1 New Course:

CSB457H1: Post-transcriptional Gene Regulation

Contact Hours:
Lecture: 12 / Seminar: 24

Description:
This course focuses on advances in post-transcriptional gene regulation. Topics include regulatory RNAs, RNA processing, localization, translation, and degradation. In addition to lectures covering background material, emphasis is placed on current research and involves discussion of primary literature in a round-table format.

Prerequisites:
Minimum grade of 70% in BCH311H1/CSB349H1/MGY311Y1

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: notably
Quantitative Reasoning: none; Social and Ethical Responsibility: none

Experiential Learning:
Research: none; Other: none

Rationale:
This course is designed to supplement knowledge in the area of gene regulation, expanding upon material covered in CSB349H1. Emphasis will be placed on biological processes that occur after transcription has occurred, and will provide insight into recent exciting developments in RNA metabolism. Additionally, students will learn to dissect and critically evaluate primary research literature in round-table discussions, an important skill that will complement more traditional lecture-based learning.

Consultation:
We have been in contact and will continue to discuss course content with Biochemistry and Molecular Genetics and Microbiology to minimize the overlap. The other departments do not seem to have concerns about excessive overlap among these courses.

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

Overlap with Existing Courses:
This course is designed to build upon material covered in courses like BCH311H1, CSB349H1 and MGY311Y1, but emphasizing dissection and critical evaluation of primary literature through small class size based discussions. There is a potential for some overlap with MGY420H1, Regulation of Gene Expression.

**Programs of Study for Which This Course Might be Suitable:**
- Cell and Molecular Biology
- Genome Biology
- Molecular Genetics
- Biochemistry

**Estimated Enrolment:**
- 24

**Instructor:**
- Prof. John Calarco
4 Course Modifications:

**CHM210H1: Chemistry of Environmental Change**

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<thead>
<tr>
<th>Prerequisites:</th>
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<tbody>
<tr>
<td>CHM135H1/CHM139H1/CHM151Y1,(MAT135H1, MAT136H1)/ MAT137Y1/MAT157Y1</td>
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**CHM217H1: Introduction to Analytical Chemistry**

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<tr>
<td>(CHM135H1/CHM139H1, CHM136H1/CHM138H1)/ CHM151Y1 with a minimum grade of 63%;(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1</td>
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**CHM310H1: Environmental Chemistry**

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<tr>
<td>(CHM135H1/CHM139H1, CHM136H1/CHM138H1)/ CHM151Y1,(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1</td>
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**CHM317H1: Introduction to Instrumental Methods of Analysis**

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4 New Courses:

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

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<tr>
<th>Contact Hours:</th>
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<tr>
<td><strong>Lecture:</strong> 24 / <strong>Practical:</strong> 12</td>
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**Description:**

How does the human mind work? We explore this question by analyzing a range of data concerning such topics as human rationality and irrationality, human memory, how objects are represented in the mind, and the relation of language and cognition. This class provides critical thinking and practical computational skills that will allow students to work with data in cognitive science and related disciplines.

**Prerequisites:**

CSC108H1

**Corequisites:**

COG250Y1

**Exclusions:**

**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:** slightly

**Experiential Learning:**

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

**Rationale:**

An important skill for cognitive science students to acquire is the ability to relate human behavioral data (from experimental or observational studies), and/or brain imaging data, to theories and models about the representations and mechanisms that underlie various aspects of cognition. Advances in data science are key to making these links in theoretically-motivated and methodologically-justified ways. This course will develop in students these disciplinary-specific skills (which have wide applicability in various fields, such as organizational behaviour, human-computer interaction design, various medical fields, etc.), as well as transferable skills such as data analysis techniques and computational design and implementation methods.

**Consultation:**

Psychology and Computer Science

**Resources:**

TA support in the amount of 80 hours, following the standard practice in courses in CSC (2 hr/student), that are comparable in format to the present course.

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

**Overlap with Existing Courses:**

6
Computer Science (FAS), Department of

No direct overlap with existing courses.

<table>
<thead>
<tr>
<th>Programs of Study for Which This Course Might be Suitable:</th>
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<tr>
<td>COG Major (Science – ASMAJ1446)</td>
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<th>Estimated Enrolment:</th>
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<tr>
<th>Instructor:</th>
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<tr>
<td>Prof. Yang Xu</td>
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CSC303H1: Social and Information Networks

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<th>Contact Hours:</th>
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<td>Lecture: 24  /  Tutorial: 12</td>
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**Description:**

A course on how networks underlie the social, technological, and natural worlds, with an emphasis on developing intuitions for broadly applicable concepts in network analysis. Topics include: introductions to graph theory, network concepts, and game theory; social networks; information networks; the aggregate behaviour of markets and crowds; network dynamics; information diffusion; popular concepts such as "six degrees of separation," the "friendship paradox," and the "wisdom of crowds."

**Prerequisites:**

CSC263H1/CSC265H1, STA247H1/STA255H1/STA257H1/ECO227Y1, MAT221H1/MAT223H1/MAT240H1

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**

**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:* slightly

**Experiential Learning:**

*Research:* none; *Other:* none

**Rationale:**

Based on CSCC46H3, with the same name, taught by Professor Ashton Anderson, and similar courses at other universities. This course is a complement to CSC304H1 (Algorithmic Game Theory and Mechanism Design).

**Consultation:**

Discussions at the Department of Computer Science's Undergraduate Committee. Confirmed no overlap with Sociology courses.

**Resources:**

*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:**
All Computer Science programs.

**Estimated Enrolment:**
85

**Instructor:**
Professor Nisarg Shah

### CSC421H1: Neural Networks and Deep Learning

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

**Description:**

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

**Corequisites:**

**Exclusions:**

**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:**
Material in CSC321H1 has evolved so that it now belongs in a more advanced course (students are not ready for the current content by 3rd year). Students will benefit from the removal of material that is currently duplicated in CSC321H1 and CSC411H1, by making CSC411H1 a prerequisite.

**Consultation:**
Discussion at the Department of Computer Science's Undergraduate Committee.

**Resources:**
- **Budget Implications:** The academic unit will provide the resources required for this course from existing budget.
JSC270H1: Data Science I

Contact Hours:
- Lecture: 24 / Practical: 24

Description:
This course is intended for students in the Data Science Specialist program. Data exploration and preparation; data visualization and presentation; and computing with data will be introduced. Professional skills, such as oral and written communication, and ethical skills for data science will be introduced. Data science workflows will be integrated throughout the course. These topics will be explored through case studies and collaboration with researchers in other fields.

Prerequisites:
- STA257H1, CSC207H1, CSC236H1

Corequisites:
- STA261H1, MAT237Y1/257Y1, CSC263H1

Exclusions:

Recommended Preparation:

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

Distribution Requirements:

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

Experiential Learning:
- Research: notably; Other: notably;
- Nature of "Other" Experiential Learning: Experiential Study

Rationale:
The National Academies of Sciences, Engineering, Medicine interim report on “Envisioning the Data Science Discipline: The Undergraduate Perspective” states that, in addition to foundational skills (e.g., mathematics, computational and statistical thinking), translational skills are valuable for data science students.

It is important for data science education to incorporate real data, broad impact applications, and commonly deployed methods. (page 16)
Training as a data scientist involves more than completing courses in computer science and statistics. A double major, for example, will not give students the benefit of an integrated pathway of courses designed explicitly to teach data science theories and methods. A key aspect of The Data Science Specialist program is to provide students with a rich, integrated experiential learning component, which will develop students’ translational skills in topics such as data preparation, computational considerations involved in the statistical analysis of large-scale data sets, and the theory of data science. These experiential learning outcomes will be achieved through the integrative courses.

This course is the first in a series of three courses that will scaffold experiential learning within the Data Science specialist program, and integrate ideas and techniques from computer science and statistics. “These courses will make this program unique among Data Science-focused programs currently available at other Canadian universities”. (Appraisal Report for Undergraduate Specialist in Data Science, September 25, 2017).

Consultation:
A committee was formed in June 2015 to advise on the development of the data science program. Committee members included seven U of T faculty members from both Statistical Sciences and Computer Science, and data scientists working at U of T affiliated institutions and private industry. An advisory committee of nine faculty members from Statistical Sciences and Computer Science, and data scientists working in industry was also established to help the committee in developing this specialist program.

An early draft of the data science proposal was circulated to all chairs sitting on the Sciences Curriculum Committee, and received favourable feedback. The brief was also circulating to all units within Arts and Science that have a potential interest in Data Science.

Resources:
Instructors:
The course be co-taught by computer science and statistics.
TAs: A TA with statistical expertise and a TA with expertise in computer science will be required. Two TAs @ 60 hrs per TA.
Computing:
- Computer Science undergraduate computing resources will be sufficient to support the course.
- The course will also use cloud computing from a provider that offers programs for education such as Microsoft Azure or Amazon Web Services (AWS). Prof. Taback currently has a grant from Microsoft Azure that would meet the needs of this course.

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:
Data science specialist program

Estimated Enrolment:
30-45

Instructor:
Nathan Taback

2 Course Modifications:

CSC411H1: Machine Learning and Data Mining

Prerequisites:
CSC263H1/CSC265H1, MAT(MAT135H1 +35H1, MAT136H1 +26H1)/MAT137Y1/MAT137Y1/MAT157Y1, STA247H1/STA255H1/STA257H1, MAT221H1/MAT223H1/MAT240H1

Rationale:

Consultation:
CSC418H1: Computer Graphics

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<th>Prerequisites:</th>
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<td>CSC336H1/CSC350H1/CSC351H1/CSC373H1,(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1, MAT221H1/MAT223H1/MAT240H1, CSC209H1/proficiency in C or C++. Prerequisite C++; Prerequisite for Engineering students only:ECE345H1 or ECE352H1</td>
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1 Retired Course:

CSC321H1: Introduction to Neural Networks and Machine Learning

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<th>Rationale:</th>
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1 New Course:

**ESS223H1: Earth System Chemistry 1: Earth Materials**

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

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

**Description:**
This course introduces the basic principles of thermodynamics and kinetics and more specialized concepts used in the Earth Sciences, e.g., the forms and transfer of energy, the equation of states of gaseous, fluid and solid materials, thermodynamics of solutions, chemical equilibria of multicomponent systems, mineral solubility, phase diagrams, phase interface processes on mineral surfaces, and mass transport. The tutorials will include basic calculation exercises and some computational modeling used to understand fluid phase reactions and phase equilibria in the earth system. The course aims to provide a solid background for advanced courses in igneous and metamorphic petrology, aqueous geochemistry and geodynamics.

**Prerequisites:**
MAT135H1, MAT136H1, CHM139H1, ESS221H1, ESS262H1

**Corequisites:**

**Exclusions:**
ENV233H1

**Recommended Preparation:**

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

**Distribution Requirements:**
Science

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

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

**Rationale:**
This course was previously team taught with Chemistry as ENV233. However this experiment has failed as acknowledged by the School of the Environment, Chemistry and the Earth Science Departments. It has been agreed that the course will revert back to the ES-Department where it will be refocused to strengthen the ES related course content, specifically lay the groundwork for the chemistry needed in the 3rd and 4th year courses of the Earth Science curriculum.

**Consultation:**
The is proposal is the result of extensive discussions between the Earth Science and Chemistry Departments, as well as with the School of the Environment. This proposal was also extensively discussed within the ES curriculum committee and presented to the ES faculty members on Sept 21st.
**Resources:**
A 0.5 FCE teaching position, as well as lab space. Both will be provided by the Department of Earth Sciences.

**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:**
Geology Specialist, Environmental Geology Specialist, Geoscience Major, Earth and Environmental Systems Major

**Estimated Enrolment:**
40

**Instructor:**
TBD

### 1 Course Modification:

**ESS452H1: Geophysical Imaging with Non-seismic Methods**

**Prerequisites:**
- Previous: PHY395H1, APM346H1
- New:

**Rationale:**
We would like to remove the prerequisites for this course, following upon the recommendation of the course instructor.

**Consultation:**
Course instructor and Undergraduate Affairs Committee, November 3, 2017

### 1 Retired Course:

**ENV233H1: Earth System Chemistry**

**Rationale:**
1 Course Modification:

EEB323H1: Evolutionary Genetics

Contact Hours:
  Previous: Lecture: 24 / Tutorial: 24
  New: Lecture: 36 / Tutorial: 12

Recommended Preparation:
  (MAT135H1, MAT136H1) / MAT125Y1 / MAT126Y1 / MAT127Y1 / MAT157Y1

Rationale:

Consultation:

3 Retired Courses:

EEB206H1: Studying Behaviour

Rationale:

EEB492H1: Internship in Ecology and Evolutionary Biology

Rationale:

EEB492Y1: Internship in Ecology and Evolutionary Biology

Rationale:
3 New Courses:

GGR385H1: Special Topics in Geography

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<td><em>Lecture:</em> 24</td>
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**Description:**

Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). The program in which this course can be used depends on its content.

**Prerequisites:**

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**

**Breadth Requirements:**

**Distribution Requirements:**

**Competencies:**

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

**Experiential Learning:**

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

**Rationale:**

In the last few years we have experienced an issue with our 3rd-year Special Topics course GGR300H1. We have only one such course and this had posed a problem when we have offered more than one Special Topics course in any one year. It produces administrative and scheduling difficulties for the Undergraduate Student Advisor, and confusion for students as it is not clear which Special Topics courses can be used for specific programs.

We plan on replacing our single 3rd-year Special Topics course with four program-specific Special Topics courses, and one extra in the event we need to offer two Special Topics courses for the same program in the same term. This will have two positive effects. First, the fact that they are program specific allows students to know which programs they can be used towards. This will ensure that the course is being credited to students programs correctly. Second, it allows us to offer more than one Special Topics course in a term. This also allows students to register for more than one. This will do away with the confusion that students have noted when more than one GGR300H1 is taught in any year and allows the Student Advisor to oversee a more streamlined administrative process.

No Breadth Requirement or Distribution Requirement designation has been assigned as the course could be BR=3 or BR=4 or BR=5/Soc Sci or Science, based on course content in any given year.

**Consultation:**
Resources:

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:
All programs in the Department of Geography and Planning.

Estimated Enrolment:
60

Instructor:

GGR386H1: Special Topics in Geographic Information Systems

Contact Hours:
Lecture: 24

Description:
Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). Can be used towards GIS, Human Geography, and Environmental Geography programs.

Prerequisites:

Corequisites:

Exclusions:

Recommended Preparation:

Breadth Requirements:

Distribution Requirements:

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

Experiential Learning:
Research: none; Other: none

Rationale:
In the last few years we have experienced an issue with our 3rd-year Special Topics course GGR300H1. We have only one such course and this had posed a problem when we have offered more than one Special Topics course in any one year. It produces administrative and scheduling difficulties for the Undergraduate Student Advisor, and confusion for students as it is not clear which Special Topics courses can be used for specific programs.

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No Breadth Requirement or Distribution requirement designation has been assigned as the course could be BR=3 or BR=5/Soc Sci or Science, based on course content in any given year.

### Consultation:

### Resources:

**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:
- Geographic Information Systems Minor
- Human Geography - Specialist, Major, Minor,
- Environmental Geography - Specialist, Major, Minor

### Estimated Enrolment:
- 60

### Instructor:

### GGR388H1: Special Topics in Physical & Environmental Geography

#### Contact Hours:

- **Lecture:** 24

#### Description:

Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). Can be used towards Physical & Environmental Geography and Environmental Geography programs.

#### Prerequisites:

#### Corequisites:

#### Exclusions:

#### Recommended Preparation:

#### Breadth Requirements:
- The Physical and Mathematical Universes (5)

#### Distribution Requirements:
- Science

#### Competencies:
In the last few years we have experienced an issue with our 3rd-year Special Topics course GGR300H1. We have only one such course and this had posed a problem when we have offered more than one Special Topics course in any one year. It produces administrative and scheduling difficulties for the Undergraduate Student Advisor, and confusion for students as it is not clear which Special Topics courses can be used for specific programs.

We plan on replacing our single 3rd-year Special Topics course with four program-specific Special Topics courses, and one extra in the event we need to offer two Special Topics courses for the same program in the same term. This will have two positive effects. First, the fact that they are program specific allows students to know which programs they can be used towards. This will ensure that the course is being credited to students programs correctly. Second, it allows us to offer more than one Special Topics course in a term. This also allows students to register for more than one. This will do away with the confusion that students have noted when more than one GGR300H1 is taught in any year and allows the Student Advisor to oversee a more streamlined administrative process.

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

The Breadth and Distribution requirements are being updated to accurately reflect the skills and methods learned and in this course, which are statistical/mathematical. These skills are used to interpret Social Science data.
20 Course Modifications:

HAJ453H1: AIDS: A Global Perspective

Prerequisites:

**Previous:** 14 FCE complete, AND either (HMB302H1 / HMB303H1/ HMB322H1/ HMB323H1/ HMB342H1) OR (0.5 FCE from a ANT300+ level course from Group B- Evolutionary)

**New:** 14 FCE complete, ANT208H1 / BIO220H1/PHS300H1/JNH350H1

Rationale:

the pre-requisite line as it was written was impossible to enforce; students from other units expressed interest in the course, but if they were non-science students we had no way to ensure that assessments were equitable. Further, the split pre-requisite (either/or) was difficult to for Degree Explorer to assess properly. BIO220H1 is required for all three HMB Programs that take this course, and it is also required for the Biological Anthropology program, whose students share priority enrolment with HMB students into this course. JNH350H1 is another HMB joint course about AIDS and PHS300H1 is a Dalla Lana undergraduate course that seems a number of students take, and then are interested in taking further courses that discuss HIV/AIDS.

Consultation:

Consultation with HMB faculty; feedback requested from Anthropology September 29; Dr. Lehman said there was no need to change the pre-requisite and if it was too much work for HMB, ANT could do the pre-requisite checks. HMB replied saying it was not just the tedium of the task, it's the equity of the matter. We proposed on October 4 that we add ANT208H1 to the streamlined pre-req line, and at this time we are waiting for a response.

HMB300H1: Neurobiology of Behaviour

Description:

This intermediate course in neuroscience course focuses on higher brain functions and the mechanisms underlying human and animal behaviours. Topics may include the emerging role of the gut microbiome's impact on behaviour, advanced neurophysiological, pathogens that alter neuronal development, neuroanatomical and the biological genetic basis of mindfulness, various cortical functions, including learning and placebos. In addition, memory, "mirroring", the impact that exercise and sleep play in modulating these behaviours are examined. Common experimental techniques used in neuroscience research such as electrophysiological recordings; brain imaging and cellular genetics are emphasized.

Prerequisites:

BIO230H1, HMB200H1/PSY290H1; BIO230H1/PSL300H1/CJH332H1

Rationale:

update of the course description to better reflect how course is taught and change to pre-requisites to allow a more diverse cohort acknowledging that we have other HMB students interested in this course, but who do not need to take HMB200H1 for their programs and the neurophysiology they need to know prior to taking this course is taught (in varying degrees) in a number of courses across the Faculty of Arts & Science. This pre-requisite change will open the course up to more students.

Consultation:

consultation with the professor and feedback from students

HMB301H1: Biotechnology

Prerequisites:
Proposals Pertaining to Freestanding Programs

**Previous:** HMB201H1  
**New:** HMB265H1 / BIO260H1

**Rationale:**
This course is broadly popular with other HMB programs and life science programs and as the HMB:Genetics program is quite small there is always space after priorities drop, and we are unable to enforce the HMB201H1 pre-requisite. The unit simply wants students in the course to have a basic understanding of genetics, and HMB265H1/BIO260H1 is sufficient for this, and is a program requirement in the majority of life science programs within the Faculty of Arts & Science.

**Consultation:**
discussions with HMB faculty

**HMB312H1: Laboratory in Health and Disease**

**Description:**
A laboratory course based on current research techniques for students in the HMB: Health & Disease and HMB: Global Health programs. Lab topics which may include basic microbiology, molecular biology and animal cell culture techniques, immunocytochemistry, changes in gene expression microarrays, and histological techniques. (Lab Materials Fee:$51)

**Corequisites:**
**Previous:** PSL301H1  
**New:** BCH210H1

**Rationale:**
update to pre-requisites to better match content in course (and acknowledge that this course will be moved to F-term so the PSL301H1 co-req is not possible as PSL301H1 is a S-term course)

**Consultation:**
consultation with course instructor(s) and Teaching Lab coordinator and HMB Faculty

**HMB314H1: Laboratory in Human Biology**

**Description:**
Students analyze whole body, cellular, and molecular responses to stress. Techniques range from those standard in medical practice (e.g., fitness measures, blood pressure, lung function) to current those used in cutting-edge research techniques laboratories (cell culture e.g., changes in gene expression microarrays). Students gain technical and analytical skills as they work at the bench use these laboratory techniques to design and carry out individual and group experiments. (Lab Materials Fee:$50)

**Prerequisites:**
9 FCE complete: HMB200H1/HMB201H1/HMB202H1/HMB203H1/HMB204H1/HMB220H1, HMB265H1/BIO260H1, BIO230H1/BIO255H1

**Corequisites:**
PSL300H1, PSL301H1

**Rationale:**

**Consultation:**
HMB342H1: Epidemiology of Health & Disease

**Prerequisites:**
9 FCE complete, BIO120H1, BIO130H1 HMB200H1/HMB201H1/HMB202H1/HMB203H1/HMB204H1

**Recommended Preparation:**
STA288H1 HMB325H1 or other statistics course

**Rationale:**
updating pre-requisites so they are enforceable because this course opens up beyond HMB students and right now it's a free for all and really pre-requisites should either be enforced or not exist or be modified so that they are enforceable but also ensuring students have the necessary background to succeed in the course.

**Consultation:**
discussion with HMB faculty and program office

HMB401H1: Biomedical Advances & Technologies

**Description:**
This course introduces life science students to biomedical advances and technologies in medicine, including drug patents, medical device implants, diagnostic and medical device software. Limitations of patent protection in commercializing medical products, and limitations to scalability may also be discussed. Specific topics vary from year to year and will be based on the course instructor's area(s) of expertise.

**Prerequisites:**
14 FCE completed, HMB301H1/HMB321H1/BCH311H1/CSB349H1/PSL350H1, HMB201H1/HMB202H1/HMB203H1/HMB204H1

**Rationale:**
expanding pre-requisite line (in with minor program modification)

**Consultation:**
consultation with HMB faculty

HMB402H1: Topics in Translational Medicine

**Description:**
The bridge between basic scientific research and clinical practice integrates fundamental knowledge about molecular/cellular mechanisms and clinical disorders to increase the potential for new medical treatments, therapies and interventions as well as understanding of disease processes. Specific topics vary from year to year and will be based on the course instructor's area(s) of expertise. Case applications delivered by experts illustrate how promising laboratory discoveries transform medicine and will be based on the course instructor's area(s) of expertise in medical science.

**Prerequisites:**
14 FCE complete, BCH210H1, BIO230H1/BIO255H1, HMB302H1/HMB312H1/HMB321H1/HMB322H1/BCH311H1/CSB349H1/PSL350H1, and HMB202H1/HMB203H1/HMB204H1

**Recommended Preparation:**
CSB349H1/BCH311H1/CSB349H1/PSL350H1

**Rationale:**
### Proposals Pertaining to Freestanding Programs

Updating course description to emphasize that topics vary from year to year, and updating pre-requisite line to be more inclusive of our diverse HMB programs but also to ensure enrolment controls are not bypassed.

**Consultation:**
consultation with HMB Faculty and past course instructor, William Ju. Consultation with Tom Mackay and Stella Ip on how to fairly regulate course enrolment and enrolment control bypassing.

### HMB420H1: Seminar in Neurobiology of Behaviour

**Description:**
This seminar course focuses on recent research into the neurobiology underlying human behaviour. A variety of normal and abnormal human behaviours are studied which may include: (e.g., voluntary action; action; moral cognition; hedonism; aggression; mental health; addiction; the impact of the gut microbiome on brain development and health.

**Prerequisites:**
14 FCE complete, HMB200H1, HMB300H1/HMB310H1/HMB320H1/HMB360H1/ANA300Y1/ECB332H1 (formerly CSB332H1)

**Rationale:**
As the neuroscience program has been realigned to better prepare students for future research and careers in neuroscience, both neurobehaviour and neuroanatomy are now required courses, and thus the program can pedagogically require either/both as a pre-requisite (as opposed to the current pre-requisite which acknowledged students only needed one of those courses. Now they are all required).

**Consultation:**
Consultation with both instructors of the course, and consultation with governance regarding the two courses used (one for each instructor as they teach the course materials from different view points)

### HMB421H1: Seminar in Fundamental Genetics and its Applications

**Description:**
Theme based lecture and seminar course underlining current medical research in relation to the areas of genes, genetics and genetics biotechnology. Topics vary yearly.

**Prerequisites:**
14 FCE complete, HMB265H1/HMB301H1/HMB311H1/HMB314H1/BIO260H1, HMB201H1/HMB321H1, cGPA 2.5

**Rationale:**

**Consultation:**
Consultation with course instructor

### HMB430H1: Trends in Neuroscience

**Description:**
Proposals Pertaining to Freestanding Programs

Current research covering the breadth of neuroscience is showcased by members of the Collaborative Program in Neuroscience. Topics vary yearly, but these topical reports cover the spectrum from molecular through genetic, cellular, developmental, systems, behavioural and modelling. As well, approaches to studying neurodegenerative diseases and clinical neurophysiology are introduced.

Prerequisites:
14 FCE complete, HMB200H1, CJH332H1, HMB300H1/HMB310H1/HMB320H1/JHA410H1 HMB360H1/ANA300Y1 CJH332H1 (formerly CSB332H1)

Rationale:
updating pre-requisite line so students better prepared for course (and adding administrative pre-requisite of HMB200H1)

Consultation:
Consultation with course instructors and consultation with Tom Mackay and Stella Ip on ways to combat bypass enrollment attempts.

HMB431H1: Innovation in Applied Genetics

Description:
This course explores innovation in research and technology in the field of applied genetics. Specific topics vary from year to year and will be based on the course instructor's area(s) of expertise.

Prerequisites:
14 FCE complete, HMB321H1, HMB201H1/HMB202H1/HMB203H1/HMB204H1 a HMB300-level course

Corequisites:
Previous: HMB325H1/ STA288H1/ STA220H1/ PSY201H1
New:

Recommended Preparation:
Previous: HMB301H1
New:

Rationale:
updating pre-requisite

Consultation:
discussion with HMB Faculty

HMB432H1: Topics in Histology & Histopathology

Prerequisites:
14 FCE complete, HMB302H1/HMB312H1/HMB314H1/HMB322H1, cGPA 2.5

Recommended Preparation:
Previous:
New: BCH311H1/CSB349H1/PSL350H1

Rationale:
updating pre-req line and adding recommended preparation line

Consultation:
discussion with the instructor.
HMB434H1: Complementary & Integrative Medicine

Description:

Introduction to complementary and alternative medical therapies. Topics include, Traditional Chinese Medicine, Naturopathy, Ayurvedic, and Mind-Body Practices. Biological and Physiological mechanisms will be emphasized and therapies will be critically analyzed from an evidence-based research perspective. Integrating alternative therapies into Western practices with a focus on personalized medicine will be discussed.

Prerequisites:
14 FCE complete, BCH210H1, BIO230H1/BIO255H1, HMB302H1/HMB303H1/HMB312H1/HMB314H1/HMB322H1/HMB323H1/HMB342H1, and HMB202H1/HMB203H1/HMB204H1

Rationale:
Update to pre-requisite line to better ensure students are prepared and to help mitigate enrollment bypassing attempts

Consultation:
consultation with course instructor, and with Tom Mackay and Stella Ip.

HMB435H1: Selected Topics in Molecular Cell Biology

Description:

Theme-based lecture and seminar course underlining current basic science research in the area of molecular and cell biology, focusing on cell migration and its relevance as related to human health and disease. Topics may focus on the impact of fundamental processes underlying (e.g., cell migration) on the cell biology, cellular and molecular aspects of physiology and pathophysiology of cell motility in a variety of systems (e.g., immune, nervous system, cancer context).

Prerequisites:
14 FCE complete, BCH311H1/CSB349H1/PSL350H1/BCH311H1

Rationale:
update to course description to better match focus of course and re-ordering pre-reqs so alpha order.

Consultation:
consultation with course instructor

HMB436H1: Medical and Veterinary Mycology

Contact Hours:
Previous: Lecture: 16 / Practical: 6 / Seminar: 8
New: Lecture: 24

Prerequisites:
14 FCE complete, HMB265H1/BIO260H1, BIO220H1

Exclusions:
Previous: BOT405H1
New:

Rationale:
Proposals Pertaining to Freestanding Programs

update to pre-requisite/exclusion line to ensure students recognize this is a ecological-focused course and BOT405H1 has not been offered for quite some time so is being removed as part of clean up. Hours updated to reflect how course is taught already

Consultation:
consultation with the course instructors, HMB Faculty.

HMB437H1: The Biology of the Human Metallome

Description:

This course will discuss how heavy metals are integral to organ function through various biological pathways, the importance of metal regulation and control and its relationship with gene transcription. An introduction of metallo-therapeutics will also be featured, ranging from neurodegenerative therapies to cancer treatment.

Prerequisites:
14 FCE complete, HMB265H1/BIO260H1, BIO230H1/BIO255H1, BCH210H1

Recommended Preparation:
Previous: BCH210H1
New:

Rationale:
Update to pre-requisite as planned when course first proposed; BCH210H1 is required for all HMB programs as it is, and it is a very good preparation for the course.

Consultation:
Consultation with the course instructor.

HMB440H1: Dementia

Description:

(This course is not offered for the 2017-2018 academic year)

This course, featuring a service-learning component, explores dementia. In patients with dementia, intellectual, social and occupational functioning deteriorate. The course addresses the multi-disciplinary aspects of dementia(clinical, genetic, molecular, social)with a focus on the most common cause of dementia, Alzheimer's disease.

A short application to enrol in this course is required. Information may be found via the Human Biology Program website.

Prerequisites:
14 FCE complete, HMB265H1/BIO260H1, PSL300H1, HMB300H1/HMB310HH/HMB302H1/HMB312HH/HMB320H1/HMB321H1/ANA300Y1 HMB322H1

Rationale:
update of pre-requisite to demonstrate what course covers and to ensure students are covering relevant topics that will help prepare them for course.

Consultation:
consultation with course instructor.
HMB441H1: Genetics of Human Disease

Description:
This advanced course aims to provide students with Toronto researchers present current, in-depth knowledge of insight into the genetics of specific human diseases, including: single gene(e.g., Huntington disease cystic fibrosis), multifactorial chromosome (e.g. Alzheimer’s disease; Down syndrome), and non-Mendelian multifactorial inheritance (e.g. mitochondrial DNA-related; heart disease) disorders, and how the use of genetics to elucidate disease mechanisms can lead to treatments and personalized medicine in order to improve healthcare disorders.

Prerequisites:
14 FCE complete, HMB265H1/BIO260H1, BCH210H1, HMB300H1/HMB302H1/HMB321H1 HMB311H1/HMB322H1 HMB312H1/BCH311H1 HMB314H1/CSB349H1 HMB321H1/PSL350H1, and HMB201H1 HMB321H1/HMB202H1/HMB203H1/HMB204H1 HMB322H1

Recommended Preparation:
HMB301H1/HMB321H1, PSL300H1, PSL301H1

Rationale:
adjustment of course description to set better expectations among students looking to take this course (feedback from students regularly comments they did not realize it would be “so advanced in genetics”) and updating pre-requisites so students are better prepared and adding the administrative pre-requisite to mitigate enrolment bypassing attempts

Consultation:
Consultation with HMB faculty and course instructor of course.

HMB450H1: Neurodevelopmental Disorders and Diseases

Description:
Proper development of the human brain is essential for human health. This course will examine how neurodevelopmental failures contribute to neurological disorders and diseases, such as including epilepsy and autism. Current research from basic, translational, and clinical perspectives will be examined using case studies. The impact of neurodevelopmental disorders and diseases on the individual and community will be discussed.

Prerequisites:
14 FCE complete, HMB200H1, HMB300H1/HMB310H1/HMB320H1/ANA300Y1 CJH332H1 (formerly CSB332H1)

Rationale:
Update to pre-requisite to ensure students are better prepared; can now do this update as neuroanatomy required for program requirements. Also updated administrative controls to mitigate enrollment bypassing attempts.

Consultation:
Consultation with course instructor and Tom Mackay and Stella Ip.

2 Retired Courses:

HMB325H1: Statistics Applied to Human Biology

Rationale:
As the unit is now offering a joint course with the Department of Statistical Sciences (STA288H1) that is geared for life science students, it is not necessary to continue to offer a second statistics course.
Proposals Pertaining to Freestanding Programs

**Consultation:**
Discussions with Governance Fall 2016 when developing STA288H1; discussions with HMB Faculty when 2017-2018 HMB programs were in development; part of the discussions with Statistics and Pharmacology when working on the course proposal and development for STA288H1.

**HMB395Y1: Human Biology Research Project**

**Rationale:**
For years, HMB395Y1 was used for third year students and HMB499Y1 was used for fourth year students who did the research project during the academic term but the two "courses" were coordinated as one, with PIs from one course acting as second readers on assessments from students in the other course (they were matched up based on topics, not by course section) and students in both HMB395Y1 and HMB499Y1 were assessed based on the same grading matrix. Further, students are not allowed to do more than two research projects with HMB (excluding the international research projects which are open to all students, HMB394Y1 and HMB396Y1), but there were three codes: HMB395Y1, HMB499Y1, and HMB496Y1 which was the summer project code, but not coordinated or assessed any differently than HMB395Y1 and HMB499Y1.

To recognize that a student in third year could be capable of doing the same caliber of research as a fourth year (and already being assessed as such) last year HMB moved to re-title HMB496Y1 and HMB499Y1 "Research Project I and II" respectively. They are now both offered in the summer and during the academic term. As such, the need for a third research project code is not necessary.

**Consultation:**
Discussion with HMB faculty and students when developing 2017-2018 HMB programs (December 2015-September 2016); Discussions with Governance ~January 2017 when submitting re-titling proposals for HMB496Y1 and HMB499Y1 during the 2016-2017 Curriculum Cycle.
2 Course Modifications:

LMP410H1: Pathobiology of Neurodegenerative Disease

Description:

Molecular basis of neurodegenerative diseases of the central and peripheral nervous systems. Emphasis on the relevant neuroanatomy and molecular pathobiology of neurodegenerative diseases, current research developments and guidance with writing of research proposals. Mid-term and final exams will practice assembly of a succinct current research proposal and query topics in neurodegenerative disease material taught in course. diseases.

Prerequisites:

(BIO270H1, BIO240H1, BIO271H1, BIO241H1)/BIO255H1 /BIO255Y1/(PSL300H1, PSL301H1)/ PSL302Y1

Rationale:

Consultation:

LMP436H1: Microbial Pathogenesis

Prerequisites:

BCH210H1/BCH242Y1, (IMM340H1/IMM350H1)/(IMM341H1, IMM351H1)

Rationale:

Consultation:
## 11 Course Modifications:

### MGY200H1: Current Topics in Molecular Genetics and Microbiology

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<th>BIO120H1, BIO230H1/BIO255H1</th>
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<th>Corequisites:</th>
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<td>Previous: BIO260H1/HMB265H1</td>
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### MGY311Y1: Molecular Biology

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<th>BIO120H1, BIO230H1/BIO255H1, BCH242Y1(Note: BCH210H1 may be acceptable with permission of instructor)</th>
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### MGY314H1: Principles of Genetic Analysis I

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### MGY315H1: Principles of Genetic Analysis II

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### MGY340H1: Molecular Genetics

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### MGY379Y1: Microbiology Laboratory

| Prerequisites: | BIO120H1, BIO230H1/BIO255H1, BIO260H1/HMB265H1 |
| Rationale:     |                                               |
| Consultation:  |                                               |

### MIJ485H1: Vaccines and Immunity

| Prerequisites: | (IMM340H1/IMM350H1)/IMM351H1 (IMM341H1 IMM334Y1/IMM351H1 IMM335Y1), MGY377H1, MGY378H1 |
| Rationale:     |                                               |
| Consultation:  |                                               |
2 New Courses:

NEW106H1: Science and Social Justice I

Contact Hours:
- Lecture: 12 / Seminar: 24

Description:
Exploring key themes and different kinds of knowledge implied by the notion of “learning without borders”, this interdisciplinary course looks at how scientific knowledge and technology are mobilized to deal with global problems such as disease, mental health, discrimination, economic inequality and threats to our environment.

Prerequisites:
Admission to New One

Corequisites:

Exclusions:
INI, SMC, TRI, UC, VIC, and WDW One

Recommended Preparation:
None

Breadth Requirements:
Society and its Institutions (3)

Distribution Requirements:
Social Science

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

Experiential Learning:
Research: none; Other: none

Rationale:
Provides first-year students with an introduction to university study in a small group setting

Consultation:

Resources:
Sessional Instructor(S)

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

Overlap with Existing Courses:
Intentional connections to key themes in New College programs in order to make first-year students aware of these often unfamiliar interdisciplinary fields of study.

Programs of Study for Which This Course Might be Suitable:

Estimated Enrolment:
25
NEW116H1: Science and Social Justice II

Contact Hours:

| Lecture: 12 | Seminar: 24 |

Description:

Building on the integrated learning from any New One I course, this course considers the scientific debates and social justice implications of selected contemporary transnational issues such as climate change, pandemics, gender identities, disability, and pharmaceutical research. Research projects allow students to focus on an issue of particular interest.

Prerequisites:

Admission to New One

Corequisites:

Exclusions:

INI, SMC, TRI, UC, VIC, and WDW One

Recommended Preparation:

None

Breadth Requirements:

Society and its Institutions (3)

Distribution Requirements:

Social 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:

Provides first-year students with an introduction to university study in a small group setting.

Consultation:

Resources:

Sessional Instructor(s)

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

Overlap with Existing Courses:

Intentional connections to key themes in New College programs in order to make first-year students aware of these often unfamiliar interdisciplinary fields of study.

Programs of Study for Which This Course Might be Suitable:

Estimated Enrolment:

25
Instructor: TBD
# 1 New Course:

**PCL490H1: Advanced Topics in Pharmacology and Toxicology**

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

**Contact Hours:**
- **Lecture:** 12 / **Seminar:** 12

**Description:**
An opportunity to expand on innovative and unique topics in Pharmacology and Toxicology that are not already extensively addressed. The course will reveal the dynamic nature of the field and the diverse interests of our faculty. Students will be introduced to leading edge topics and research within the discipline of Pharmacology and Toxicology.

**Prerequisites:**
- PCL302H1, STA288H1 (or equivalent)

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**
- PCL469H1

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

**Distribution Requirements:**
- Science

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

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

**Rationale:**
This program elective course will provide an opportunity to reflect on the research and expertise of our associated faculty. Currently within the program there is no one course that has the flexibility to allow students to delve into special topics that reflect these talents and interests. The course would provide senior students an opportunity to build on their knowledge and gain deeper insight into ground-breaking ideas and applicable knowledge within the Pharmacology and Toxicology discipline which they can leverage for their next step towards their long-term career path. The course will utilize active learning strategies to further develop students skills and experiences.

**Consultation:**
Presented to Basic Medical Sciences FOM Committee.

**Resources:**
- Instructors, TAs, Active Learning space

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

**Overlap with Existing Courses:** 35
No significant overlap.

**Programs of Study for Which This Course Might be Suitable:**
Specialists and Majors in the final year of studies with the Department. Fourth year students in other Life Science programs with the appropriate background.

**Estimated Enrolment:**
40

**Instructor:**
TBD

### 2 Course Modifications:

**PCL200H1: Drugs & the Brain**

**Exclusions:**
PSY396H1, PCL302H1, BCH210H1, BCH242Y1

**Rationale:**

**Consultation:**

**PCL475Y1: Neuropsychopharmacology**

**Prerequisites:**
- **Previous:**
- **New:** A minimum of 9.0 FCE

**Rationale:**

**Consultation:**

### 1 Retired Course:

**PCL465H1: Advanced Toxicology Laboratory**

**Rationale:**
## 2 Course Modifications:

### PHY131H1: Introduction to Physics I

**Contact Hours:**
- **Previous:** Lecture: 24 / Practical: 20
- **New:** Lecture: 36 / Practical: 20

**Prerequisites:**
- **Previous:** MCV4U Calculus & Vectors / MHF4U Functions & Calculus
- **New:**

**Corequisites:**
- MAT135H1/MAT137Y1/MAT157Y1 recommended, but may be required prerequisite in 2nd year Physics courses

**Recommended Preparation:**
- MCV4U Calculus & Vectors/MHF4U Functions & Calculus, SPH4U Physics and SCH4U Chemistry

**Rationale:**

**Consultation:**

### PHY132H1: Introduction to Physics II

**Contact Hours:**
- **Previous:** Lecture: 24 / Practical: 20
- **New:** Lecture: 36 / Practical: 20

**Corequisites:**
- MAT136H1/MAT137Y1/MAT157Y1 recommended, but may be required prerequisite in 2nd year Physics courses

**Rationale:**

**Consultation:**

## 1 Retired Course:

### PHY495H1: Research Topic in Geophysics

**Rationale:**
1 Course Modification:

**PSY201H1: Statistics I**

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<tbody>
<tr>
<td>ECO220Y1/ECO227Y1/EEB225H1/GGR270H1/HMB325H1/POL232H1/POL242Y1/SOC202H1/STA220H1/STA248H1/STA288H1</td>
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<tr>
<th>Rationale:</th>
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<tr>
<th>Consultation:</th>
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2 New Courses:

**JSC270H1: Data Science I**

**Contact Hours:**
- Lecture: 24  /  Practical: 24

**Description:**
This course is intended for students in the Data Science Specialist program. Data exploration and preparation; data visualization and presentation; and computing with data will be introduced. Professional skills, such as oral and written communication, and ethical skills for data science will be introduced. Data science workflows will be integrated throughout the course. These topics will be explored through case studies and collaboration with researchers in other fields.

**Prerequisites:**
- STA257H1, CSC207H1, CSC236H1

**Corequisites:**
- STA261H1, MAT237Y1/257Y1, CSC263H1

**Exclusions:**

**Recommended Preparation:**

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

**Distribution Requirements:**

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

**Experiential Learning:**
- Research: notably; Other: notably;
- Nature of "Other" Experiential Learning: Experiential Study

**Rationale:**
The National Academies of Sciences, Engineering, Medicine interim report on “Envisioning the Data Science Discipline: The Undergraduate Perspective” states that, in addition to foundational skills (e.g., mathematics, computational and statistical thinking), translational skills are valuable for data science students.

It is important for data science education to incorporate real data, broad impact applications, and commonly deployed methods. (page 16)

Training as a data scientist involves more than completing courses in computer science and statistics. A double major, for example, will not give students the benefit of an integrated pathway of courses designed explicitly to teach data science theories and methods. A key aspect of The Data Science Specialist program is to provide students with a rich, integrated experiential learning component, which will develop students’ translational skills in topics such as data preparation, computational considerations involved in the statistical analysis of large-scale data sets, and the theory of data science. These experiential learning outcomes will be achieved through the integrative courses.
This course is the first in a series of three courses that will scaffold experiential learning within the Data Science specialist program, and integrate ideas and techniques from computer science and statistics. “These courses will make this program unique among Data Science-focused programs currently available at other Canadian universities”. (Appraisal Report for Undergraduate Specialist in Data Science, September 25, 2017).

Consultation:
A committee was formed in June 2015 to advise on the development of the data science program. Committee members included seven U of T faculty members from both Statistical Sciences and Computer Science, and data scientists working at U of T affiliated institutions and private industry. An advisory committee of nine faculty members from Statistical Sciences and Computer Science, and data scientists working in industry was also established to help the committee in developing this specialist program.

An early draft of the data science proposal was circulated to all chairs sitting on the Sciences Curriculum Committee, and received favourable feedback. The brief was also circulating to all units within Arts and Science that have a potential interest in Data Science.

Resources:
Instructors:
The course be co-taught by computer science and statistics.
TAs: A TA with statistical expertise and a TA with expertise in computer science will be required. Two TAs @ 60 hrs per TA.
Computing:
- Computer Science undergraduate computing resources will be sufficient to support the course.
- The course will also use cloud computing from a provider that offers programs for education such as Microsoft Azure or Amazon Web Services (AWS). Prof. Taback currently has a grant from Microsoft Azure that would meet the needs of this course.

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:
Data science specialist program

Estimated Enrolment:
30-45

Instructor:
Nathan Taback

STA314H1: Statistical Methods for Machine Learning I

Contact Hours:

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
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<td>36</td>
<td>12</td>
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Description:
Statistical methods for supervised and unsupervised learning from data: training error, test error and cross-validation; classification, regression, and logistic regression; principal components analysis; stochastic gradient descent; decision trees and random forests; k-means clustering and nearest neighbour methods. Computational tutorials will support the efficient application of these methods.

Prerequisites:
STA238H1/STA248H1/STA255H1/STA261H1, CSC108H1/CSC120H1/CSC121H1/CSC148H1, MAT223H1/MAT240H1

Corequisites:
Exclusions:
CSC411H1

Recommended Preparation:
MAT235Y/MAT237Y1/MAT257Y1

Breadth Requirements:
The Physical and Mathematical Universes (5)

Distribution Requirements:

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:

Machine learning methods in statistical practice continue to become more prominent. Currently, the Department of Statistical Sciences has only one dedicated course in the statistical aspects of machine learning, STA414H1. We plan to augment this by offering a 3rd year course, STA314H1, which will introduce statistical methods for machine learning and computational skills. STA414H1 will then become a more advanced version of the current course, with more focus on the theoretical foundations and more advanced methods at the interface of current research.

The current curriculum renewal project in statistics has a key goal of enhancing the computational skills of our students and giving them greater exposure to computationally intensive methods, and this course sequence will play an important role.

We expect that demand for this course will be high.

Consultation:

The course has been developed in consultation and in parallel to developments in the Department of Computer Science.

It was developed in response to needs identified by:
• A survey of alumni and current undergraduate students in statistics, carried out in the fall of 2016. Responses to this survey indicated a strong desire and demand for a course of this nature.
• The most recent instructors of the 4th year course (STA414H1), who designed this course to support the development of skills and knowledge they discovered that their students were lacking.
• The curriculum renewal project in the Department of Statistical Sciences. The creation of this course has been strongly endorsed at meetings of the curriculum renewal committee, the undergraduate committee, and the department.

Resources:

Teaching assistants to support marking and to provide tutorials to develop computational skills (approximately 7 teaching assistants x 50 hours).

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

Overlap with Existing Courses:

The Department of Computer Science offers its own sequence of courses in machine learning and both departments are re-designing our courses in parallel.

Each department will have its own introductory machine learning course. The course in the Department of Statistical Sciences with leverage the statistical knowledge of our students, with extra emphasis on supporting students with weaker computational skills, and the course in the Department of Computer Science will leverage the computational abilities of the computer science students. These courses (STA314H1 and CSC411H1) will be exclusions.

Each department will continue to offer more advanced specialized courses in machine learning, for which either of the introductory courses (STA314H1 or CSC411H1) can serve as the prerequisite in machine learning.
### Programs of Study for Which This Course Might be Suitable:
- Statistics, Actuarial Science, Computer Science

### Estimated Enrollment:
- 300

### Instructor:
- David Duvenaud, Dan Simpson

### 5 Course Modifications:

#### STA130H1: An Introduction to Statistical Reasoning and Data Science

**Corequisites:**
- MAT135H1/MAT136H1/MAT137Y1/MAT157Y1, CSC108H1/CSC120H1/CSC121H1/CSC148H1

**Exclusions:**
- Any of STA220H1/STA255H1/STA248H1/STA261H1/ECO220Y1/ECO227Y1 taken previously or concurrently

**Rationale:**

**Consultation:**

#### STA302H1: Methods of Data Analysis I

**Prerequisites:**
- STA238H1/STA248H1/STA255H1/STA261H1/ECO227Y1, CSC108H1/CSC120H1/CSC121H1/CSC148H1, MAT221H1 (70%)/MAT223H1/MAT240H1

**Rationale:**

**Consultation:**

#### STA355H1: Theory of Statistical Practice

**Prerequisites:**
- STA255H1 (75%)/STA248H1 (75%)/STA238H1 (75%)/STA261H1 (60%)/ECO227Y1 (60%), MAT235Y1/MAT237Y1/MAT257Y1, MAT223H1/MAT240H1

**Rationale:**

**Consultation:**

#### STA437H1: Methods for multivariate data

**Prerequisites:**
- STA302H1/STA352Y1 (MAT224H1/MAT247H1 recommended)

**Rationale:**

**Consultation:**
### STA414H1: Statistical Methods for Data Mining and Machine Learning

<table>
<thead>
<tr>
<th>Title:</th>
<th>Statistical Methods for Data Mining and Machine Learning II</th>
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<tr>
<td>Abbreviated Title:</td>
<td>Stat Data Mining &amp; Machine Learning II</td>
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**Description:**

**Previous:**

**New:**
Probabilistic foundations of supervised and unsupervised learning methods such as naive Bayes, mixture models, and logistic regression. Gradient-based fitting of composite models including neural nets. Exact inference, stochastic variational inference, and Markov chain Monte Carlo. Variational autoencoders and generative adversarial networks.

**Prerequisites:**

- STA314H1/CSC411H1 (beginning Fall 2019), STA302H1, CSC108H1/CSC120H1/CSC121H1/CSC148H1, MAT235Y1, STA302H1/MAT237Y1/MAT257Y1/CSC411H1, MAT223H1/MAT240H1, STA303H1 (recommended)

**Exclusions:**
- Previous: MAT235Y1
- New: CSC412H1

**Recommended Preparation:**
- Previous: 
- New: CSC412H1
1 New Course:

**TRN141Y1: Environmental Science and Pathways to Sustainability**

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<th>Contact Hours:</th>
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<td>Seminar: 48</td>
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**Description:**

This course introduces students to fundamental issues in environmental science with a multi-disciplinary focus on human impacts on physical and biological systems, and on identifying pathways to sustainability. Key themes will include energy and resources, climate change, land use, contaminants and protecting biodiversity in the context of the Anthropocene. The course challenges students to apply the scientific method to environmental monitoring, research and problem solving through project design, data collection and analysis. The course also emphasizes information literacy, skills to distinguish science from pseudo-science, and considerations around representation of environmental science in the media.

**Prerequisites:**

**Corequisites:**

TRN140Y1

**Exclusions:**

**Recommended Preparation:**

**Breadth Requirements:**

Living Things and Their Environment (4), The Physical and Mathematical Universes (5)

**Distribution Requirements:**

**Competencies:**

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

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

**Experiential Learning:**

*Research:* notably; *Other:* none

**Rationale:**

Current gap in first year programming within Trinity One. Developed in close consultation with the School of the Environment. This provides students with an interdisciplinary experience.

**Consultation:**

Developed in close consultation with the School of the Environment, Trinity College Arts and Science Committee and Senate.

**Resources:**

Instructor stipends

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

**Overlap with Existing Courses:**
Trinity College

<table>
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<tr>
<th>Programs of Study for Which This Course Might be Suitable:</th>
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<tbody>
<tr>
<td>Trinity One</td>
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<tr>
<th>Estimated Enrolment:</th>
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<tr>
<th>Instructor:</th>
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<td>TBA</td>
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1 New Course:

COG260H1: Data, Computation, and the Mind

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<th>Contact Hours:</th>
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<td><strong>Lecture:</strong> 24 / <strong>Practical:</strong> 12</td>
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**Description:**

How does the human mind work? We explore this question by analyzing a range of data concerning such topics as human rationality and irrationality, human memory, how objects are represented in the mind, and the relation of language and cognition. This class provides critical thinking and practical computational skills that will allow students to work with data in cognitive science and related disciplines.

**Prerequisites:**

CSC108H1

**Corequisites:**

COG250Y1

**Exclusions:**

**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:* slightly

**Experiential Learning:**

*Research:* notably; *Other:* none

**Rationale:**

An important skill for cognitive science students to acquire is the ability to relate human behavioral data (from experimental or observational studies), and/or brain imaging data, to theories and models about the representations and mechanisms that underlie various aspects of cognition. Advances in data science are key to making these links in theoretically-motivated and methodologically-justified ways. This course will develop in students these disciplinary-specific skills (which have wide applicability in various fields, such as organizational behaviour, human-computer interaction design, various medical fields, etc.), as well as transferable skills such as data analysis techniques and computational design and implementation methods.

**Consultation:**

Psychology and Computer Science

**Resources:**

TA support in the amount of 80 hours, following the standard practice in courses in CSC (2 hr/student), that are comparable in format to the present course.

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

**Overlap with Existing Courses:** 46
University College

No direct overlap with existing courses.

**Programs of Study for Which This Course Might be Suitable:**
- COG Major (Science – ASMAJ1446)

**Estimated Enrolment:**
- 40

**Instructor:**
- Prof. Yang Xu