated Enrolment:**
20, working in groups of 2-3

**Instructor:**
TBA
1 New Course:

PSY324H1: Moral Thought and Behavior

<table>
<thead>
<tr>
<th>Contact Hours:</th>
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<tbody>
<tr>
<td>Lecture: 36</td>
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Description:

Moral values vary considerably across individuals, groups, countries, and cultures. What explains the emergence of these differential moral systems? What psychological processes are involved in moral decisions and actions? How might insights from psychological research shed light on contemporary, ‘hot-button’ moral issues? How are moral decisions similar to – and different from – other types of everyday decisions? What is the role of emotion in moral decision making? As an introduction to the field of moral psychology, this 300-level course will cover research from a range of sub-disciplines within psychology including social-personality psychology, cognitive neuroscience, and developmental psychology. In addition, students will gain exposure to related material in other fields including philosophy, ethology, and economics. Students will gain a firm understanding of the key debates and issues in the study of the moral mind and will gain skills in critical thinking and writing.

Prerequisites:

PSY201H1 (or exclusion) and PSY220H1, or permission of the instructor

Corequisites:

Exclusions:

PSYD14H3

Recommended Preparation:

Breadth Requirements:

Thought, Belief and Behaviour (2)

Distribution Requirements:

Science

Competencies:

*Communication*: notably; *Critical and Creative Thinking*: extensively; *Information Literacy*: extensively

*Quantitative Reasoning*: slightly; *Social and Ethical Responsibility*: extensively

Experiential Learning:

*Research*: notably; *Other*: none

Rationale:

Recent decades have seen a blossoming of research on the psychology of morality. This research has provided important insights into the emergence and maintenance of moral values, the contexts in which moral values translate into moral action, and constructive (versus destructive) moral dialogue. This work has had an unusually interdisciplinary flavor; researchers in cognitive neuroscience, social psychology, developmental psychology, philosophy, animal behavior, economics, and political science have often addressed similar questions using the tools of their respective disciplines. Providing undergraduates with classic and contemporary theories and evidence will help students to reflect on the origin and nature of moral values and moral discourse. This course would fill a clear lacuna in the Psychology Department curriculum. Due to its interdisciplinary focus, it is likely to attract both B.A. and B.S. students. The field of moral psychology is increasingly assuming a more central role in psychological research. Therefore, providing students with the opportunity to engage in this area is critical for a well-rounded education in psychology.
| Consultation: | N/A |
| Resources: | Lecture hall capable of holding 50 students. Audio/Video Equipment for displaying lecture materials. Budget Implications: The academic unit will provide the resources required for this course from existing budget. |
| Overlap with Existing Courses: | PSY414H1: Moral Development examines how early life experiences and reaching cognitive developmental milestones impact moral beliefs and behaviour. While the proposed course will touch on some of the development literature, the main focus will be on understanding the nature of specific moral beliefs and how these values impact moral behaviour. Additionally, a principal focus of the course will be on thinking about how these psychological processes may relate to moral dialogue. Therefore, the current overlap of the current course with PSY414 will be low. **ETH220H1:** Moral Psychology examines the role that insights from moral psychological research might play in informing normative ethical perspectives. The main focus of ETH220 is philosophical in nature (how might psychology lead to a coherent normative moral theory - i.e., What is the proper way to act?). In contrast, the proposed course aims to cover the descriptive, psychological processes that lead to different moral beliefs and values and behaviour. Because the overall approach to the material is rather different, I imagine any overlap between the two courses will be low. |
| Programs of Study for Which This Course Might be Suitable: | N/A |
| Estimated Enrolment: | 50 |
| Instructor: | Dr. Jason Plaks |
### 6 Course Modifications:

#### COG260H1: Data, Computation, and the Mind

<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>CSC108H1/CSC148H1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breadth Requirements:</strong></td>
<td>The Physical Society and Mathematical Universes its Institutions (5 3 )</td>
</tr>
<tr>
<td><strong>Rationale:</strong></td>
<td></td>
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<tr>
<td><strong>Consultation:</strong></td>
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<td><strong>Resources:</strong></td>
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#### COG402H1: Seminar in Cognitive Science

| **Description:** | Advanced treatment of cognitive science topics such as neuroscientific theories of consciousness, rationality and modelling of cognitive processes. |
| **Prerequisites:** | Previous: 5.0 credits in courses listed in the cognitive science major. New: PSY270H1; 14.0 credits |
| **Exclusions:** | Previous: COG401H1 New: COG401H1; COG403H1 |
| **Rationale:** | |
| **Consultation:** | |
| **Resources:** | |

#### COG403H1: Seminar in Cognitive Science

| **Prerequisites:** | CSC148H1; COG260H1; 5.0 credits in courses listed in the cognitive science major. CSC148H1.(MAT135H1, MAT136H1)/MAT137Y1, 0.5 FCE in statistics; 14.0 credits statistics |
| **Exclusions:** | Previous: COG401H1 New: COG401H1; COG402H1 |
| **Breadth Requirements:** | The Physical Thought, Belief and Mathematical Universes Behaviour (5 2 ) |
| **Rationale:** | |
COG415H1: Cognitive Science in Practice

Breadth Requirements:
- Thought, Belief Society and Behaviour its Institutions (2 +)

Rationale:

Consultation:

Resources:

COG498H1: Independent Study

Description:

Advanced Independent Study. Not eligible for CR/NCR option.

Rationale:

Consultation:

Resources:

HST373H1: Epidemiology

Contact Hours:
- Previous: Seminar: 24
- New: Lecture: 36

Prerequisites:
- STA220H1 or equivalent/GGR270H1

Breadth Requirements:
- The Physical Society and Mathematical Universes its Institutions (5 +)

Rationale:

Consultation:

Resources: