Science Curriculum Committee
Full Review Proposals By Unit
1 Minor Program Modification:

Earth and Environmental Systems Major

Completion Requirements:

(8 full courses or their equivalent including at least 2.0 FCE at 300+ series with at least 0.5 FCE at 400 level series.)

1. 2.0 FCE foundation science courses: 2.0 FCE selected from JEG100H1/ESS102H, BIO120H1/BIOL130H1, CHM135H1/CHM139H, CHM136H1/CHM138H, PHY131H1, PHY132H1, MAT135H1, ENV237H1/ENV238H1

2. 3.0 FCE core courses:

- 1.0 FCE at 200 level: ESS261H1, ESS262H1 (NOTE: ESS261H and ESS262H1 may be taken in either order.)
- 1.0 FCE at 300 level: ESS345H1, ESS361H1/ESS362H1/GGR305H1
- 0.5 FCE field course: ESS410H1/ESS450H1/GGR390H1
- 0.5 FCE capstone course: ESS461H1/ESS462H1/ESS463H1/ESS464H1

3. 3.0 FCE elective courses:

In addition to the above core courses, you need to take 3 FCE electives. This requirement can be satisfied by any of the courses Earth Sciences Courses listed in this "Earth and Environmental Systems Major" program section categories A to F below. The following clusters of courses are neither mutually exclusive nor meant to limit choice but intended to show logical course complements. These are not POSI requirements; rather the clusters are presented to aid students in course selection according to their interests.

a) Earth Surface Processes

ESS241H1, ESS311H1, ESS331H1, ESS445H1, GGR201H1, GGR205H1, GGR272H1

b) Paleoclimate

ESS331H1, ESS361H1, ESS362H1, ESS461H1, ESS464H1, ENV234H1, GGR305H1

c) Biogeochemistry

ESS223H1/ENV233H, ESS311H1, ESS312H1, ESS362H1, ESS410H1, ESS462H1

d) Global Environmental Change

ESS362H1, ESS462H1, ESS463H1, GGR203H1, GGR314H1, PHY392H1

e) Quarternary Science

ANT314H1, ANT315H1, ANT409H1, ANT419H1, ESS461H1

f) Environmental Systems

This cluster focuses on the modern day interactions of biology, climate and geology. It is particularly suited to a double major with the Environmental Biology Major offered by the Department of Ecology and Evolutionary Biology.

Suggested courses are:
### Description of Proposed Changes:

**Rationale:**

**Impact:**

**Consultation:**

**Resource Implications:**
2 New Courses:

**EEB462H1: Phylogenetic Systematics**

**Contact Hours:**
- **Lecture:** 24  /  **Practical:** 36

**Description:**

The Tree of Life metaphor for evolutionary relationships among species, phylogenies, is now fundamental in biology. Phylogenetic trees are now used both in species classification and to investigate myriad biological hypotheses about the evolutionary process and applied problems like virus and cancer epidemiology. This course will train students in the concepts and core methods of phylogenetic tree inference, including parsimony, likelihood, and Bayesian techniques. Students will gain bioinformatics skills with application to DNA sequence analysis and phylogenetic tree inference. Through a combination of lectures, discussion, and computer labs, students will master theory and practice of phylogenetic tree construction and inference.

**Prerequisites:**
- BIO220H1, EEB225H1/STA220H1/STA251H1/STA288H1/GGR270H1/PSY201H1

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**
- CSC108H1, EEB323H1, EEB362H1

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

**Distribution Requirements:**
- Science

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

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

**Rationale:**

Nothing makes sense in biology, except in the light of evolution. Nothing makes sense in evolution, except in the light of phylogenetics. Phylogenetic systematics is the basis for how we understand and classify the living world, often represented visually as a branching tree diagram of relatedness among species. Whereas a robust phylogenetic hypothesis holds a tremendous amount of information, it takes an understanding of the evolutionary process, the defining of taxonomy and phylogenetic theory to interpret the information. Both students and professors at the University of Toronto have identified phylogenetics as a gap in our training. This course aims to fill that gap. The course will introduce students to comparative data, dataset creation, phylogenetic theory, tree building and tree interpretation based on both DNA sequence information and phenotypic traits. Through lectures and discussions of scientific articles, the students will acquire a deeper understanding of evolutionary hypotheses, rigorous hypothesis testing, the processes that relate species to one another, and how errors can be assessed and overcome. Through computer lab practicals, students will learn to generate their own datasets (using either downloaded data or data that they themselves have created) and analyze those data with modern statistical methods, including application of different optimality criteria (parsimony, likelihood, and Bayesian) and inference of support values and error assessment.
Moreover, students will be exposed to the practical applications of phylogenetic theory for specimen identification and learn the implications for classification and taxonomy, when this tool is not used in conjunction with other tools. All lectures will be accompanied by an article discussion on the lecture topic to develop oral communication skills. Lab practicals will use interactive problem-based learning to define testable phylogenetic hypotheses based on the concepts covered in lectures such that students will then gather relevant publicly-available data (data mining), perform data analysis, and synthesize results into written assessments in the style of peer-reviewed scientific articles. These practicals will involve individual and group learning exercises and project work to develop quantitative, statistical and bioinformatics skills. The final project assessment will develop professional writing communication skills.

The proposed course will promote mastery of all 9 Program Learning Outcomes from the EEB Curriculum Map. A FAS WIT proposal for pedagogical funding (in progress) aims to work with the course instructors to maximize the impact on students for the writing assignments developed for this course. This course also will expand EEB’s course offerings in quantitative biology, an area of strength and growth identified in EEB’s recent UTQAP review and which meshes with a proposed new Major POS in Quantitative Biology. Both professors have cross-appointments as ROM curators, promoting the integration of teaching and research expertise between the museum and the university; both professors teach other successful courses in EEB at UofT.

Consultation:
We searched for potentially related courses in other units, but found no examples requiring close consultation with other units.

Resources:
Computer lab

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

Overlap with Existing Courses:
The EEB department offers a lecture-based course on macroevolution (EEB362H1) and a course on molecular evolution (EEB460H1) that share some conceptual overlap with this new course, but no existing course at UofT covers the material in the proposed course. The new course EEB462 provides students advanced conceptual and practical computational analysis for how to infer evolutionary relationships among species, extensively using project-based learning. Some courses in Statistics cover theory and applications of Bayesian and likelihood inference that are relevant to EEB462, but they do not focus on biological problems or use a phylogenetic context.

Programs of Study for Which This Course Might be Suitable:
EEB Specialist and Major, Biology Specialist and Major, Biodiversity and Conservation Biology Major, Environmental Biology Major, Cell & Molecular Biology Specialist and Major, Genome Biology Major, Statistics Specialist (EEB focus) and Major

Estimated Enrolment:
30

Instructor:
Prof. Sebastian Kvist, Prof. Santiago Claramunt

NUS201H0: Life Science Course A

Contact Hours:

Description:
A 2000-level Life Sciences (LSM) course offered at the National University of Singapore. For course offerings see:
www.lifesciences.nus.edu.sg/lsm.html
Prerequisites and Exclusions: see the EEB website (http://www.eeb.utoronto.ca/undergrad/programs.htm)

Prerequisites:
Ecology and Evolutionary Biology (FAS), Department of

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<th>BIO120H1, BIO130H1</th>
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**Corequisites:**

**Exclusions:**

**Recommended Preparation:**

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

**Distribution Requirements:**
- Science

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

**Experiential Learning:**
- Research: extensively;
- Other: extensively;
- Nature of "Other" Experiential Learning: International Student Exchange

**Rationale:**

**Consultation:**

**Resources:**

**Overlap with Existing Courses:**

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

**Estimated Enrolment:**

**Instructor:**


1 Minor Program Modification:

**Immunology Major**

**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 2.0 required first-year courses:

BIO120H1, BIO130H1, [CHM135H1 (formerly CHM139H1); CHM136H1 (formerly CHM138H1)]/CHM151Y1 with an average of at least 70% on these 2.0 full-course equivalents (FCEs) and a final mark of at least 60% in each course.

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 = high 70s; average = high 70s.

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

Note: Students must apply to this program on the A&S Current Students Program Enrolment website.

For more information, refer to the Immunology website at: www.immunology.utoronto.ca.

**Completion Requirements:**

(8 full courses or their equivalents, including two 400-series courses)

First Year:
BIO120H1; BIO130H1; [CHM135H1 (formerly CHM139H1); CHM136H1 (formerly CHM138H1)]/CHM151Y1

Second Year:
1. BCH210H1; BIO230H1; IMM250H1; BIO260H1/HMB265H1
2. 0.5 full-course equivalent (0.5 FCE) from the following list: BIO220H1/STA220H1/TRN225Y1/TRN236H1/CHM247H1/CHM249H1

Third Year:
IMM340H1; IMM350H1; CSB349H1/BCH311H1; One full-course equivalent from the following list: BCH370H1/MGY377H1/MGY378H1/PHL281H1

Fourth Year:
One full-course equivalent from the following list: IMM428H1/IMM429H1/IMM430H1/IMM435H1/MIJ485H1

Notes:
1. Students considering graduate school are encouraged to add the additional non-compulsory IMM450Y research course, if space permits.
2. MIJ485H1 requires MGY377H1 & MGY378H1 as pre-requisites.
3. IMM435H1 is capped at 40 students. Priority will be given to Immunology Specialist students, followed by Immunology Major students.

**Description of Proposed Changes:**
The proposed changes aim at correcting some mistakes that had somehow been introduced in our curriculum. The modifications also fix and simplify some of the wording for course requirements. We would just like to run these changes by the concerned units for accuracy and approval.

**Rationale:**
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### Impact:

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| Resource Implications: |

#### 1 Course Modification:

**IMM428H1: Molecular Immunology**

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<th>Prerequisites:</th>
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<tbody>
<tr>
<td>BCH210H1/BCH242Y1, BCH311H1/CSB349H1/MGY311H1/PSL350H1, IMM350H1/IMM351H1/(IMM334Y1/IMM335Y1)</td>
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<th>Recommended Preparation:</th>
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<tr>
<td>Previous: CSB349H1/MGY311Y1/PSL350H1</td>
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<td>New:</td>
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<th>Rationale:</th>
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<tr>
<td>The course modification for IMM428H1 revises and enlarges the prerequisites, to give students more options. We would just like to run these changes by the concerned units for accuracy and approval.</td>
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## 1 New Course:

**MAT377H1: Mathematical Probability**

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<th>Contact Hours:</th>
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<td><strong>Lecture:</strong> 36 / <strong>Tutorial:</strong> 12</td>
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### Description:

This course introduces students to various topics in probability theory. Topics include basic concepts (such as probability, random variables, expectations, conditional probability) from a mathematical point of view, examples of distributions and stochastic processes and their properties, convergence results (such as the law of large numbers, central limit theorem, random series, etc.), various inequalities, and examples of applications.

### Prerequisites:

- MAT247H1, MAT257Y1

### Corequisites:

- None

### Exclusions:

- STA347H1

### Recommended Preparation:

- None

### Breadth Requirements:

- The Physical and Mathematical Universes (5)

### Distribution Requirements:

### Competencies:

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

### Experiential Learning:

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

### Rationale:

Probability theory is one of the most active areas of mathematics today, and specialist undergraduate students in mathematics, physics, and computer science, should be introduced to the field before they go to graduate school. Right now Mathematics Department does not offer any course in probability. Compared, for example, to STA347H1, the course will go more in depth while giving examples of applications of probabilistic ideas beyond statistics (for example, geometry and computer science) and incorporating modern ideas (such as concentration inequalities and random graphs, among many other possible topics).

All other parameters are the same as standard 300-level course, such as Differential Geometry.

### Consultation:

- None

### Resources:

### Overlap with Existing Courses:
Mathematics (FAS), Department of

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2 New Courses:

PSL445H1: Neuroscience: Cellular and Molecular

Contact Hours:
Lecture: 36

Description:
Overview of the fundamentals of cellular and molecular aspects of brain function. Course material is updated yearly to reflect the rapid evolution of ideas in Neuroscience.

Prerequisites:
PSL300H1, PSL301H1, CJH332H1 or permission of instructor

Corequisites:

Exclusions:
PSL444Y1

Recommended Preparation:

Breadth Requirements:
Living Things and Their Environment (4)

Distribution Requirements:
Science

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

Experiential Learning:
Research: none; Other: none

Rationale:
The Department of Physiology is proposing that PSL444Y1Y, a full year course be retired and replaced by two half year courses with essentially identical content from the previous course. This will provide more flexibility for students who are interested in the material but were discouraged from taking the course because of the length and inability to fit into their schedule.

Consultation:
Ron Wilson - Human Biology, agreed that it would give Neuroscience students "we are fully supportive of PSL offering the two half courses. Many of our neuroscience students have expressed interest in taking PSL444Y1, but end up choosing other courses due to the length of PSL444Y1. Thank you!"
Tony Harris - Cell and Systems Biology stated "I checked with a couple of people in CSB, and we have no concerns."

Resources:
None

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

Overlap with Existing Courses:
There are no overlaps.

Programs of Study for Which This Course Might be Suitable:
**Physiology (MED), Department of**  
Physiology Specialist and Major Programs, HMB Neuroscience Specialist and Major Programs

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<th>Estimated Enrolment:</th>
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<td>Instructor:</td>
<td>James Eubanks</td>
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**PSL446H1: Neural Disorders**

**Contact Hours:**  
*Lecture:* 36

**Description:**
Explore topics in neurological disorders and treatments to reinforce and expand your knowledge of cellular and molecular neurophysiology. Course material is updated yearly to reflect the rapid evolution of ideas in this area.

**Prerequisites:**
PSL300H1, PSL301H1, CJH332H1 or permission of instructor

**Corequisites:**

**Exclusions:**
PSL444Y1

**Recommended Preparation:**

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

**Distribution Requirements:**
Science

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

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

**Rationale:**
The Department of Physiology is proposing that PSL444Y1Y, a full year course be retired and replaced by two half year courses with essentially identical content from the previous course. This will provide more flexibility for students who are interested in the material but were discouraged from taking the course because of the length and inability to fit into their schedule.

**Consultation:**
Human Biology - Ron Wilson was consulted and stated that HMB450H1 - Neurodevelopmental Disorders and Diseases really focuses on neurodevelopment and disorders. He said "there may be some overlap [with PSL446H], but not enough to warrant an exclusion".  
Tony Harris - Cell and Systems Biology stated "I checked with a couple of people in CSB, and we have no concerns."

**Resources:**
No

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.
**Overlap with Existing Courses:**
No overlap (see below)

**Programs of Study for Which This Course Might be Suitable:**
- Physiology Major and Specialist
- Neuroscience Major and Specialist

**Estimated Enrolment:**
20

**Instructor:**
James Eubanks

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### 1 Retired Course:

**PSL444Y1: Neuroscience II: Cellular and Molecular**

**Rationale:**
1 New Course:

**ACT350H1: Applied Probability for Actuarial Science**

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<td>The course offers an introduction to elementary probability theory and stochastic processes. The main goal of the course is to help actuarial students understand the concept of stochastic processes with particular emphasis on Markov chains that are of great importance in Life Contingencies and Property and Casualty insurance.</td>
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The course will cover the following topics: a basic review of probabilities with emphasis on conditional probabilities and expectations, discrete time Markov chains, Poisson processes, continuous time Markov chains, renewal theory and some applications, queueing theory.

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<tr>
<td>ACT240H1 (minimum grade 63%); ACT245H1 (minimum grade 63%); ACT247H1 (minimum grade 63%); STA257H1; MAT223H1/MAT240H1, MAT237Y1/MAT257Y1</td>
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<th>Breadth Requirements:</th>
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<td>The Physical and Mathematical Universes (5)</td>
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<td>Communication: none; Critical and Creative Thinking: none; Information Literacy: none</td>
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<td>Research: none; Other: none</td>
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1 Course Modification:

STA201H1: Why Numbers Matter

Exclusions:
MAT133Y1/MAT135H1/MAT136H1/MAT137Y1/MAT157Y1. This course is not open to first-year students, nor to students enrolled in any science Major or Specialist program.

Rationale:
STA201H1 was created as an option for humanities students to fulfill the quantitative literacy component of their degree. Currently, students enrolled in a science major or specialist are excluded from the course. About half of the students currently enrolled in the course are our target audience, and the others come from programs that require a full year of mathematics and a full year of statistics. These are mostly Rotman Commerce students. In consultation with David Goldreich, the Director of the Rotman Commerce program, we have decided that we would like to exclude these students (and other students whose programs of study require a significant quantitative component) from STA201H1. The mathematics department was also consulted and has no objections.

Consultation:

Resources: