NOTICE OF MEETING
November 10, 2020
3pm – 4:30pm
via Zoom

AGENDA

1. Call to Order and Approval of Agenda
2. Chair’s Remarks
3. Approval of October 13, 2020 Minutes
4. Inquiries and Communications
   4.1 Senate Synopsis of meetings held on October 22, 2020
   4.2 Student Caucus Representative Report
5. Business Arising
6. Dean’s Remarks
7. Associate Deans’ and Head of Bethune College Remarks
8. Reports from Science Representatives on Senate Committees
9. Reports from Standing Committees of Council
   9.1 Executive Committee
      9.1.1 Ratification and Call for Nominations for Senate and Standing Committee of Council
      9.1.2 Vacancies report on the Standing Committees of FSc Council (items for action)
   9.2 Curriculum Committee (consent agenda items)
10. Other Business
    10.1 Agenda Items for Information
        10.1.1 KUALI CMS Presentation: An update on the new KUALI system for course development and proposals – Paul Mayol
        10.1.2 York Cares United Way Campaign – Stephen Childs
1. Call to Order and Approval of Agenda

The Chair of Council, C. Storry, called the meeting to order and the Agenda was adopted.

2. Chair’s Remarks

The Chair of Council, C. Storry welcomed Faculty Council.

3. Approval of September, 8, 2020 Minutes

A motion was moved, seconded and carried to approve the Minutes.

4. Inquiries and Communications

4.1 Senate Synopsis of meetings held on September 24, 2020

5. Business Arising

There was none.

6. Dean’s Remarks

Dean Wang welcomed members to Faculty Council, and praised the meeting's high engagement. He reported that there are 4346 students registered for fall term courses and 12% - 14% of the students are on campus taking classes or in residence. He continued by reporting that fall student enrolment (FFTE) for Undergraduate students surpassed the 2020 target by 2.1%, International student enrolment decreased by 4.6% & Graduate student enrolment increased by 5.4%. Overall, Faculty of Science performed better in 2020 than in 2019. He expressed how proud he was of the Faculty, staff and students for their hard work.

Dean Wang highlighted some Faculty achievements, directly and indirectly related to York Science:

- Dr. Jennifer Doudna and Dr. Emanuelle Charpentier received the Nobel Prize in Chemistry.
- **Dr. Doudna** received an Honorary Doctor of Science degree at the Faculty of Science convocation ceremony in June 2019.

- **Dasantila Golemi-Kotra (Chemistry) and Jianhong Wu (Math & Stats)** received the Ontario Ministry of Colleges and Universities Awards of Excellence.

- **Carswell Scholars:**

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<tr>
<th>Student Name</th>
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<tr>
<td>Jenna Braun</td>
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<td>Si Jia Molly Hu</td>
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<td>David Jaramillo</td>
<td>Math</td>
<td>Patrick Ingram</td>
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<td>Gehrig Carlse</td>
<td>Physics</td>
<td>A. Kumarakrishnan</td>
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Dean Wang gave the following updates:

- Space Task Force White Paper campus wide consultation is being held soon, Faculty Council reminded to provide feedback on the Space Task Force White Paper by October 15.

- Life in Space program is being proposed at the departmental level and a round-table discussion will be held for interested faculties.

- Divisional Advancement Priority consultation: leaders in each department’s divisions to identify priorities in specific areas for advancement fundraising priorities.

- Faculty input and feedback on a proposed Senate policy change to waive doctor notes for sicknesses needed to create an integrated response for the University.

- Launch of the Faculty of Science’s next 5-year strategic plan.

- Call for the Faculty of Science Teaching Awards is opened for students to nominate their Professors and Teaching Assistants.

- York University has a new brand. Faculty and staff are encouraged to visit the Brand website to learn more about the brand: [https://www.yorku.ca/brand/](https://www.yorku.ca/brand/).

7. **Associate Deans’ and Head of Bethune College Remarks**

   **On behalf of the Head of Bethune College, John Amanatides**, Cody updated council that election for Undergraduate and Graduate student representatives was complete. The Science Student Caucus leader is Aleeea Qayyum and there are 20 undergraduate student representatives and 5 graduate student representatives that have been placed on Faculty of Science standing committees.

   **Associate Dean, Graduate Studies and Education, Jennifer Steeves**, reported the following:
CHIR project grant applications are due end of October.
NSERC’s Research Tools and Infrastructure competition deadline is October 26.
Discovery Grants competition deadline is November 2.

Reminded faculty members to submit budgets and ORS checklists to Research Officer, Jerusha Lederman, for review and to be signed off.

Faulty of Science Research Awards nominations are open, nominate a colleague or yourself before October 30.

**Associate Dean, Students, Michael Scheid,** reported the following:

650 students attended the first York University virtual open house and 95 students attended the Faculty of Science booth.

Currently soliciting responses from Faculty regarding doctor’s notes requirement (Attending Physician Statements) for sick students.

There are 20 York Science Student Award recipients.

**Associate Dean, Faculty Affairs, Gerald Audette,** reminded council that sabbatical reports from 2019-20 sabbaticals are due November 1 and advised of the upcoming 2020-21 annual call for CVs and outside activities call.

### 8. Reports from Science Representatives on Senate Committees

**D. Golemi-Kotra,** Faculty of Science representative on the Academic Policy, Planning and Research Committee (APPRC) gave an update on the Markham Campus:

Undergraduate programs being proposed: Sport Management, Financial Technology, Entrepreneurship, Business Communications, Creative Technology, Computer Science and Engineering and 5 Graduate diplomas including a Diploma in Biotechnology.

Research is envisioned to be interdisciplinary, combining ideas and research from different disciplines with a view for creating more integrated theories and innovated technologies for solving complex problems.

Goal of opening in 2023, with 4200 enrolled students by 2030.

Governance has not yet been established.

Hiring 7 tenure stream Faculty members (3 Professorial, 4 Teaching Streams) and professional staff Executive Director, Vice-President, and Library representatives.

### 9. Reports from Standing Committees of Council

#### 8.1 Executive Committee

**8.1.1 Ratification and Call for Nominations for Senate and Standing Committee of Council**

A motion was moved, seconded and carried to ratify all nominations as presented.
8.1.2 Vacancies report on the Standing Committees of FSc Council (items for action)

The Chair of Council of Council, C. Storry, noted the following outstanding vacancies:

Petitions: 2 members at large
Graduate Program Committee: 1 member from Faculty of Health OR Lassonde and 1 member at large

10. Other Business

10.1 EDI initiative – Gerald Audette

There was a motion to create a Committee on Equity, Diversity and Inclusivity and 58 members voted in favour.

10.2 Agenda Items for Information

10.2.1 Instructor Participation in online surveys – Mary-Helen Armour & Carl Wolfe

A call with a link to be distributed to students to be sent to faculty members soon.

10.2.2 New pan-university strategic entrepreneurship plan – Sarah Howe & Chris Caputo

Encouraged faculty to submit anonymous feedback at https://iy.info.yorku.ca/strategic-entrepreneurship-plan.

Meeting adjourned.

C. Storry, Chair of Council
T. McFarlane, Assistant Secretary of Council
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<td>Margaret</td>
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<td>Brad Sheeller (non-member/guest)</td>
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The Senate of York University
Synopsis

The 670th Meeting of Senate held on Thursday, October 22, 2020 via Zoom

Remarks

The Chair of Senate, Professor Alison Macpherson of the Faculty of Health, welcomed Senators to the meeting and acknowledged the recent passing of Professor Gene Denzel, a stalwart of York for decades who, through his numerous service contributions, left a strong legacy of collegial governance in the Department of Mathematics and Statistics and across the wider University.

Comments made by President Rhonda Lenton included the following:

- the improved financial outlook for the University as the implications of the pandemic on enrolment numbers were not as significant as anticipated in the spring
- highlights from the President’s 2019-2020 Annual Report, Creating Positive Change, the first digital iteration, which documents the impressive progress made by the York community to advance priorities and goals over the past year despite the challenges of the pandemic
- gratitude for the generous donations from the family of the late Avie Bennet, former Chancellor of York, to support the Canadian Writers in Person course, and from the Bratty Family to support the construction of Markham Centre Campus
- highlights from the “Kudos” report, including the establishment of a global network of Emergency and Business Continuity Management by Master of Disaster and Emergency Management graduates Alisha Khan and Magda Sulzycki

The monthly “Kudos” report on the achievements of members of the York community can be accessed with other documentation for the meeting.

Reports

Under the auspices of the Academic Policy, Planning and Research Committee, Provost Philipps presented the Autumn Report on Complement and Enrolment and VP Finance and Administration McAulay delivered an update on the University budget. In follow-up to the multi-year budget presentation made to Senate in June, the budget update provided revised information reflecting the fuller knowledge of the enrolment picture currently available.
The Senate of York University

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Approvals

Senate approved the recommendations of its Executive Committee to:

- establish the Faculty of Environmental and Urban Change Faculty Council, effective 1 September 2020
- elect Professor Jeffrey S. Everett, Schulich, to the Tenure and Promotions Committee

On the recommendation of its Academic Standards, Curriculum and Pedagogy Committee, Senate approved:

- revisions to the *Common Grading Scheme for Undergraduate Faculties* and Honours Progression requirements, effective FW2023-2024, including:
  - the establishment of the *Policy on York University Grading Schemes*
  - the recission of the *Common Grading Scheme for Undergraduate Faculties*, Progression Requirements to Maintain Honours Standing, and Progression Requirements to Maintain Honours Standing in Bachelor of Engineering (BEng)
  - the establishment of corresponding qualitative descriptors for the undergraduate grading scheme as an appendix to the *Policy on York University Grading Schemes*
- changes to coursework and language requirements for the PhD program in English, housed within the Graduate Program in English, LA&PS / Graduate Studies, effective FW2020-2021

Committee Information Reports

Executive (Professor Mario Roy, Vice-Chair)

The Executive Committee’s information items included the following:

- its ongoing monitoring of the impact of the COVID-19 pandemic on academic activities, with actions pertaining to the disruption outlined in its written Report
- encouragement for Senators to assist in the process of identifying prospective candidates to fill the remaining vacancies on the Tenure and Promotions and Tenure and Promotions Appeals Committees
- its approval of Senate Committee members nominated by Faculty Councils
- its review of Senate committee priorities for 2020-2021
The Senate of York University

Synopsis

- the plans to position its Sub-Committee on Equity to coordinate and facilitate implementation of anti-Black and anti-Indigenous racism and equity, diversity and inclusion measures within collegial governance frameworks and processes
- its review of the Faculty Council rules and procedures of the Lassonde School of Engineering
- temporary actions taken by the Committee to support a Faculty Council experiencing uncertainty
- the completion of the mandate of the Temporary Sub-Committee established to review and resolve cases of outstanding provisional grades assigned as a result of the labour disruption in Winter 2018
- a consolidated report on actions taken by Senate in 2019-2020
- an update on its membership for 2020-2021

Academic Policy, Planning and Research (Professor Brenda Spotton Visano, Chair)

APPRC reported on the following items:

- its reflections on the Provost’s Autumn Report on Complement and Enrolment and budget update
- its confirmation of 2020-2021 priorities, with a key focus on setting the stage to advance and track progress on University Academic Plan 2020-2025 priorities
- its identification of Markham Centre Campus as a priority, plans to include it as a standing agenda item for each meeting, and receipt of a briefing from the Provost on the status of campus planning earlier in the month
- its review of the results of the 2019-2020 Senator and Senate committee member surveys
- an update on its membership for 2020-2021

ASCP (Professor Chloë Brushwood Rose, Chair)

ASCP’s information items included the following:

- changes to Leaves of Absence and Registration Status regulations, Faculty of Graduate Studies
- sessional dates for three academic years, from SU2021 to SU2024, with an update to follow on the scheduling of Fall 2021 orientation activities

Awards (Professor Shayna Rosenbaum, Chair)

With the call for nominations for the President’s Research Awards issued earlier in the month, Senators were encouraged to submit nominations and promote the submission
The Senate of York University

Synopsis

of nominations among their colleagues. Details are available on the Awards Committee website.

Additional Information about this Meeting

Please refer to the full Senate agenda and supplementary material posted online with the Thursday, October 22, 2020 meeting for details about these items.

https://secretariat.info.yorku.ca/senate/meeting-agendas-and-synopses/

November Meeting of Senate

Senate’s next meeting will be held at 3:00 pm on Thursday, November 26, 2020.
November 3, 2020

Ratification of Nominations

**Academic Policy and Planning Committee**
Rachel Duncan

**Appeals Committee**
Yurij Kunyckyj
Tanya Rajwani

**Committee of Equity, Diversity and Inclusivity**
A. Chow
C. Le
V. Pavri
Ailiya Rizwan
Olga Andriyevska
Hamed Babazadeh

**Committee on Examinations and Academic Standards**
Ali Bashar
Sormeh Hamedani

**Committee on Teaching and Learning**
Areeba Chaudhry

**Curriculum Committee**
Elana Dhaigham
Jessica Sinha

**Executive Committee**
Hila Akbari

**Research and Awards Committee**
Sameen Ali

**Petitions Committee**
Yashna Manek
Hassan Khan

**Tenure and Promotion Committee**
Daniel Kamel
Si Jia (Molly) Hu
### Senate

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### Executive Committee

| Chair of Council | S. Watson, Mathematics & Statistics | Designated |
| Vice-Chair of Council | C. Storry | Designated |
| Secretary of Council | A. Mun | Designated |
| The Academic Policy and Planning Committee (APPC) | T. Baumgartner, Chemistry | Designated |
| The Curriculum Committee | S. Connor | Designated |
| The Senate Executive | A. Mun | Designated |

### FSc Reps on Senate Committees

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<td>Curriculum Committee</td>
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<td>Senate Executive</td>
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### Academic Policy, Planning and Research Committee (APPC)

- The Executive Committee will normally meet the 1st Tuesday of each month (September to April) from 3:00pm - 4:30pm in LUM 305B
- The Curriculum Committee will normally meet the 4th Tuesday of each month (September to April) from 1:30 pm - 3:00 pm
- The Senate Executive will normally meet the 1st Tuesday of each month (September to April) from 1:30 pm - 3:00 pm

### Senate Rules and Procedures

- The Senate Rules and Procedures shall be established by the Chair of the Senate and include the Vice-Chair of the Senate, the Dean of the Faculty of Science, and one member elected from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy, and Science and Technology Studies/Natural Science, the Dean of Science and Technology Studies/Natural Science, the Dean of the Faculty of Science, the Chair or designate of each standing committee of the Senate, and one of the staff members elected to Council.

### Senate Meeting Time / Membership

- September 2020 - April 2021
- September 2021 - April 2022
- September 2022 - April 2023
- September 2023 - April 2024
- September 2024 - April 2025

### Senate Vacancies

- Designated: 1 member from FSc

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- September 2022 - April 2023
- September 2023 - April 2024
- September 2024 - April 2025

### Senate Vacancies

- Designated: 1 member from FSc

### Senate Meeting Time / Membership

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### Senate Vacancies

- Designated: 1 member from FSc
### Committee on Teaching and Learning (CoTL)

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<th>Chair</th>
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<th>Associate Dean - Research &amp; Graduate Education, ex officio</th>
<th>Teaching Commons Rep</th>
<th>Staff Representation, selected</th>
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<td>Gabriella Gerzon</td>
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### SRC (Standing Senate Committee)

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### CEAS (Committee on Examinations and Academic Standards)

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### SRC T & P Committee

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Graduate Education Program:

- Associate Dean – Research & Graduate Education (ex officio)
- Graduate Program Director (or designate who must be a member of the graduate program’s convocation committee) of each Graduate Program in the Faculty of Science
- One graduate student member from any Graduate Program in the Faculty of Science who is appointed to teach in any FSc graduate program
- One member with knowledge of graduate programming and experience with curriculum approvals at the Faculty level

The Graduate Education Committee shall consist of:
- Associate Dean – Research & Graduate Education (ex officio)
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- One graduate student member from any Graduate Program in the Faculty of Science who is appointed to teach in any FSc graduate program
- One member with knowledge of graduate programming and experience with curriculum approvals at the Faculty level

The Chair of the Committee is selected by the voting members of the Committee for a one-year term.

Meeting is held TBD

Associate Dean – Research & Graduate Education (ex officio)
- G. Audette

Associate Dean - Faculty Affairs, ex officio
- Ailiya Rizwan

Associate Dean, Research & Graduate Education (ex officio)
- Olga Andriyevska

Undergraduate Student Rep
- Undergraduate Student Rep

Graduate Student / Post Doc Reprsentative
- Graduate Student / Post Doc Reprsentative

Biology
- Biology

Chemistry
- Chemistry

Physics & Astronomy
- Physics & Astronomy

Math & Stats
- Math & Stats

STS
- STS

The purpose of the Committee on Equity, Diversity & Inclusivity is to provide broad review and leadership to Council on matters of Equity, Diversity and Inclusivity.

The Equity, Diversity and Inclusivity Committee shall consist of:
- Associate Dean, Faculty Affairs (ex officio)
- Associate Dean – Research & Graduate Education (ex officio)
- Two primary and one alternate member from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy and Science & Technology Studies.
- Two graduate students or postdoctoral fellows (one primary and one alternate) from any graduate program within the Faculty of Science who are graduate students.

Meeting is held TBD

Associate Dean – Faculty Affairs (ex officio)
- K. Birch

Associate Dean, Research & Graduate Education (ex officio)
- J. Steeves

Associate Dean, Faculty Affairs (ex officio)
- B. Stutchbury

Associate Dean, Research & Graduate Education (ex officio)
- R. McLaren

Associate Dean, Faculty Affairs (ex officio)
- M. Johnson

Associate Dean, Research & Graduate Education (ex officio)
- S. Moghadas

Associate Dean, Faculty Affairs (ex officio)
- K. Birch

Associate Dean, Faculty Affairs (ex officio)
- VACANT

Associate Dean, Faculty Affairs (ex officio)
- VACANT

Associate Dean, Faculty Affairs (ex officio)
- Ellie Abdollahi

Associate Dean, Faculty Affairs (ex officio)
- VACANT

Associate Dean, Faculty Affairs (ex officio)
- C. Le

Associate Dean, Faculty Affairs (ex officio)
- VACANT

Associate Dean, Faculty Affairs (ex officio)
- A. Chow

Associate Dean, Faculty Affairs (ex officio)
- V. Pavri

Associate Dean, Faculty Affairs (ex officio)
- VACANT
Curriculum Committee Report

September 2020

The Faculty of Science Curriculum Committee has reviewed proposals for changes to course information and degree requirements and recommends to the Executive Committee that the following changes be submitted to Council for approval.

Details regarding these proposals (and regarding other minor changes to Calendar/Repository course descriptions and prerequisites which were approved by the Committee but are not reported here) are included in the working papers of September 29, 2020, meeting of the Curriculum Committee, which are on file for your inspection in the Office of the Dean, with all members of the Curriculum Committee or by contacting the Secretary of the Committee at tinar@yorku.ca

1.2 BIOL
1.2.1 New course: SC/BIOl 4160 3.0 “The Human Microbiome”
1.2.2 New course: SC/BIOl 4040 3.0 “Protein Structure and Mechanisms of Disease”
1.2.3 New course: SC/BIOl 4120 3.0 “Applied Immunology”
1.2.4 Change in pre-requisite: SC/BIOl 1001 “Biology II: Evolution, Ecology, Biodiversity and Conservation Biology”
1.2.5 Change in pre-requisite, title and calendar description: SC/BIOl 4270 3.0 “Reproduction”
1.2.6 Change in pre-requisite and in course format/mode of delivery: SC/BIOl 4400 3.0 “Behavioural Genetics”
1.2.7 Change in Degree requirements: Biomedical Sciences Stream, change to Specialized Honours, Honours Major, Honours Major/Minor, iBSc Honours Major/Minor and iBSc Honours Major – adding SC/BIOl 3350 4.0.
1.2.8 Retire/expire course: SC/BIOl 3100 2.0 “Current Topics in Biological Research”
1.2.9 Change in pre-requisite: SC/BIOl 4000 3.0 and SC/BIOl 4000 8.0 “Honours Thesis
1.2.10 Change in degree requirements: BSc. Biology Hons. Specialized (including Biomedical stream) and iBSc. Biology Honours Specialized – removing the requirement of SC/BIOl 3100 2.0 (Minor Modifications)

1.3 MATH
1.3.1 Change in calendar description: SC/MATH 2001 3.0 “Real Analysis I”
1.3.2 Change in calendar description: SC/MATH 3001 3.0 “Real Analysis II” - Tabled
1.3.3 Change in pre-requisite, title and calendar description: SC/MATH 4011 “Real Analysis III” - Tabled
1.3.4 Change in pre-requisite, title and calendar description: SC/MATH 4012 3.0 “Analysis IV” - Tabled
1.3.5 Change in degree requirements: BSc. and BA degree in Pure and Applied Math program – change to Specialized Honours, Honours Majors and Bachelors - Tabled
1.4 NATS
1.4.1 Change in CCE/NCRs: SC/NATS 1570 3.0 “Exploring the Solar System”
1.4.2 Change in CCE/NCRs: SC/NATS 1585 3.0 “Astronomy: Exploring the Universe”
1.4.3 Change in CCE/NCRs: SC/NATS 1740 6.0 “Astronomy”
1.4.4 Change in calendar description: SC/NATS 1750 6.0 “Earth and its Atmosphere”

1.5 NEUROSCIENCE PROGRAM
1.5 Change in short and full title: HH/NRSC 3000 3.0 “Molecular and Cellular Basis of Perception and Cognition
COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY
TEMPLATE
NEW COURSE PROPOSAL FORM

Faculty:
Indicate all relevant Faculty(ies)

Faculty of Science

Department:
Indicate department and course prefix (e.g. Languages, GER)

Biology

Date of Submission:

Course Number:
Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")

BIOL 4160  Var:  Academic Credit Weight:
Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6  3.0

Course Title:
The official name of the course as it will appear in the Undergraduate Calendar and on the Repository

The Human Microbiome

Short Title:
Appears on any documents where space is limited - e.g. transcripts and lecture schedules - maximum 40 characters

With every new course proposal it is the Department’s responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.
This course focuses on the microbial world that is part of the complex ecosystem of human body. It explores the mechanisms and consequences of microbial interactions with the human body, including the microbial communities that inhabit our bodies, their essentiality to our health, and the delicate balance between health-promoting and disease-causing microbial behaviour. The application aspect of the human microbiome also is discussed in terms of factors that lead to the alteration of human microbiota, and their implication in treatment of human disorders.

Prerequisites: SC BIOL3150 4.0 or SC/BIOL 3150 3.0

This course explores the many microbial symbioses with humans. It describes the delicate balance that exists between the microorganisms and the host and its impact on the human health and well-being. In addition, the course describes the factors that alter the human microbiota, means to maintain a healthy microbiota and efforts of the medical community to take into account the human microbiome in treatment of human disorders.
This course focuses on the communities of microorganisms that have developed a symbiotic relationship with the human body, commonly referred to as the human microbiota. The four objectives of the course are: (1) to explore the diversity of microorganisms that inhabit regions of the human body such as skin, gastrointestinal tract, urinary tract and respiratory tract as revealed by genomic studies; (2) to analyze their impact on the well-being of the host; (3) to explore the molecular mechanisms proposed to link a number of human disorders to the integrity of the human microbiota; (3) to assemble and analyze evidence on the importance of diet and the impact of antimicrobial agents in the human microbiota; and lastly (4), to explore efforts by the medical community to exploit our knowledge of the human microbiota for the treatment of human disorders.

In this course, students will explore/learn about the microorganisms that inhabit the human body, the mechanisms that underlie interactions between the host and the microorganisms, the impact of those interactions on human health, and the parameters being developed to assess proposed links between human diseases and the human microbiota. In addition, students will acquire skills to assemble scientific evidence and critically assess the scientific literature on the human microbiota as a causative agent of human diseases, summarize pro and con theories on the impact of microorganisms on particular human disorders, and verbally communicate those discoveries to a lay and diverse audience such as their own peers.

Topics in this course include:

1) Humans as a unique and complex ecosystem
   - Microbial Ecosystems
   - Methods in Microbial Ecology
   - Human microbiome

2) Microbial symbioses with humans
3) Disorders linked to the human microbiome
4) Factors that alter the human microbiome (such as antibiotics & diet)
5) The human microbiota as a tool for the treatment of human disorders (such as fecal transplants, prebiotics probiotics)

Course Learning Objectives

- Explore the interactions of microorganisms with each other and their natural habitats, and methods to study the microbial activity and diversity in their natural habitats.
- Gather, summarize and analyze the scientific data that link different microorganisms of the human microbiota to certain human disorders
- Explain the molecular mechanisms that underlie the intimate relationships between humans and microorganisms and their subsequent impact on human health.
- Gather and summarize evidence on the impact of diet and chemotherapeutic agents on the human microbiome and consequently human health.
- Discredit myths regarding human health and the microbial world.
- Compare and contrast controversial theories on the role of the host microorganism in particular human disorders.
- Critically read and assess scientific research regarding the role of the human microbiome in human disorders.
- Facilitate the communication of scientific research on the human microbiome to a lay audience.
**Expected Learning Outcomes**
This course allows the students to:

- Explain major concepts, methodologies, and issues in studying the human microbiota, demonstrating detailed knowledge in certain topics (*i.e.*, course topics).
- Gather, synthesize, interpret, and critically evaluate, information (including experiments and data) about the role of the human microbiota in a number of human disorders from a variety of sources (*e.g.*, reviews, primary sources).
- Apply scientific knowledge and critical thinking to identify, define, and analyze problems, and design/suggest solutions or opinions.
- Summarize key points from a piece of scientific literature to provide relevant information and support in a written scientific assignment.
- Critique a primary research article, assessing the link between a particular microorganism and a human disorder and providing evidence to support the assessment.
- Design and evaluate a methodology that would test various hypotheses related to the role of the human microbiota in human health and well-being.
- Apply learning from other areas (*e.g.*, genetics, biochemistry, microbiology) to prove or disapprove scientific claims made about the human microbiota.
- Explain the use of model organisms in making correlations between the human microbiota and human disorders.
- Communicate (orally and in writing) scientific discoveries clearly to peers and a scientific audience.
- Edit and/or evaluate classmates’ written and oral assignments, providing constructive suggestions for improvement.
- Discuss and debate issues relating to human microbiota that are not discussed by the instructor.
- Work effectively, responsibly, and collegially with peers in and out of class.
**Course Design:**

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours, what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course material will be presented primarily through lectures that draw their main content from the scientific literature. It will also include in-class presentations prepared by students on specific topics not covered in lectures. In addition, students will lead in-class discussions on the most recent scientific reports. Hence, the course time will be partitioned among lectures, in-class student presentations and student-led discussions.

Student understanding of the course material will be assessed through two tests, student presentations, participation in in-class discussions, and a final exam.

The course will be scheduled as two 90 min classes per week. Lectures will incorporate iClickers, in-class presentations and student-led discussions in order to assess student understanding of the course material and to encourage independent learning (see more below) and independent research. In-class presentations, about 15 min long, will be spread throughout the course. Some of the topics for these presentations will be proposed by the instructor, and students will be encouraged to tackle topics of their choice that fall within the umbrella of the course objectives. In-class presentations and group discussions provide the students with a means to connect with the course material, learn to digest scientific content, present a topic in a clear, easy to follow and convincing manner, and critically analyze scientific reports. Moreover, they provide a learning platform for the student to defend their ideas (or the report/research that they are presenting).

The course will take advantage of technology to provide students with a platform to make abstract and complex concepts more concrete and review and learn course content. For these purposes, illustrative animations from Science and Nature publishers will be made available to students during the lecture time and posted on Moodle. In addition, to provide students with tools to concisely present a topic and gain presentation skills, they will be directed to TED talks given by influential researchers in the field of microbiology and human microbiome.

Moodle will be the technology-based platform for students to gain access to the course material such as lecture notes, to exchange ideas with their peers on topics that interest them, to present and discuss scientific literature in the classroom, to review/edit each-others’ presentations, and to be made aware of the latest discoveries on the topics that are relevant to this course.
Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).

2. Number of department members currently competent to teach the course.

3. Instructor(s) likely to teach the course in the coming year.

4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained OR in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1) This course will be offered each year in the Winter term in order to accommodate the preceding Fall Bio3150 students (Bio3150 is a prerequisite)

2) The first time this course is offered, Dr. Golemi-Kotra will be teaching this course. In future years, this course could also be taught by Dr. Nicole Nivillac of the Biology Department.

3) The contact time is envisioned as two 90 min sessions per week (three hours total).

4) Students are expected to spend about two hours of preparation per week for each class.
Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Evaluation of students’ learning will be based on:

1) Two tests, each worth 15% (Total 30%)
2) In-class presentations, worth 15%
3) Student-led discussions, worth 15%
4) Iclicker-based quizzes, worth 5%
5) Final exam, worth 35%

Tests, in-class presentations, in-class discussions and Iclickers will be used as a means to assess the student progress, and identifying any need for adjustments to the delivery of the course or additional supports for student learning. It will also provide students with regular low-stakes feedback. The midterms will provide additional feedback and help prepare students for the final exam. Both the tests and the final exam will consist of short answer questions.

Tests, in-class presentations, discussions and Iclickers will be held during lecture time, and the Final Exam will be held during the scheduled exam-time period.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.


{Urbaniak, 2014 #32; Reid, 2015 #31}


Other Resources:
A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain. COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

This course does not require resources outside of classroom space.
Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

In recent years there has been an explosion of discoveries on the contribution of microorganisms that inhabit the human body to human health and well-being. The molecular mechanisms of interactions between microorganisms and the human body are now better understood and this has led to the revelation that disruption of the normal microbiota contributes to a number of human disorders/diseases. The rationales for offering this course are provided below:

1) **Need for an advanced course in Microbiology**: There is no advanced Microbiology course offered currently in the Biology undergraduate program, or anywhere else at York. Currently, the Biology Department offers advanced courses in Virology and Biochemistry, which enable the students to look at the subject matters of these two disciplines in a more complex context. An advanced course in Microbiology would offer similar opportunities, i.e. it should teach students the behavior of microorganisms at a system level rather than in isolation (cell level); scientific research has shown that such an approach can provide a better understanding of the interactions of microorganisms with each-other and with diverse and complex eco-systems (e.g. the human body).

2) **Building on the fundamental principles of Microbiology**: The proposed course builds on the fundamental principles of microbiology introduced at the third year level (Biol3150). As such, it offers students a platform for deepening their knowledge of the biology of microorganisms and using the basic concepts of microbiology to synthesize complex concepts about microbial cells behavior in complex systems, such as the human body.

3) **Teaching the relevance of Microbiology to everyday life**: The choice of the human body as the eco-system of interest in this course serves two purposes: i) to make aware of and reflect on the revolution happening in understanding the involvement of microorganisms in human disorders/diseases; microbes are not the mere causative agents of infectious diseases, they can alter the biology and biochemistry of the human body with great consequences. As such, students will be exposed to the most recent advancements in microbiology; and ii) to strengthen the notion that microbiology is as much an applied discipline as it is a fundamental one. For example, learning about the interactions of microorganisms with their environment (i.e. the human body in the proposed course) will teach students about the surface structural elements of microorganisms used to attach and colonize the host, about the host taking advantage of the microbial cells metabolism, and why the metabolism of certain microorganisms is not compatible with the host and what is the impact on the host.

4) **Human health aspects of Microbiology are relevant to other programs at York**: The connection of this course with human disorders such as obesity, neurodegenerative disorders, immunological disorders will be of great interest to students not only in the Biology-related Programs at the Faculty of Science, but also to students from the Faculty of Health, especially to those that are part of the Kinesiology and Psychology Programs, for which this course can serve as an elective course.

There is no substantive overlap between this course and others that currently are being offered in the Department of Biology or in other departments at York. There might be some tangential overlap of topics in courses that cover the immune system (eg SC/BIOL 3120) and microbial ecology. However, in this course these topics will not be discussed in-depth but only in the context of the role of microbial activity affecting the eco-system that they inhabit, i.e. the human body.

A limit of 40 students is envisioned for this course.
Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

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| Unit: ______biology_________ | Date: Sept 2020 |
## NEW COURSE PROPOSAL FORM

### Faculty:
Indicate all relevant Faculty(ies)

| Science |

### Department:
Indicate department and course prefix (e.g. Languages, GER)

| Biology/ BIOL |

### Date of Submission:

| |

### Course Number:
Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")

| 4040 | Var: |

### Academic Credit Weight:
Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6)

| 3 |

### Course Title:
The official name of the course as it will appear in the Undergraduate Calendar and on the Repository

| Protein Structure and Mechanisms of Disease |

### Short Title:
Appears on any documents where space is limited - e.g. transcripts and lecture schedules - maximum 40 characters

| Protein Structure and Mechanisms of Disease |

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*With every new course proposal it is the Department’s responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.*
This course introduces advanced topics in protein structure and function, especially how a protein's tertiary structure facilitates its function. The effects of mutations on protein function and their links to various medical disorders or diseases will be explored. The focus of the course will be on the structural basis of interaction with other proteins, DNA, ligands or drug compounds, and will include advanced analysis of and visualization of protein structures using molecular graphics software.

Three lecture hours per week. One term. Three credits.

Prerequisites: BIOL 3010 and BIOL 3130
Course Description: This course will explore the different functions that proteins play in cells, highlighting how their tertiary structures facilitate their function and how amino acid substitutions disrupt their function. Lectures will include the visualization and analysis of protein structures using molecular graphics software. Assignments will include more advanced analysis of the structures. Students are expected to bring their laptops to each lecture.

**Topics:**
1. Introduction to three-dimensional protein structure determination using crystallography, cryo-electron microscopy and nuclear magnetic resonance.
2. Protein structures relating to epigenetics and chromatin (protein complexes including Polycomb repressive complex 1 and nucleosome).
3. Protein structures relating to gene regulation and transcription factors (protein-nucleic acid complexes).
4. Protein structures relating to large molecular machines (GroEL-GroES / ribosome / ATP dependant proteases / ATP synthase).
5. Protein structures relating to cell signaling (ubiquitination and phosphorylation).
6. Protein structures relating to membrane proteins (GPCRs, channels and transporters).
7. Protein structures relating to host-pathogen interactions (hijacking of host protein functions).
8. Protein structures relating to tumour suppressors and cell cycle regulators (p53, myc, fos, cyclins).
9. Protein structures relating to cell-cell contact (cadherins).
10. Protein structures relating to growth factors and receptors (NGF-TrkA).
11. Protein structures relating to enzymatic catalysis.
12. Protein structures relating to CRISPR/Cas mechanisms.

**Learning Objectives:**

This course will include lecture material and presentations.

By the end of this course students should be able to:

1. Distinguish critical features found in protein structures. Identify protein domains and their importance.
2. Describe the structural basis for the recognition of different modifications on chromatin including phosphorylation, acetylation, ubiquitination, and their relationship to function.
3. Explain the structural basis of the interaction of the large protein complexes involved in epigenetics.
4. Distinguish important interactions formed between proteins (transcription factors) and DNA, including the common characteristics found in interactions between transcription factors and DNA
5. Explain the importance of short linear motifs in protein interactions.
6. Describe the structures of large machines and how they function.
7. Describe the structural basis of recognition of phosphorylated residues and their importance in cell signaling.
8. Describe the structural basis of transport and signal transduction.
10. Visualize protein structures.
11. Analyze current literature in the field of protein structure.
12. Interpret ordered and disordered regions in proteins and how these regions affect protein function.
13. Describe how post-translational modifications affect protein structure and ultimately result in altered protein function.
14. Describe methods used to determine protein structures including X-ray crystallography, cryo-electron microscopy and nuclear magnetic resonance.
15. Describe the molecular mechanisms of enzymatic catalysis for methyltransferases, acetylases, deacetylases, kinases, phosphatases, deubiquitinases and ligases.
16. Communicate orally to an audience of peers, information about and interpretations of a protein structure.
Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course will include 3 hours of lecture time each week. Of the 3 hours, 2 hours will be dedicated to the introduction of the topic of the week. The remaining hour will include in-class group work, in-depth discussion of a research article or rigorous analysis of a protein structure.

The initial part of the course will be lecture based with these lectures forming the basis of the presentation topics. The presentation component of the course is where the students will be paired up and will present a novel protein structure obtained from recent publications in Cell, Science or Nature. There will be various assignments during the semester where students will be asked to analyze protein structures (downloaded from rcsb.org) using molecular graphics software.

An important part of the course is learning to visualize and analyse protein structure using available software (PyMOL, iSEE, etc). Instructional videos for using the software will be available from the course website. In addition, students will be expected to bring a laptop (their own or one borrowed from the library) to each lecture. The instructor will model the use of relevant software during lecture (with written instructions), and students will be able to follow along on their laptops. During in-class group work students will work with the software (in groups and individually). Both peers and the instructor will be available to provide support.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained OR in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to

1. Course will be offered every year during the fall semester.
2. Faculty able to teach course are Vivian Saridakis, Yi Sheng, Logan Donaldson.
4. Lecture format will be 2 x 1.5 hours.
5. Expected enrolment will be 50 students.
spend engaged in learning activities required by the course.

**Evaluation:**

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

**20 % Midterm test**

**30 % Assignments**

**10 % Presentations**

**40 % Final Exam**

**Bibliography:**

**A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES**

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and


that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

**LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.**


**Other Resources:**

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain.

**COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.**

**Smart learning lecture hall required to permit analysis of the protein structures. No additional resources are required.**
Course Rationale:
The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

This course proposal results from the latest Biology curriculum review that identified a need for more course offerings at the 4th year level in biochemistry and protein structure. The course will primarily contribute to the courses offered in cell and molecular biology, one of three core strengths within the Biology department. Currently there aren’t any courses that focus on the relationship between protein structure and function at the advanced undergraduate course level, and thus fills a substantial gap in the curriculum. It is expected to have a broad appeal to upper level students in cell and molecular biology. This course will provide students the opportunity to improve their skills in communication and critical thinking.

Expected enrolment: 50 students.

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Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women’s Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.
Accessible format can be provided upon request.
Committee on Academic Standards, Curriculum and Pedagogy

New Course Proposal Form

Faculty:  
Indicate all relevant Faculty(ies)

Science

Department:  
Indicate department and course prefix (e.g. Languages, GER)

Biology, BIOL

Date of Submission:

Course Number:  
Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")

4120 Var:

Academic Credit Weight:  
Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6)

3.0

Course Title:  
The official name of the course as it will appear in the Undergraduate Calendar and on the Repository

Applied Immunology

Short Title:  
Appears on any documents where space is limited - e.g. transcripts and lecture schedules - maximum 40 characters

Applied Immunology

With every new course proposal it is the Department’s responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.
This course explores the structure and function of the immune system and its applications. Students will build a deeper understanding of the molecular, cellular and regulatory mechanisms of the immune system while exploring the research on, and application of, immunology in living systems. Both normal immune functions and disorders of the immune response will be addressed.

Prerequisites: SC/BIOL 3120 3.0
This course explores the structure and function of the immune system and its application. Students will build a deeper understanding of the molecular, cellular and regulatory mechanisms of the immune system while exploring how knowledge of immune processes can be applied to better understand living systems and treat and manage disease.

The course will initially run in a blended format. During face-to-face classes, discussions and activities will be used to investigate current issues in immunology and build research and communication skills. This will be complemented by online and independent activities where students will apply their knowledge of the immune response while further enhancing their critical analysis, writing and communication skills.

Active participation in class will help students gain familiarity with and practice the skills necessary for success in the online and self-directed components of the course. Students will have ample opportunities to interact with, and seek support from, the course instructor and each other, both off- and online.

Overall Course Learning Objectives
Upon successful completion of this course, students will be able to:

- Apply knowledge of the immune system to discussions of organism function.
- Describe how cellular, molecular and regulatory aberrations of the immune response can lead to immunological conditions.
- Explain, with examples, how principles of immunology have been applied to the development of drugs, vaccines and experimental and diagnostic techniques.
- Relate the pathology, treatment and prevention of immune-related conditions to fundamental principles of immunology.
- Critically evaluate scientific literature and integrate and summarize information from a range of published sources.
- Work both individually and in a team to synthesize and communicate ideas in immunology in relation to immune-related conditions, therapies and diagnostics, and infectious disease responses.

The course is divided into seven modules, with each module focusing on course topics and/or skill building. The module course topics are: Self Tolerance, Immunodeficiency, Hypersensitivities, Immunosurveillance, and Infectious Disease Responses. A 7th topic – Immunotherapies – will be integrated across the course.
Course Modules

**Module 1 (3 weeks; face-to-face classes)**
*Topic:* Introduction to Course Topics & Tolerance
*Skill-based Activities:* Finding, reading and evaluating scientific literature; research paper planning; oral and written communication

**Module 2 (2 weeks; online)**
*Topic:* Immunodeficiency & Hypersensitivities (journal club format)

**Module 3 (1 week; face-to-face classes)**
*Topic:* Research and Writing Skills

**Module 4 (2 weeks; online)**
*Topic:* Immunosurveillance (journal club format)

**Module 5 (1 week; face-to-face classes)**
*Skill-based Activities:* Science Communication Skills

**Module 6 (1 weeks; online)**
*Topic:* Infectious Disease Responses (journal club format)

**Module 7 (2 weeks; both face-to-face classes and online)**
*Topic:* Connecting Concepts in Applied Immunology
- Course topics will be reviewed with an emphasis on connections between concepts.
### Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

This course is designed as a blended experience that incorporates both active learning and experiential education components.

To qualify as blended at least 1/3 of in-class meetings must be replaced with online instruction. Students will be provided with a customized schedule at the start of term indicating which in-class meetings will be replaced by online/out of class components. To help build a sense of connectedness and enhance the student experience, in-class meetings will focus on small and larger group activities and discussions and promote student interactions with the instructor and their peers.

Most in-class time will be spent on building essential research, writing and communication skills through activities and discussions. Material necessary to support active participation including review of necessary background knowledge will be provided online before in-class meetings. Active participation in class will also help students gain familiarity with and practice the skills necessary for success in the online and self-directed components of the course.

In weeks without face-to-face classes students will engage in collaborative online activities with their peers. These activities will be scaffolded to encourage participation and accurate understanding of material. The instructor will monitor online participation, provide additional support when necessary, and provide points of self- and graded assessment to ensure students remain on track.

The main online collaborative learning component of the course will be in the form of a student-led journal club. Students will be divided into small groups within which two students per week will present and lead a discussion of one recently published article. All students are expected to have read the assigned article and to participate actively in discussion.

(Journal clubs are used extensively in higher education, especially in health/medical related professional schools because of their effectiveness at teaching critical appraisal and evidence-based decision-making skills. Students deepen their knowledge of the field being studied, while gaining hands on skills in effectively analyzing, evaluating, and utilizing the scientific literature.)

Class time (Module 1; face-to-face) will be used to address the skills needed to successfully engage in journal club.

Journal clubs will take place on Moodle forums, which allow for asynchronous text-based discussions but can also be used to share video and/or audio presentations.

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As journal club hosts students will be assessed on their ability to evaluate, synthesize and summarize concepts within their assigned paper, connecting them to wider course themes, and on their communication skills. They will apply knowledge gained from their analysis of the reading to the creation of an initial presentation of the paper and discussion prompts, and facilitation of the asynchronous discussion of the paper.

The journal club will run for two to three days, at the end of which, the hosting student will write a summary of the discussion to share with the group.

There will also be topic-based activities, and a final summative assignment, to assess students on the knowledge gained from the papers discussed in journal club.

Overall, the journal club structure is designed foster a deeper respect and buy-in for the learning processes makes it more likely students will actively participate, stay on top of their workload and learn effectively with one another.

Peer-reviewed scientific literature will be the main source of course concept specific material, with a focus on primary sources. Focusing on primary publications also allows the course to be easily updated between offerings to keep pace with changes in the field.

All readings and other course material will be freely accessible to students. Readings will come from open access sources, be available through York University Libraries, or otherwise fall under copyright provisions that allow for sharing.

Experiential education helps students apply theory to an experience either in- or out- of class and requires students to reflect upon their learning. In completing the course students will gain a deeper appreciation for the immune system and how knowledge of immune processes can be applied to better understand living systems and treat and manage disease. Activities and assignments will be designed to help students apply course concepts to their lived experiences and students will also be guided in reflections on their learning process.

Students will write a review paper in the format of a "state-of-the-art review". They will choose a suitable topic within the scope of the course, and analyze, evaluate and draw connections between the published literature to write an interpretive synthesis describing the current state of their topic. Scaffolding of the assignment, and in-class and online activities will assist students with the research and writing process. Completing the review paper will also illustrate how scientific fields advance and how knowledge generated becomes incorporated into standard understandings/practices.
The other major assessed piece will be a science communication project. Students will gain skills in knowledge translation for the general public, while learning about immunotherapies. The science communication project will take the form of podcasts, building oral communication skills serving as a complement to other course components. In completing the project students will reflect upon how scientific advancements are communicated to a general audience and how communication effects things such as willingness to accept proposed medical treatments and trust in medical systems.

**Instruction:**

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained OR in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. 3-credit course, 1 section offered at least once a year, with the potential to offer 1 section per semester throughout the year
2. Immunology is a broad field that overlaps with many other study areas. Most department faculty with a research focus on animal physiology, and cell and molecular biology, could potentially teach the course.
3. The course has been developed by CUPE 3903 contract faculty member, Tanya Da Sylva. As per the CUPE 3903 Unit 2 Collective Agreement, Dr. Da Sylva will be assigned the course for the first three offerings.
4. A breakdown is given in the Expanded Course Description. There will be between 18 to 24 in-person contact hours (face-to-face class time).

All students will be required to complete topic and skills-based activities online at various points throughout the course and use non-class time to work on major projects/assignments. Online required learning activities will take no more than 18 hours.

The online journal club component will be the bulk of required learning activities during weeks with no scheduled contact hours. These will take place over 5 weeks. During the one-week students are hosting the journal club they may spend over 3 hours on the activity. This will include things such as completing the assigned reading, preparing material and writing the end of discussion summary. If a similar assignment was part of in-
person classes many of these components would still be completed outside of class time.

To do well in a course, students often spend two to three times the number of contact hours per week in self-directed engagement with material (giving 9-12hrs per week per 3-credit course; 3 contact hours plus 6-9 additional hours of self-directed engagement). Hosting the journal club is likely to fall into this range, with the actual posting of material and facilitating of the discussion taking no more than it would if it was part of a typical 90-minute class period. In weeks where students are only responsible for active participation in journal club their time commitment for this component will be significantly lower.
Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Online Student-led Journal Club – 21%

Topic Based Activities – 25%
  • Similar in function to unit tests; can be completed online

Review Paper – 22%

Science Communication Project – 12%

Summary Assignment – 10%
  • Comprehensive assignment that focuses on connections between concepts learned throughout the course

Participation – 10%
  • Throughout the term, both in-person and online

All assessments, except participation, will require students to analyze, synthesize and apply course concepts. Very few marks will be associated with lower-level learning skills such as recall of material that can be easily looked up or shared amongst students. In completing assessments students will be required to submit original unique answers to problems/questions (such as with topic-based activities) or create substantial original material of their own. Focusing on higher levels of assessment and original work will maintain the integrity of evaluations.

Students will also be prompted to review academic integrity policies and guides on acceptable paraphrasing and other key skills, at the start of term and at regular points during the term. Expectations with respect to academic honesty will be clearly communicated. Any suspected cases of academic dishonesty will be reported to the department immediately.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Readings will focus on recent publications and be updated between course offerings, with an emphasis on articles published within two years of the course start date, as such specific readings are not yet chosen. However, all required readings will be freely accessible to students.

Readings will be chosen from open access sources or sources available through licenses held by York University Libraries.

The vast majority of required course readings will come from the following journals:

Journal of Immunology (Baltimore, Md.: 1950: Online); American Association of Immunologists: Bethesda, Md.
Nature Immunology.; Nature America Inc.: New York, NY.
BMC Immunology; BioMed Central: London.
Trends in Immunology.; Elsevier Science: Amsterdam;
Also please list any online resources.

If the course is to be integrated (graduate/undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

<table>
<thead>
<tr>
<th><strong>Frontiers in Immunology.</strong></th>
<th>Frontiers Research Foundation: Lausanne.</th>
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With **some additional required and optional readings** from:

- **Allergy, Asthma, and Clinical Immunology: Official Journal of the Canadian Society of Allergy and Clinical Immunology.;** BC Decker: Hamilton, Ont.
- **Annals of Allergy, Asthma, & Immunology (Online);** American College of Allergy, Asthma, & Immunology: Arlington Heights, Ill.

Review of background knowledge and foundational principles necessary for students to engaged with the recently published literature will be provided through in-class instruction, online videos created by the instructor, and some readings from the following online resources:

- **Autoimmune Info - American Autoimmune Related Diseases Association**
- **Canada, P. H. A. of. Diseases and conditions**
- **Home | AAAAI**
- **Immune Deficiency Foundation |**
- **NIH: National Institute of Allergy and Infectious Diseases | Leading research to understand, treat, and prevent infectious, immunologic, and allergic diseases**
- **What is Immunotherapy?**
Other Resources:
A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain.

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

Courses will only require standard classroom allocation for face-to-face scheduled class periods. All online components can be supported through currently available Moodle features.

Course Rationale:
The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

BIOL 3120 (Immunobiology), which covers the basics of immunology, is one of the most popular third year courses (three offerings per year, all more than 150 students) offered by the Biology department. Students have expressed considerable interest in a fourth-year course in immunology such that they can continue learning about this discipline. Such a course would, no doubt, be a popular one and given the current COVID-19 pandemic, it is also timely.

BIOL 4120 would build on the foundations provided in BIOL 3120 and allow students to explore the contemporary literature. Topics in BIOL 4120 are cutting edge and allow them to see real-life applications of immunological knowledge. The structure of BIOL 4120 will further expand the research and communication skills students have been building throughout their degree.

The high degree of analysis, critical thinking and communication required in this course will contribute to key program learning outcomes.

There is no overlap with existing courses.

Expected enrolment: 50 students
Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women’s Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

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Accessible format can be provided upon request.
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<td>Updating fourth year curriculum</td>
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**Reason(s) for creation/ modification/ retirement:**

Updating fourth year curriculum
## Changes to Existing Course

**Faculty:**

**Department:** Biology

**Date of Submission:** Aug. 2020

**Course Number:** SC/Biol 1001 3.0

**Effective Session:** Sept. 2021

**Course Title:** Biology II: Evolution, Ecology, Biodiversity and Conservation Biology

### Type of Change:

- [x] in pre-requisite(s)/co-requisite(s)
- [ ] in cross-listing
- [ ] in course number/level
- [ ] in degree credit exclusion(s)
- [ ] in credit value
- [ ] regularize course (from Special Topics)
- [ ] in title (max. 40 characters for short title)
- [ ] in course format/mode of delivery *
- [ ] in Calendar description (max. 40 words or 200 characters)
- [ ] retire/expire course
- [ ] other (please specify):

### Change From:

**Prerequisites:** SC/Biol 1000 3.00

### To:

**Prerequisites:** SC/Biol 1000 3.00 12U Biology or SC/Biol 1500 3.00; 12U Chemistry or SC/Chem 1500 4.00.

### Rationale:

This proposal removes the BIOL 1000 prerequisite to facilitate student progression and to permit Env. Sci. students to complete BIOL 1001 without BIOL 1000. Appropriate modifications to both courses will be implemented that will effectively de-couple them.

---

**Note:** For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/Department is required.

**Note:** Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

**Note:** If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised “Course Design” and “Method of Instruction” information.
# Changes to Existing Course

**Faculty:**

**Department:** Biology  
**Date of Submission:** Aug. 2020

**Course Number:** SC/BIOL 4270 3.0  
**Effective Session:** Sept. 2021

**Course Title:** Reproduction

## Type of Change:

- [x] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [x] in title (max. 40 characters for short title)
- [ ] in cross-listing
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [ ] in course format/mode of delivery
- [ ] retire/expire

### SC/BIOL 4270 3.00 Reproduction

Molecular, genetic, cytological and evolutionary aspects of sexual reproduction. Comparison of the regulatory genes and proteins of sexual differentiation in Saccharomyces, Drosophila, Caenorhabditis elegans, mice, human and plants. Evolutionary advantages and disadvantages of sexual reproduction; asexual reproduction through parthenogenic mechanisms. Prerequisites: SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 2040 3.00, SC/BIOL 2070 3.00.

### SC/BIOL 4270 3.00 Integrative Reproduction: Questions & Concepts

Molecular, genetic, cytological and evolutionary aspects of sexual reproduction. Comparison of the regulatory genes and proteins of sexual differentiation in Saccharomyces, Drosophila, Caenorhabditis elegans, mice, human and plants. Evolutionary, molecular, physiological, and ecological aspects of sexual reproduction. Evolutionary advantages and disadvantages of sexual reproduction; asexual reproduction through parthenogenic mechanisms. Topics updated to represent current or relevant findings. Independent and team work on projects, paired with written and oral communication to a variety of audiences. Prerequisites: SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 2040 3.00, SC/BIOL 2070 3.00; SC/BIOL 2040 3.0 and one of the following SC/BIOL 3130 3.00 or SC/BIOL 3171 3.00 or SC/BIOL 3070 4.00.

- [x] in Calendar description (max. 40 words or 200 characters)
- [ ] course
Change From: | To:
---|---

**Rationale:**
This change in description and pre-requisites aligns the course description with the current structure of the course. This course adds to our growing pool of integrative courses.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
# Changes to Existing Course

**Faculty:** Science  
**Department:** Biology  
**Date of Submission:** August 12, 2020  
**Course Number:** BIOL 4400  
**Effective Session:** Winter  
**Course Title:** Behavioural Genetics

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<td>BIOL 4400 Behavioural Genetics: Differences in behaviour are analyzed through evolutionary and mechanistic approaches. Hypotheses, models, experimental and field data are used to address the importance of heredity and environment in the development of individual differences, social systems, communication, habitat and sexual selection. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisites: SC/BIOL 2040 4.00; SC/BIOL 2050 4.00; SC/BIOL 2060 3.00.</td>
<td>BIOL 4400 Behavioural Genetics: Differences in behaviour are analyzed through evolutionary and mechanistic approaches. Hypotheses, models, experimental and field data are used to address the importance of heredity and environment in the development of individual differences, social systems, communication, habitat and sexual selection. <strong>Three lecture hours.</strong> One term. Three credits. Prerequisites: SC/BIOL 2040 4.00; SC/BIOL 2050 4.00; SC/BIOL 2060 3.00; <strong>SC/BIOL 3200 3.00.</strong></td>
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<td>other (please specify):</td>
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*Note: The change in course format/mode of delivery has been highlighted for emphasis.*
Rationale: This fourth year seminar style course benefits from examining primary literature, student presentations, grant writing, mock reviews, and paper discussion. The lab component is replaced with more literature-based active learning and group participation.

The prerequisite of BIOL 3200: Evolution is added since students will need a basic understanding of life history evolution, selection, adaptation, social evolution, brain and behaviour, etc. all covered in BIOL 3200.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
# Changes to Degree Requirement

**Faculty:**

**Department:** Biology  
**Date of Submission:** Sept 1, 2020

**Course Number:** Biomedical Sciences Stream  
**Effective Session:** Fall 2021

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<td>additional biology credits from the following courses, as required, for an overall total of 51 biology credits: SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2060 3.00, SC/BIOL 3010 3.00, SC/BIOL 3060 4.00, SC/BIOL 3070 4.00, SC/BIOL 3071 3.00, SC/BIOL 3100 2.00, SC/BIOL 3110 3.00, SC/BIOL 3120 3.00, SC/BIOL 3130 3.00, SC/BIOL 3140 4.00, SC/BIOL 3150 4.00, SC/BIOL 3155 3.00, SC/BIOL 4000 3.00, SC/BIOL 4000 8.00, SC/BIOL 4010 3.00, SC/BIOL 4020 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4110 4.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4155 3.00, SC/BIOL 4200 3.00, SC/BIOL 4220 4.00, SC/BIOL 4270 3.00, SC/BIOL 4285 3.00, SC/BIOL 4290 4.00, SC/BIOL 4310 3.00, SC/BIOL 4320 3.00, SC/BIOL 4350 4.00, SC/BIOL 4360 3.00, SC/BIOL 4370 3.00, SC/BIOL 4380 3.00, SC/BIOL 4410 3.00, SC/BIOL 4450 4.00, SC/BIOL 4510 3.00;</td>
<td>additional biology credits from the following courses, as required, for an overall total of 51 biology credits: SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2060 3.00, SC/BIOL 3010 3.00, SC/BIOL 3060 4.00, SC/BIOL 3070 4.00, SC/BIOL 3071 3.00, SC/BIOL 3100 2.00, SC/BIOL 3110 3.00, SC/BIOL 3120 3.00, SC/BIOL 3130 3.00, SC/BIOL 3140 4.00, SC/BIOL 3150 4.00, SC/BIOL 3155 3.00, SC/BIOL 4000 3.00, SC/BIOL 4000 8.00, SC/BIOL 4010 3.00, SC/BIOL 4020 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4110 4.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4155 3.00, SC/BIOL 4200 3.00, SC/BIOL 4220 4.00, SC/BIOL 4270 3.00, SC/BIOL 4285 3.00, SC/BIOL 4290 4.00, SC/BIOL 4310 3.00, SC/BIOL 4320 3.00, SC/BIOL 4350 4.00, SC/BIOL 4360 3.00, SC/BIOL 4370 3.00, SC/BIOL 4380 3.00, SC/BIOL 4410 3.00, SC/BIOL 4450 4.00, SC/BIOL 4510 3.00;</td>
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</tbody>
</table>
Honours Major Program (iBSC) Biomedical Science
Stream

additional biology credits from the following courses, as required, for an overall total of 51 biology credits: SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2060 3.00, SC/BIOL 3010 3.00, SC/BIOL 3060 4.00, SC/BIOL 3070 4.00, SC/BIOL 3071 3.00, SC/BIOL 3100 2.00, SC/BIOL 3110 3.00, SC/BIOL 3120 3.00, SC/BIOL 3130 3.00, SC/BIOL 3140 4.00, SC/BIOL 3150 4.00, SC/BIOL 3155 3.00, SC/BIOL 4000 3.00, SC/BIOL 4000 8.00, SC/BIOL 4010 3.00, SC/BIOL 4020 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4110 4.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4155 3.00, SC/BIOL 4200 3.00, SC/BIOL 4220 4.00, SC/BIOL 4270 3.00, SC/BIOL 4285 3.00, SC/BIOL 4290 4.00, SC/BIOL 4310 3.00, SC/BIOL 4320 3.00, SC/BIOL 4350 4.00, SC/BIOL 4360 3.00, SC/BIOL 4370 3.00, SC/BIOL 4380 3.00, SC/BIOL 4410 3.00, SC/BIOL 4450 4.00, SC/BIOL 4510 3.00;

Honours Major Program (iBSC) Biomedical Science
Stream

additional biology credits from the following courses, as required, for an overall total of 68 biology credits: SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2060 3.00, SC/BIOL 3010 3.00, SC/BIOL 3060 4.00, SC/BIOL 3070 4.00, SC/BIOL 3071 3.00, SC/BIOL 3100 2.00, SC/BIOL 3110 3.00, SC/BIOL 3120 3.00, SC/BIOL 3130 3.00, SC/BIOL 3140 4.00, SC/BIOL 3150 4.00, SC/BIOL 3155 3.00, SC/BIOL 3350 4.00, SC/BIOL 4010 3.00, SC/BIOL 4020 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4110 4.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4155 3.00, SC/BIOL 4200 3.00, SC/BIOL 4220 4.00, SC/BIOL 4270 3.00, SC/BIOL 4285 3.00, SC/BIOL 4290 4.00, SC/BIOL 4310 3.00, SC/BIOL 4320 3.00, SC/BIOL 4350 4.00, SC/BIOL 4360 3.00, SC/BIOL 4370 3.00, SC/BIOL 4380 3.00, SC/BIOL 4410 3.00, SC/BIOL 4450 4.00, SC/BIOL 4510 3.00;
Honours Major/Minor Program (iBSC) Biomedical Science Stream

additional biology credits from the following courses, as required, for an overall total of 68 biology credits:
- SC/BIOL 2010 4.00
- SC/BIOL 2030 4.00
- SC/BIOL 2060 3.00
- SC/BIOL 3010 3.00
- SC/BIOL 3060 4.00
- SC/BIOL 3070 4.00
- SC/BIOL 3071 3.00
- SC/BIOL 3110 3.00
- SC/BIOL 3120 3.00
- SC/BIOL 3130 3.00
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- SC/BIOL 3150 3.00
- SC/BIOL 3155 3.00
- SC/BIOL 3160 3.00
- SC/BIOL 3170 3.00
- SC/BIOL 3180 3.00
- SC/BIOL 3190 3.00
- SC/BIOL 3200 3.00
- SC/BIOL 3210 3.00
- SC/BIOL 3220 3.00
- SC/BIOL 3230 3.00
- SC/BIOL 3240 3.00
- SC/BIOL 3250 3.00
- SC/BIOL 3260 3.00
- SC/BIOL 3270 3.00
- SC/BIOL 3280 3.00
- SC/BIOL 3290 3.00
- SC/BIOL 3300 3.00
- SC/BIOL 3310 3.00
- SC/BIOL 3320 3.00
- SC/BIOL 3330 3.00
- SC/BIOL 3340 3.00
- SC/BIOL 3350 4.00
- SC/BIOL 4010 3.00
- SC/BIOL 4020 3.00
- SC/BIOL 4030 3.00
- SC/BIOL 4040 3.00
- SC/BIOL 4050 3.00
- SC/BIOL 4060 3.00
- SC/BIOL 4070 3.00
- SC/BIOL 4080 3.00
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- SC/BIOL 4150 3.00
- SC/BIOL 4160 3.00
- SC/BIOL 4170 3.00
- SC/BIOL 4180 3.00
- SC/BIOL 4190 3.00
- SC/BIOL 4200 3.00
- SC/BIOL 4210 3.00
- SC/BIOL 4220 3.00
- SC/BIOL 4230 3.00
- SC/BIOL 4240 3.00
- SC/BIOL 4250 3.00
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- SC/BIOL 4270 3.00
- SC/BIOL 4280 3.00
- SC/BIOL 4290 4.00
- SC/BIOL 4300 3.00
- SC/BIOL 4310 3.00
- SC/BIOL 4320 3.00
- SC/BIOL 4330 3.00
- SC/BIOL 4340 3.00
- SC/BIOL 4350 4.00
- SC/BIOL 4360 3.00
- SC/BIOL 4370 3.00
- SC/BIOL 4380 3.00
- SC/BIOL 4390 3.00
- SC/BIOL 4400 3.00
- SC/BIOL 4410 3.00
- SC/BIOL 4420 3.00
- SC/BIOL 4430 3.00
- SC/BIOL 4440 3.00
- SC/BIOL 4450 4.00
- SC/BIOL 4460 3.00
- SC/BIOL 4470 3.00
- SC/BIOL 4480 3.00
- SC/BIOL 4490 3.00
- SC/BIOL 4500 4.00
- SC/BIOL 4510 3.00

Rationale:

BIOL 4450 4.00 has long been part of the BioMed stream. Several years ago this course was converted to a three credit course, BIOL 3350 4.0, but it was not added to the BioMed stream due to an error of omission. We are now correcting that omission.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
Changes to Existing Course

<table>
<thead>
<tr>
<th>Faculty:</th>
<th>Date of Submission:</th>
<th>September 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department: Biology</td>
<td>Effective Session:</td>
<td>Fall 2021</td>
</tr>
<tr>
<td>Course Number: BIOL 3100 2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Title: Current Topics in Biological Research</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Type of Change:

- [ ] in pre-requisite(s)/co-requisite(s)
- [ ] in cross-listing
- [ ] in course number/level
- [ ] in degree credit exclusion(s)
- [ ] in credit value
- [ ] regularize course (from Special Topics)
- [ ] in title (max. 40 characters for short title)
- [X] in course format/mode of delivery *
- [ ] in Calendar description (max. 40 words or 200 characters)
- [ ] retire/expire course
- [ ] other (please specify):

### Change From:

### To:
This course is a prerequisite for students wishing to enroll in the Honours Thesis course in their 4th year of study (SC/Biol 4000 8.00 or SC/Biol 4000 3.00).

The course was created when the program was far smaller, to expose students to research within the department and to prepare them for honours thesis work. While intended only for students planning to complete an Honours Thesis, it is taken by many honours students, not just those who will complete the thesis, resulting in large sections that make it impossible to meet key course objectives (such as developing presentation and writing skills). We are unable to meet demand for the course.

Faculty research information is now available online, and key skills required for thesis work have now been incorporated directly into BIOL 4000; thus BIOL 3100 is no longer required.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised 'Course Design' and 'Method of Instruction' information.
**Changes to Existing Course**

**Faculty:**

**Department:** Biology  
**Date of Submission:** September 2020

**Course Number:** BIOL 4000 3.0 and 8.0  
**Effective Session:** Fall 2021

**Course Title:** Honours Thesis

**Type of Change:**

- [x] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [ ] in title (max. 40 characters for short title)
- [ ] in Calendar description (max. 40 words or 200 characters)
- [ ] other (please specify):

**Change From:**

<table>
<thead>
<tr>
<th>BIOL 4000 8.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course Description:</strong></td>
</tr>
<tr>
<td>A research thesis based on laboratory and/or field investigations under the supervision of a faculty member. Rules governing this course are outlined in the Department of Biology undergraduate handbook. Note: Only open to Honours students majoring in biology and environmental biology or environmental science (life sciences stream) with at least 84 credits, and a Biology Major GPA of at least 6.0. Prerequisite: SC/BIOL 3100 2.00.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BIOL 4000 3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course Description:</strong></td>
</tr>
<tr>
<td>A substantial written thesis, including a literature review based on library investigations, under the supervision of a faculty member. Rules governing this course are outlined in the Department of Biology undergraduate handbook. Note: Open only to Honours students majoring in Biology, Environmental Biology or Environmental Science (life sciences stream) with at least 84 credits, and a Biology Major GPA of at least 6.0. Prerequisite: SC/BIOL 3100 2.00.</td>
</tr>
</tbody>
</table>

**To:**

<table>
<thead>
<tr>
<th>BIOL 4000 8.0</th>
</tr>
</thead>
<tbody>
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<td><strong>Course Description:</strong></td>
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<tr>
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</table>

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<th>BIOL 4000 3.0</th>
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</tr>
</tbody>
</table>
**Rationale:**

As the program has grown, enrolments in BIOL 3100 have become far too large to actually meet the learning outcomes of the course. Consequently, key skills required for thesis work have now been incorporated directly into BIOL 4000; thus BIOL 3100 is no longer required.

*Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
Proposal For Minor Modifications to Biology Degree Requirements

1. **Program:** Honours Specialized Programs in Biology

2. **Degree Designation:**

   BSc Biology Hons. Specialized (including BioMed stream)

   International BSc Biology Hons. Specialized

3. **Type of Modification:** Removal of SC/BIOL 3100 course requirement for BSc. Hons. Specialized Degrees.

4. **Effective Date:** Fall 2021

5. **Provide a general description of the proposed changes to the program.**

   We are removing the requirement of SC/BIOL 3100 2.0 from the Hons Specialized Programs in Biology.

6. **Provide the rationale for the proposed changes.**

   The course is being retired. It was a prerequisite to the honours thesis BIOL 4000. Key content from the course will instead be directly incorporated into BIOL 4000 where it is most relevant and will be more effectively delivered.

7. **Describe any resource implications and how they are being addressed.** This change will save resources, as teaching and TA resources previously required for this course can be redeployed to other areas that are under-resourced, such as second, third and fourth year course offerings.
8. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.

<table>
<thead>
<tr>
<th>Current Calendar Copy</th>
<th>Proposed Calendar Copy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Honours Programs</strong></td>
<td><strong>Honours Programs</strong></td>
</tr>
<tr>
<td>SPECIALIZED HONOURS PROGRAM</td>
<td>SPECIALIZED HONOURS PROGRAM</td>
</tr>
<tr>
<td>Students may follow a stream in biology, biomedical science or biotechnology.</td>
<td>Students may follow a stream in biology, biomedical science or biotechnology.</td>
</tr>
<tr>
<td>A. General education:</td>
<td>A. General education:</td>
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<tr>
<td>non-science requirement: 12 credits;</td>
<td>non-science requirement: 12 credits;</td>
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<td>mathematics: SC/MATH 1505 6.00, or six</td>
</tr>
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<td>credits from SC/MATH 1013 3.00, SC/MATH</td>
<td>credits from SC/MATH 1013 3.00, SC/MATH</td>
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<td>computer science: LE/EECS 1520</td>
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<td>3.00 or LE/EECS 1530 3.00 or LE/EECS 1540</td>
<td>3.00 or LE/EECS 1530 3.00 or LE/EECS 1540</td>
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<td>3.00; foundational science: one of SC/CHEM 1000</td>
<td>foundational science: one of SC/CHEM 1000</td>
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<td>3.00 and SC/CHEM 1001 3.00 (prerequisites for</td>
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<td>SC/Biol 2020 3.00 and SC/CHEM 2020</td>
<td>SC/Biol 2020 3.00 and SC/CHEM 2020</td>
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<td>3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.</td>
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<tr>
<td>Note that the biomedical science and biotechnology streams require specific courses (see below).</td>
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<tr>
<td>B. Major requirements:</td>
<td>B. Major requirements:</td>
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<tr>
<td><strong>Biology Stream</strong></td>
<td><strong>Biology Stream</strong></td>
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<tr>
<td>The program core, as specified above (24 credits);</td>
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<td>SC/Biol 3100 2.00, SC/Biol 4000</td>
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<td>8.00 or SC/Biol 4000 3.00;</td>
<td>8.00 or SC/Biol 4000 3.00;</td>
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<tr>
<td>additional credits from biology courses, as required for an overall total of at least 68</td>
<td>additional credits from biology courses, as required for an overall total of at least 68</td>
</tr>
</tbody>
</table>
credits must be at the 3000 level or higher, of which at least 12 credits are at the 4000 level.

### Biomedical Science Stream

<table>
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<th>Credits</th>
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Within the 68 biology credits, at least 18 credits must be at the 3000 level or higher, of

### Biomedical Science Stream

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Within the 68 biology credits, at least 18 credits must be at the 3000 level or higher, of
which at least 12 credits must be at the 4000 level. This must also include a minimum of seven credits from 3000 level or higher biology courses with an associated laboratory component.

**SPECIALIZED HONOURS IN BIOLOGY (HONOURS IBSC)**

A. General education:

- non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component);
- mathematics: `SC/MATH 1505 6.00`, or six credits from `SC/MATH 1013 3.00`, `SC/MATH 1014 3.00`, `SC/MATH 1025 3.00`;
- computer science: `LE/EECS 1520 3.00` or `LE/EECS 1530 3.00` or `LE/EECS 1540 3.00`;
- foundational science: one of `SC/CHEM 1000 3.00` and `SC/CHEM 1001 3.00` (prerequisites for `SC/BIOL 2020 3.00` and `SC/CHEM 2020 3.00`); `SC/PHYS 1410 6.00`; `SC/PHYS 1420 6.00`; `SC/PHYS 1010 6.00`; `SC/ISCI 1310 6.00`; `SC/PHYS 1411 3.00` and `SC/PHYS 1412 3.00`; `SC/PHYS 1421 3.00` and `SC/PHYS 1422 3.00`; `SC/PHYS 1011 3.00` and `SC/PHYS 1012 3.00`; `SC/ISCI 1301 3.00` and `SC/ISCI 1302 3.00`.

B. Major requirements:

- the program core as specified above (24 credits);
  - `SC/BIOL 3100 2.00`;
  - `SC/BIOL 4000 8.00` or `SC/BIOL 4000 3.00`;
- additional credits from biology courses, as required for an overall total of at least 62 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level.

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- additional credits from biology courses, as required for an overall total of at least 62 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level.
**Changes to Existing Course**

**Faculty:**

**Department:** Mathematics & Statistics  
**Date of Submission:**

**Course Number:** SC/MATH 2001 3.00  
**Effective Session:** 2020-2021

**Course Title:** Real Analysis I

**Type of Change:**

- [x] in Calendar description (max. 40 words or 200 characters)
- [ ] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [ ] in title (max. 40 characters for short title)
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [ ] in course format/mode of delivery *
- [ ] retire/expire course
- [ ] other (please specify):

**Change From:**

Axioms for, and properties of, the real numbers; sequences; functions of a real variable, continuity, and differentiation. Rigorous definitions of convergence and limit underpin a proof-based treatment of the subject material. Intended for Honours students in Mathematics.

Prerequisites: SC/MATH 1200 3.00, SC/MATH 1310 3.00.

Course credit exclusion: SC/MATH 3110 3.00, GL/MATH 3320 3.00.

NCR note: MATH 2001 3.00 is not open to any student who has passed MATH 1010 3.00

**To:**

Axioms for, and properties of, the real numbers; sequences; functions of a real variable, continuity, differentiation, Riemann integration. Rigorous definitions of convergence and limit underpin a proof-based treatment of the subject material. Intended for Honours students in Mathematics.

Prerequisites: SC/MATH 1200 3.00, SC/MATH 1310 3.00.

Course credit exclusion: SC/MATH 3110 3.00, GL/MATH 3320 3.00.

NCR note: MATH 2001 3.00 is not open to any student who has passed MATH 1010 3.00
Rationale: The notion of Riemann integration was moved to MATH 2001 from MATH 3001 to make MATH 2001 a more complete study of analysis and in order to make more room in MATH 3001 for more advanced topics.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
Changes to Existing Course

Faculty:

Department: STS/NATS

Date of Submission: July 2020

Course Number: NATS 1570

Effective Session: 2021/2022

Course Title: Exploring the Solar System

Type of Change:

☐ in pre-requisite(s)/co-requisite(s)  ☐ in cross-listing
☐ in course number/level
☐ in degree credit exclusion(s)
☐ in credit value
☐ regularize course (from Special Topics)
☐ in title (max. 40 characters for short title)
☐ in course format/mode of delivery *
☐ in Calendar description (max. 40 words or 200 characters)
☐ retire/expire course
☐ other (please specify): CCE/NCRs

Change From:

Course credit exclusions: SC/NATS 1740 6.00, SC/NATS 1880 6.00, SC/NATS 1750 6.00. NCR: if this course is taken after the successful completion of SC/PHYS 1070 3.00. Not open to any students enrolled in the Astronomy Stream.

Course credit exclusions: SC/NATS 1740 6.00, SC/NATS 1880 6.00, SC/NATS 1750 6.00. NCR: to any student who has successfully taken or is taking SC/PHYS 1070 3.00 or SC/PHYS 1470 3.00. Not open to any students enrolled in the Astronomy Stream.

To:

Course credit exclusions: SC/NATS 1740 6.00, SC/NATS 1880 6.00, SC/NATS 1750 6.00. NCR: to any student who has successfully taken or is taking SC/PHYS 1070 3.00 or SC/PHYS 1470 3.00. Not open to any students enrolled in the Astronomy Stream.
Rationale: Updating NCRs.
This will lend clarity for student who have taken PHYS 1470, where PHYS 1070 is a CCE.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
### Changes to Existing Course

**Faculty:**

<table>
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<tr>
<th>Department:</th>
<th>STS/NATS</th>
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**Date of Submission:** July 2020

**Course Number:** NATS 1585

**Effective Session:** 2021/2022

**Course Title:** Astronomy: Exploring the Universe

### Type of Change:

- [ ] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [ ] in title (max. 40 characters for short title)
- [x] other (please specify): CCE/NCRs
- [ ] in cross-listing
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [ ] in course format/mode of delivery *
- [ ] retire/expire course

### Change From:

Course credit exclusions: SC/NATS 1740 6.00. NCR: if this course is taken after SC/PHYS 1070 3.00. Not open to any student enrolled in the Astronomy stream. Minimal simple arithmetical calculation at about the Grade 10 level.

### To:

Course credit exclusions: SC/NATS 1740 6.00. NCR: to any student who has successfully taken or is taking SC/PHYS 1070 3.00 or SC/PHYS 1470 3.00. Not open to any student enrolled in the Astronomy stream. Minimal simple arithmetical calculation at about the Grade 10 level.
Rationale: Updating NCRs. This will lend clarity for student who have taken PHYS 1470, where PHYS 1070 is a CCE.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
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<td>Course credit exclusions: SC/NATS 1880 6.00, SC/NATS 1570 3.00, SC/NATS 1585 3.00. NCR: to any student who has successfully taken or is taking SC/PHYS 1070 3.00 or SC/PHYS 1470 3.00. Not open to any students enrolled in the Astronomy stream.</td>
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</table>
Rationale:

Updating NCRs.
This will lend clarity for student who have taken PHYS 1470, where PHYS 1070 is a CCE.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
Changes to Existing Course

Faculty:  
Department: STS/NATS  
Date of Submission: April 2020

Course Number: 1750  
Effective Session: 2021/2022

Course Title: Earth and its Atmosphere.

Type of Change:

- [ ] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [x] in Calendar description (max. 40 words or 200 characters)
- [ ] in title (max. 40 characters for short title)
- [ ] in cross-listing
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [ ] in course format/mode of delivery *
- [ ] retire/expire course
- [ ] other (please specify):

Change From:
Topics addressed concerning the Earth include geochronology, seismology, geomagnetism and plate tectonics. Topics addressed concerning the atmosphere include the general circulation, climate change, ozone depletion, weather and violent storms.

To:
In this course we describe the physical properties and characteristics of Earth as an active system. We will look at the overall structure of Earth and how it is a dynamic system. Plate tectonics, the constantly changing surface of Earth, the nature of water and oceans and the atmosphere will be covered. We will also address how these different elements interact. We will touch briefly on other solar system bodies, and how they may be similar to or different from Earth. We will also look at how geology plays a role in the mineral resources on Earth. The effect and interaction with life will also be touched on.
Rationale:

Course description is highly technical and not suited to the level of natural science students and not particularly descriptive of what is covered.

Although the content is unchanged, the new course description better reflects the topics in the course and the level at which the students are engaging the material.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
Changes to Existing Course  
Faculty of Health Curriculum Committee

School/Department: 

Course Information:

Faculty: HH  Rubric: NRSC  Course #: 3000  Weight: 3.00

Course Title: Molecular and Cellular Basis of Perception and Cognition

Effective Session for Change: Term: Fall  Year: 2021-22

Type of Change (‘x’ all that apply):

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<td>retire/expire course</td>
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<tr>
<td>in course credit exclusion(s)†</td>
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</tbody>
</table>

X in short title (maximum 40 characters)

Proposed short title: Molecular and Cellular Neurobiology

X in full title (maximum 60 characters)

Proposed full title: Molecular and Cellular Neurobiology

Other (please specify)

Rationale for Change:

There are no changes to the course description or learning outcomes, just the title to reflect better the content of the course. As a core component of the Neuroscience program, this course explores the molecular, structural and cellular basis of complex brain functions focusing on perception, learning and memory. It also proposes to discuss technological advances in areas of genome engineering, optogenetics, imaging and animal models used in the field. Examples of human neurological disease conditions are used whenever appropriate to exemplify the consequences of sensory deficiencies in the nervous system.

Upon successful completion of the course students will be able to:

- Describe the structural, molecular and cellular components of the nervous system relevant to perceive and process sensory information.
- Describe the structural, molecular and cellular components of the nervous system relevant for learning and memory.
- Describe fundamental processes that generate, shape and maintain sensory organs in the developing and aging brain.
- Explain the molecular and cellular basis of fundamental processes in signal transduction (e.g. Membranes and Membrane Potentials, The Action Potential, Voltage-dependent Membrane Permeability) with a focus on sensory organs, learning and memory.
- Explain the functions of Ion Channels, Electrical and Chemical Synapses.
• Explain the functions of Signal Transduction Pathways.
• Describe pathological mechanisms of inherited sensory deficiencies like deafness or forms of blindness from a molecular and cellular perspective.
• Describe pathological mechanisms of learning and memory deficiencies
• Critique published decisions about- or arguments related to- real-world topics related to the nervous system with a focus on sensory processing, learning and memory.
• Compare the use of several state-of-the-art technologies to investigate the Sensory Systems in Health and Disease.
• Compare in vitro and in vivo strategies to investigate sensory systems from molecules to structures and cells.

When sensory systems get more complex converting sensory information to long lasting memories they enable us to respond to a constantly changing environment evoking physiological responses and behaviours. This is facilitated through highly complex processes originating in specialized nerve cells communicating within our brains. Understanding the molecular, structural and cellular basis of perception and how perception is converted into long lasting memories, maintained and protected over a lifetime is one of the most important questions in Neurobiology. Therefore, although the original title was precise it did not capture the whole of what the course would be covering so we propose that the course title be changed to something more general such as “Molecular and cellular neurobiology”.

* Cross-listed courses are offered jointly by two or more teaching units (such as departments or divisions), or teaching units in two or more different Faculties. Regardless of the offering Faculty or discipline identified by the course prefix of a cross-listed course, every offered section of a cross-listed course is substantially the same as every other and all are therefore recognized as instances of the “same” course.

† “Course Exclusion” is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both. Course exclusion status requires the same curricular approval process required for establishing cross-listings. Course exclusions will be recognized by all Faculties and programs.

The Faculty of Health Curriculum Committee requires that the course description, as listed in the course repository be included below in its entirety.

Please adhere to the format and order below for course description submissions:

- **Course Number** (credit value should be taken to two decimal places (i.e. 6.00 and 3.00)
- **Course Title** (maximum 40 characters)
- **Course Description** (maximum 60 words. For editorial consistency, verbs should be in present tense.)
- **Integrated with** (list the graduate level courses that the course is integrated with. Do not include if the course is not integrated.)
- **Prerequisite** (list of prerequisite courses etc. Only include if there are prerequisites.)
- **Corequisite** (list of corequisite courses etc. Only include if there are corequisites.)
- **Pre/Corequisite** (list of courses etc. which can be taken as pre- or corequisites.)
- **Course Credit Exclusion(s)** (list of exclusions)
- **Open to** (should only be used if this course is limited to a specific group of students)
- **Not open to** (should only be used if the course is closed to a specific group of students)
- **Notes** (includes any other information which is necessary for students to know before enrolling in the course)

Denote additions in **bold, underlining, and strikethrough for deletions.**
HH/NRSC 3000 3.00 Molecular and Cellular Basis of Perception and Cognition

Explores the molecular, structural and cellular basis of complex brain functions focusing on perception, learning and memory. Discuss technological advances in areas of genome engineering, optogenetics, imaging and animal models used in the field. Examples of human neurological disease conditions are used whenever appropriate to exemplify the consequences of sensory deficiencies in the nervous system.

Prerequisites: HH/NRSC 2000 3.00 or SC/NRSC 2000 3.00 and HH/NRSC 2100 3.00 or SC/NRSC 2100 3.00
Corequisites: HH/NRSC 2200 3.00 or SC/NRSC 2200 3.00
Open to: Honours and Specialized Honours BSc students
Cross-listed to: SC/NRSC 3000 3.00

HH/NRSC 3000 3.00 Molecular and Cellular Basis of Perception and Cognition Neurobiology

Explores the molecular, structural and cellular basis of complex brain functions focusing on perception, learning and memory. Discuss technological advances in areas of genome engineering, optogenetics, imaging and animal models used in the field. Examples of human neurological disease conditions are used whenever appropriate to exemplify the consequences of sensory deficiencies in the nervous system.

Prerequisites: HH/NRSC 2000 3.00 or SC/NRSC 2000 3.00 and HH/NRSC 2100 3.00 or SC/NRSC 2100 3.00
Corequisites: HH/NRSC 2200 3.00 or SC/NRSC 2200 3.00
Open to: Honours and Specialized Honours BSc students
Cross-listed to: SC/NRSC 3000 3.00

Confirmation of Consultation/Approval:

If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

Indicate the consultation, approval and additional documentation applicable to the proposal:

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approval by Department/School’s Curriculum Committee</td>
<td></td>
</tr>
<tr>
<td>Statement(s) from the collaborating unit</td>
<td></td>
</tr>
</tbody>
</table>
October 2020

The Faculty of Science Curriculum Committee has reviewed proposals for changes to course information and degree requirements and recommends to the Executive Committee that the following changes be submitted to Council for approval.

Details regarding these proposals (and regarding other minor changes to Calendar/Repository course descriptions and prerequisites which were approved by the Committee but are not reported here) are included in the working papers of October 27, 2020, meeting of the Curriculum Committee, which are on file for your inspection in the Office of the Dean, with all members of the Curriculum Committee or by contacting the Secretary of the Committee at tinar@yorku.ca

1.2 BIOL


1.2.2 Change to pre-requisites, credit value and degree credit exclusion: SC/BIOL 2050 4.0 “Ecology”

1.2.3 Change in degree requirements (updating program core): Biology Bachelor; Specialized Honours program, Biology stream; Honours Major Program, Biology Stream; Honours Major/Minor, Biology stream, and iBSc. Specialized Honours in Biology; iBSc. Honours Major, Biology; iBSc Honours Major/Minor, Biology stream.

1.2.4 Change in degree requirements (updating program core): Biomedical Science Stream, Specialized Honours; Biomedical Science Honours Major Program; Biomedical Science Stream, Honours Major/Minor, and iBSc.Biomedical Science Honours. and iBSc. Biomedical Stream Honours Major/Minor.

1.2.5 Change in degree requirements (updating program core): Environmental Biology Bachelor; Environmental Biology, Honours Major; Environmental Biology, Honours Double Major; Environmental Biology, Honours Major/Minor; and Environmental Biology Honours Minor.

1.2.6 Change in prerequisite: SC/BIOL 2021 3.0 “Cell Biology”

1.2.7 Retire/Expire: SC/BIOL 3001 2.0 “Field Course”

1.2.8 Retire/Expire: SC/BIOL 3002 2.0 “Field Course”

1.3 MATH

--- These items were deferred from last meeting – MATH representative is supposed to attend

1.3.1 Change in pre-requisite, title and calendar description: SC/MATH 4011 “Real Analysis III”

1.3.2 Change in pre-requisite, title and calendar description: SC/MATH 4012 3.0 “Analysis IV”

1.3.3 Change in degree requirements: BSc. and BA degree in Pure and Applied Math program – change to Specialized Honours, Honours Majors and Bachelors
1.4 NATS
1.4.1 Change in CCE/NCRs: SC/NATS 1510 “History of the Environment”
1.4.2 Change in CCE/NCRs: SC/NATS 1840 “Science, Technology and the Environment”
1.4.3 New Course: SC/NATS 1595 3.0 “The Mathematics of Biology”

1.5 PHYSICS
1.5.1 - 1.5.2 Change in degree requirements: (addition of PHYS 2030 3.0 and change of PHYS 4270 4.0 to PHYS 4270 3.0)
1.5.3 Change in credit value: SC/PHYS 4270 4.0 “Astronomical Techniques”

1.6 CHEM
1.6.1 New Course: SC/CHEM 2000 3.0 “Problem Solving in Chemistry”
COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY
TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty:
Indicate all relevant Faculty(ies)

Science

Department:
Indicate department and course prefix (e.g. Languages, GER)

Biology, BIOL

Date of Submission:
August 2020

Course Number:
Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is “C”)

BIOL 2080 3.0 Cross-list to ENVB 2080 3.0

Var:

Academic Credit Weight:
Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6)

3.0

Course Title:
The official name of the course as it will appear in the Undergraduate Calendar and on the Repository

Ecology in Practice - Research Fundamentals in Ecology and Evolution

Short Title:
Appears on any documents where space is limited - e.g. transcripts and lecture schedules - maximum 40 characters

Ecology in Practice

With every new course proposal it is the Department’s responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.
This course focuses on experiential learning in field and laboratory settings to help students acquire practical research skills in ecology, including applied aspects of evolution. It introduces students to a range of methods – from traditional approaches to modern tools and technologies – to address ecological and related evolutionary questions. Students work collaboratively to design and conduct research projects, test hypotheses, analyze and interpret data, and communicate scientific findings to different audiences.

Prerequisites: One of the following: (1) SC/Biol 1000 3.0 AND SC/Biol 1001 3.0; or (2) SC/Isci 1101 3.0 AND SC/Biol 1102 3.0; or (3) SC/Isci 1110 6.0

Cross-listed to: SC/Envb 2080 3.00
This course gives students the opportunity to develop practical research skills in ecology and evolution. Students explore and evaluate a broad range of ecological and evolutionary research methods and technologies and gain practical research experience applying select techniques in the field and/or laboratory. In a hands-on approach, students pose their own research questions, design their own study or survey and apply appropriate ecological methods to address these questions and statistics to analyze their data. Students then report on their results using different types of media, catering to different audiences. Throughout the course students will reflect on the methods they are implementing and their experiences. At the end of the course students will showcase their findings and report in a conference-style setting. Individual topics/examples will be updated periodically to reflect new developments and priorities in the field.

**Learning Objectives:**

By the end of this course students should be able to:

1. Explain the concept of biodiversity, including how it is estimated, and the factors influencing species abundances and distributions, and why these matter in a conservation context.
2. Describe how ecosystems function, species’ roles and interactions within ecosystems and how ecosystems can change over time.
3. Apply the process of observation and scientific inquiry to ecological problems, including hypothesis testing, data collection, analysis, visualization, interpretation, and reporting.
4. Critically evaluate different survey, monitoring and quantification methods and design an ecological survey and monitoring project.
5. Carry out observational studies/experiments designed in collaboration with others and use appropriate tools such as instruments and apps in a field and/or laboratory setting.
6. Effectively communicate scientific concepts and findings to different audiences using a variety of methods.
7. Demonstrate critical thinking and problem-solving skills, including troubleshooting in a field and/or laboratory setting.
8. Critically assess and discuss relevant scientific articles in the context of their own studies or experiments.
9. Contribute to community science (formerly ‘citizen science’) initiatives.

**Topics/theories/techniques:**

- Critical thinking and scientific literacy
- Design of surveys, observational studies and experiments
- Use of instruments, apps and other tools in field and laboratory settings
- Basic statistics and graphical presentation in the context of ecological data
- Species identification and surveying
- Introduction to short and long-term monitoring of populations and/or communities, including use of devices and techniques commonly employed by governmental agencies, NGOs and consulting companies (e.g. acoustic monitoring devices)
- The role of traditional ecology knowledge from indigenous peoples
- Molecular ecology
- Behavioural ecology
Course Design:
Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?
Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.
Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course is designed as one online lecture hour plus six hours of in-person contact time in a practical setting (field or laboratory) per week.

Lectures will explore important ecological concepts as applicable to each field or laboratory module and provide overviews over different ecological techniques and approaches, as well as data analysis and visualization. This course is designed as a blended learning course; in person contact time with instructors and TAs will occur in the laboratory, lectures will be primarily delivered online (through short lecture videos or podcasts and other rich media resources). Lecture material will be presented in this way to allow students to access key information before the relevant practical setting (laboratory or field work), and to review/revisit as often as required. This format also permits instructors to provide targeted supplementary lecture material if the need arises (in a “just-in-time” fashion). Associated online material, including self-assessments in the form of online quizzes, will assist students in preparing for the field or laboratory work and summative assessments in the course.

During the contact time in a field or laboratory setting, students develop and improve research skills in a variety of ways, including TA-lead exercises, collaborative learning activities and independent work (e.g., survey design, data collection/analysis/interpretation). The emphasis on hands-on experiential learning will allow students to gain experience using scientific inquiry to explore ecological questions. Students learn to apply both traditional and modern techniques and technologies, used by ecologists, develop their own questions, design their own surveys and/or observational or experimental studies and implement these to test their hypotheses. This will involve critically analyzing study design and solving problems as they arise. Throughout the different projects students will be guided to develop data analysis and visualization skills and develop scientific literacy. Students will improve their communication skills through communicating scientific concepts, approaches and findings in various oral and written formats (e.g. presentations, podcasts, blogs, posters and written reports), addressing different audiences (e.g. scientific audiences, general public). Readiness quizzes and reporting requirements in a range of different formats will assess how well students have met the learning objectives of the course.
### Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained or in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

| 1. This course will be offered every year in the fall and in other terms as required. |
| 2. Any Biology faculty member with the requisite ecology background (> 10). |
| 3. Birgit Schwarz |
| 4. 7 contact hours per week; 6 hours practical (in person), 1 hour lecture (online) per week |
**Evaluation:**

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

<table>
<thead>
<tr>
<th>Evaluation Components</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Readiness (pre-class) quizzes</td>
<td>5%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Technical/lab reports &amp; assignments</td>
<td>40%</td>
</tr>
<tr>
<td>Group poster &amp; presentation</td>
<td>25%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Bibliography:**

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Readings will include primary and secondary literature published in standard scientific journals available from the York University Library, such as:

- **AMERICAN NATURALIST**
- **ANNUAL REVIEW OF ECOLOGY EVOLUTION AND SYSTEMATICS**
- **BEHAVIORAL ECOLOGY**
- **BIOLOGICAL CONSERVATION**
- **BIOLOGY LETTERS**
- **CONSERVATION BIOLOGY**
- **ECOLOGY**
- **ECOLOGY LETTERS**
- **ECOSYSTEMS**
- **EVOLUTION**
- **FRONTIERS IN ECOLOGY AND THE ENVIRONMENT**
- **FUNCTIONAL ECOLOGY**
- **GLOBAL CHANGE BIOLOGY**
- **GLOBAL ECOLOGY AND BIOGEOGRAPHY**
- **ISME JOURNAL**
- **JOURNAL OF ANIMAL ECOLOGY**
- **JOURNAL OF APPLIED ECOLOGY**
- **JOURNAL OF ECOLOGY**
- **JOURNAL OF EXPERIMENTAL BIOLOGY**
- **LANDSCAPE ECOLOGY**
- **METHODS IN ECOLOGY AND EVOLUTION**
- **MICROBIAL ECOLOGY**
- **MOLECULAR BIOLOGY AND EVOLUTION**
- **MOLECULAR ECOLOGY**
- **MOLECULAR ECOLOGY RESOURCES**
- **NATURE**
- **OIKOS**
- **PLOS BIOLOGY**
- **PROCEEDINGS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES**
- **PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCE**
- **SCIENCE**
- **TRENDS IN ECOLOGY & EVOLUTION**
Other Resources:
A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain.

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

The course requires standard laboratory space allocation for face-to-face scheduled laboratory periods. The existing laboratory space in Lumbers that was used for the SC/BIOL 2050 4.0 laboratory component should be sufficient for all lab exercises with the exception of the molecular ecology component for which 1 to 2 weeks of wet laboratory space would be required. This could occur during the first ~ 3 weeks of the term during which laboratory space allocated to SC/BIOL 2070 is not used (as they run a dry lab then).

All online components can be supported through currently available Moodle features.

Most of the surveying equipment should already be available from SC/BIOL 2050 4.0 labs. Acoustic monitoring equipment will be needed for the monitoring project: AudioMoth acoustic logger 74US$ per device (1 device for every 4 students), plus SD cards and batteries, and waterproof housing case for 40US$/unit that would extend the life of the equipment/help prevent equipment loss. This would be a one-time total cost of approx. 5000US$. This equipment could likely be used by other ecology courses during the terms that SC/BIOL 2080 3.0 is not offered. Additionally, small amounts of standard laboratory consumables would be needed for the molecular ecology lab, plus the cost of sending samples off to be sequenced.

Currently, the SC/BIOL 2050 4.0 course has approximately 250 to 280 students per offering, requiring 10 to 12 labs of 24 to 28 students each. Each lab section requires 1 TA at 0.25 TA assignment (67.5 hours). Thus, the total TA requirements are approximately 2.5 – 3.0 full TAships.

However, we do not expect that the full number of individuals enrolled in SC/BIOL 2050 3.0 will require SC/BIOL 2080 3.0, as students from outside the Ecology/Evolution stream take SC/BIOL 2050 for interest. Given numbers in subsequent ecology/evolution courses, we expect approximately 150 students for each Fall term in SC/BIOl 2080 3.0. Thus, laboratory resources will be directed primarily to students who need or want the laboratory experience, most importantly our own majors. Assuming approximately 24 to 28 students per lab section, with each lab requiring 1 TA at 0.5 TA assignment (135 hours), the total TA requirements for SC/BIOL 2080 3.0 would be 3.0 full TAships.
Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

Currently, students in the Biology program must take either BIOL 2070 3.0 (Research Methods in Cell and Molecular Biology) OR all of BIOL 2010 4.0, 2030 4.0, and BIOL 2050 4.0. Together these latter three courses provide 3.0 credits of lab instruction. To streamline program requirements, students in the Biology program will have to complete one of BIOL 2070 3.0 or BIOL 2080 3.0 (depending on the upper year courses they have chosen) to satisfy second-year lab requirements. This is part of an ongoing effort to improve the quality of the Biology Undergraduate program and will provide students with authentic and effective research experiences, as well as facilitating improvements in pedagogy. As a separate lab course, SC/BIOL 2080 3.0 emphasizes developing important research skills through experiential learning and provides an opportunity for a more focused and relevant course for our students. The course will give students the chance to develop critical skills that have been identified as highly relevant for future careers by professionals in the field and the Vision and Change in Undergraduate Biology Education report (https://visionandchange.org/).

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women’s Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.
Required and Recommended Reading List:
I have reviewed the bibliography that you provided with the course description. We have subscriptions to all the recommended journals for the course.

Electronic Resources and Databases:
The primary databases of relevance include Biological Abstracts, Web of Science, SCOPUS, Environment Complete, GreenFILE, CBCA Complete Ulrich’s International Periodicals Directory; other specialized electronic resources are also available. Numerous electronic books in Ecology and Evolution are also available in the York Libraries catalogue.

Style guides:

The holdings in our library currently support undergraduate and graduate-level courses in related Ecology, Biology and Environmental Sciences. Should there be a need for articles not available in our holdings, interlibrary loan and document delivery options are available through RACER for any additional information needs that may come up. There is no limit to the number of articles that a student or faculty member may order through RACER per year, and these are delivered to the desktop, free of charge. Books can also be requested through this system free of charge. Registration and requesting is available from: http://www.library.yorku.ca/cms/resourcesharing/services-for-york-faculty-and-students/illrequestform/.

Should course instructors want to place any required readings on reserve for student use at Steacie Library, please see the following http://www.library.yorku.ca/cms/faculty/reserves/ for information about what materials can be posted, Fair Dealing Guidelines, etc. Items to be posted can be requested by filling out the form at: http://www.library.yorku.ca/cms/faculty/reserve-request-steacie/.

Library Research and Information Literacy Support:
Librarians provide research skills workshops to students and faculty on request, including but not limited to:

- Designing research strategies from asking a research question to searching the library catalogue, government sources, and databases such as Biological Abstracts, Web of Science, SCOPUS, etc.
- Managing references using bibliographic management software such as Mendeley.
- Writing lab reports.
- Understanding the publication cycle in science.
- Using CSE citation style.

Research guides:
An Ecology Research Guide, Biology Research Guide, Environmental Studies Research Guide, and Research Guides in related fields have been created and are maintained by subject librarians to bring
together online and print resources that may be useful to students and faculty in Ecology. Resources and links will be added upon request.

http://researchguides.library.yorku.ca/Ecology
http://researchguides.library.yorku.ca/Biology
http://researchguides.library.yorku.ca/environmentalstudies

Collection development in the library is ongoing and is based on a commitment to developing library resources that are in alignment with the University’s curricular and research activities. Books in this field will be added to the library collection as they are published. Please forward any requests for purchase to the Biology Subject Librarian: ilo@yorku.ca or submit your purchase request by using the form at http://www.library.yorku.ca/online/purchase.php

In summary, I would state that we are well positioned to support this course.

Sincerely,

Ilo-Katryn Maimets, Science Librarian
102K Steacie Science and Engineering Library
Ext: x33927
E-mail: ilo@yorku.ca
# Changes to Existing Course

**Faculty:**

**Department:** Biology  
**Date of Submission:** Aug. 2020

**Course Number:** SC/BIOL 2050 4.0 cross listed to SC/ENVB 2050 4.0  
**Effective Session:** Sept. 2022

**Course Title:** Ecology

## Type of Change:

- [x] in pre-requisite(s)/co-requisite(s)  
- [ ] in course number/level  
- [x] in credit value  
- [x] in cross-listing  
- [ ] in degree credit exclusion(s)  
- [ ] regularize course (from Special Topics)  
- [ ] in course format/mode of delivery *  
- [ ] in title (max. 40 characters for short title)  
- [ ] in Calendar description (max. 40 words or 200 characters)  
- [ ] retire/expire course  
- [ ] other (please specify):  

## Change From:

**SC/BIOL 2050 4.00**  
Ecology  
A study of the interactions between organisms and their abiotic environments, presented in an evolutionary context. Includes processes of evolution, ecosystems and communities, competition, predation, population ecology and current environmental problems such as habitat loss and extinction. Prerequisite: Both SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00, or SC/ISCI 1110 6.00, or both SC/ISCI 1101 3.00 and SC/ISCI 1102 3.00. Prerequisite or corequisite: SC/BIOL 2060 3.00. 

Cross-listed to SC/ENVB 2050 4.00 Ecology

## To:

**SC/BIOL 2050 4.00**  
Ecology  
A study of the interactions between organisms and their abiotic environments, presented in an evolutionary context. Includes processes of evolution, ecosystems and communities, competition, predation, population ecology and current environmental problems such as habitat loss and extinction. Prerequisite: Both SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00, or SC/ISCI 1110 6.00, or both SC/ISCI 1101 3.00 and SC/ISCI 1102 3.00. Prerequisite or corequisite: SC/BIOL 2060 3.00.  

**Course credit exclusions:** SC/BIOL 2050 4.00 (cross listed to SC/ENVB 2050 4.00)

Cross-listed to SC/ENVB 2050 4.00 3.00 Ecology

**Rationale:**

The change in credit weighting results from the removal of the laboratory component of this course, which will be replaced by BIOL 2080, a new ecological methods course that provides a more experiential and authentic approach to research methods in ecology. Please see the rationale in the BIOL 2080 3.0 course proposal for more information. The 4.00 version will be a course credit exclusion for this new 3.00 credit version.

The change in corequisites reflects the fact that co-requisites cannot be enforced and allows students to take the former co-requisite (SC/BIOL 2060) in Fall, Winter, or Summer, thus facilitating student progression.

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**Note:** For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

**Note:** Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.
* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised "Course Design" and "Method of Instruction" information.
Program Proposal

1. Program: Biology, iBSc Biology

2. Degree Designation:

   BSc Biology (Bachelor);
   Specialized Honours Program, Biology Stream;
   Honours Major Program, Biology Stream;
   Honours Major/Minor, Biology major

   iBSc Specialized Honours in Biology;
   iBSc Honours Major, Biology;
   iBSc Honours Major/Minor, Biology Stream

3. Type of Modification: update of program core

4. Effective Date: Fall 2021

5. Provide a general description of the proposed changes to the program.

   We are making biostatistics (SC/BIOL 2060 3.00) mandatory for all programs, introducing a new second year research methods course (resulting in a credit change to SC/BIOL 2050 4.00), and removing SC/CHEM 2020 and 2021 as an option to replace second year core Biology credits.

   In addition, one housekeeping update – the iBSC Honours Major Program was missing a note about upper year Biology credits.

6. Provide the rationale for the proposed changes.

   - Proposed modifications reflect the proposed changes to second year core requirements as described in section 5 above.

   - Addition of SC/BIOL 2060 3.00 (Biostatistics) as a required course for all programs ensures that students have a foundational understanding of statistics necessary to understand primary literature, experimental design, and data analyses. The AAAS Vision & Change in Undergraduate Biology Education Report (2011) has listed the abilities of Biology students to use quantitative reasoning, modeling and simulation, and connect biology to other sciences, including math as necessary core competencies.

   - SC/BIOL 2080 3.00 is the ecology/evolution sister laboratory course to the cell/molecular laboratory course SC/BIOL 2070 3.00. Previously students in the ecology/evolution disciplinary stream had to take 3 courses, each with 1 credit of lab (SC/BIOL 2010 4.00 + SC/BIOL 2030 4.00 + SC/BIOL 2050 4.00 = 9 hours of lab per week). With the addition of SC/BIOL 2080, all students in the above-listed programs will have to take one of the two research methods (laboratory) courses. Students opting for the ecology/evolution disciplinary stream will have more choice in their second-year core courses and have a similar load (6 hours per week) of laboratory time to those in the cell/molecular disciplinary stream. As well, BIOL 2080 will better prepare students in the ecology/evolution disciplinary stream for higher level courses in experimental design and application of experimental methods.

   - Removal of SC/CHEM 2020/2021 3.0 from the second year biology core: currently biology
majors can replace portions of the second-year Biology core with both SC/CHEM 2020 3.00 and CHEM 2021 3.00. Removing this option will provide Biology students with a more well-rounded understanding of foundational (second-year) Biology concepts and is in line with degree requirements in Chemistry and Physics, where only courses within the major satisfy second year core requirements. It will also reduce student confusion, as many think the CHEM courses count towards BIOL credit totals. CHEM 2020/2021 will continue to be required in specialized programs and streams (Biochemistry, Biotechnology and Biomedical Science). We note that there is still room in the degree program for both CHEM 2020 and CHEM 2021, and we expect many students will continue to take these courses for professional schools and general interest. We also note that the majority of our second year students are in the Biomedical Science Stream, which will still require CHEM 2020/2021.

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives. If changes to the admission requirements are being proposed, comment on the appropriateness of the revised requirements to the achievement of the program learning outcomes.

Under the OCAV Degree Level Expectation Category of “Knowledge of Methodologies”, all above-listed programs require students to be able to “evaluate and carry out appropriate experimental and observational methodologies to answer questions in biology, safely and effectively”, while “Application of Knowledge” requires that students be able to “Apply the process of science by formulating questions, developing hypotheses, designing and carrying out experiments to test hypotheses, collecting, analyzing and interpreting data to draw conclusions and, where appropriate, propose solutions.” The requirement of Biostatics (SC/BIOL 2060 3.00) will help to ensure that our students meet these learning outcomes. The addition of SC/BIOL 2080 3.00 supports these program learning outcomes for students in the ecology/evolution stream.

Removal of SC/CHEM 2020 and 2021 as options to replace BIOL courses in the second-year core supports disciplinary program learning outcomes.

8. If relevant, summarize the consultation undertaken with relevant academic units, including commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

   The Department of Chemistry has been consulted.

9. Describe any resource implications and how they are being addressed (e.g., through a reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

   There are no resource implications.

10. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar. below
### Existing

#### Program Core

The program core (24 credits) is defined as:

- SC/Biol 1000 3.00 and SC/Biol 1001 3.00;
- SC/Biol 2070 3.00 or any three of SC/Biol 2010 4.00, SC/Biol 2030 4.00, SC/Biol 2050 4.00. Both SC/Chem 2020 3.00 and SC/Chem 2021 3.00 may replace one of these three biology courses;

### Proposed

#### Program Core

The program core (24 credits) is defined as:

- SC/Biol 1000 3.00 and SC/Biol 1001 3.00;
- SC/Biol 2070 3.00 or **SC/Biol 2080 3.00** or any three of SC/Biol 2010 4.00, SC/Biol 2030 4.00, SC/Biol 2050 4.00. Both SC/Chem 2020 3.00 and SC/Chem 2021 3.00 may replace one of these three biology courses;

### Bachelor Program

#### A. General education:

- non-science requirement: 12 credits;
- mathematics: SC/Math 1505 6.00, or six credits from SC/Math 1013 3.00, SC/Math 1014 3.00, SC/Math 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/Chem 1000 3.00 and SC/Chem 1001 3.00 (prerequisites for SC/Biol 2020 3.00 and SC/Chem 2020 3.00); SC/Phys 1410 6.00; SC/Phys 1420 6.00; SC/Phys 1010 6.00; SC/ISCI 1310 6.00; SC/Phys 1411 3.00 and SC/Phys 1412 3.00; SC/Phys 1421 3.00 and SC/Phys 1422 3.00; SC/Phys 1011 3.00 and SC/Phys 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

#### B. Major requirements:

- the program core specified above (24 credits);
- additional credits from biology courses, as required for an overall total of at least 46 credits from biology courses, including at least 12 credits at the 3000 level or above.

#### C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement.

### Proposed Bachelor Program

#### A. General education:

- non-science requirement: 12 credits;
- mathematics: SC/Math 1505 6.00, or six credits from SC/Math 1013 3.00, SC/Math 1014 3.00, SC/Math 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/Chem 1000 3.00 and SC/Chem 1001 3.00 (prerequisites for SC/Biol 2020 3.00 and SC/Chem 2020 3.00); SC/Phys 1410 6.00; SC/Phys 1420 6.00; SC/Phys 1010 6.00; SC/ISCI 1310 6.00; SC/Phys 1411 3.00 and SC/Phys 1412 3.00; SC/Phys 1421 3.00 and SC/Phys 1422 3.00; SC/Phys 1011 3.00 and SC/Phys 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

#### B. Major requirements:

- the program core specified above (24 credits);
- additional credits from biology courses, as required for an overall total of at least 46 credits from biology courses, including at least 12 credits at the 3000 level or above.

#### C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement.
D. Upper level: a minimum of 18 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 90 credits.

F. Standing requirements: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program).

### Specialized Honours Program

Students may follow a stream in biology, biomedical science or biotechnology.

#### A. General education:

- non-science requirement: 12 credits;
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

Note that the biomedical science and biotechnology streams require specific courses (see below).

#### B. Major requirements:

**Biology Stream**

- The program core, as specified above (24 credits);
- SC/BIOL 3100 2.00, SC/BIOL 4000 8.00 or SC/BIOL 4000 3.00;
- additional credits from biology courses, as required for an overall total of at least 68 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level.

#### C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science and
biotechnology streams, this requirement is fully satisfied by the above requirements.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirements: to declare Specialized Honours requires successful completion of at least 24 credits, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed and a minimum cumulative credit-weighted grade point average of 6.00 (B) over all biology courses completed.

To proceed in each year of a Specialized Honours program requires a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed and a minimum cumulative credit-weighted grade point average of 6.00 (B) over all biology courses completed.

To graduate in a Specialized Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 6.00 (B) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
**A. General education:**
- non-science requirement: 12 credits;
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1411 3.00 and SC/ISCI 1301 3.00; SC/PHYS 1412 3.00 and SC/ISO 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

**B. Major requirements:**

**Biology stream**
- The program core, as specified above (24 credits);
- additional credits from biology courses, as required, for an overall total of at least 51 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level.

**C. Science breadth:** a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science stream this requirement is fully satisfied by the above requirements.

**D. Upper level:** 42 credits at the 3000 level or above.

**E. Additional elective credits,** as required, for an overall minimum total of 85 credits from science disciplines (including the major) and an overall total of 120 credits.

**F. Standing requirements:** to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
Honours Major/Minor Program

An Honours Major in biology may be combined with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section.

Students may follow a stream within the Honours Major/Minor program in Biomedical Science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors.

A. General education:

- non-science requirement: 12 credits;
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

B. Major requirements:

Biology stream

- the program core as specified above (24 credits);
- additional credits from biology courses, as required, for an overall total of at least 51 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level.
- The course requirements for the minor.

C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. Satisfied if the minor is another science discipline.

D. Upper level: 42 credits at the 3000 level or above.
### E. Additional elective credits, as required for an overall total of 120 credits.

### F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

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#### Specialized Honours in Biology (Honours iBSc)

**A. General education:**

- **non-science requirement:** 12 credits (may be satisfied in whole or part by courses in the international component);
- **mathematics:** SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- **computer science:** LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- **foundational science:** one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

**B. Major requirements:**

- the program core as specified above (24 credits);
- SC/BIOL 3100 2.00;
- SC/BIOL 4000 8.00 or SC/BIOL 4000 3.00;
- additional credits from biology courses, as required for an overall total of at least 62 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level.

In addition, the following must be completed for the international component:

- a minimum of 12 credits of language study in one of the languages offered at York University;
- a minimum of 12 credits of non-science courses with an international component (refer to sample list of courses in the section on
international degrees), which will also serve to meet the non-science requirement of the general education component;

- an additional six credits of language study or non-science international component courses, for a total of 30 credits;
- one to two exchange terms abroad as a full-time student at an institution with which York University has a formal exchange agreement.

C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the above requirements.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirement: to declare Specialized Honours requires successful completion of at least 24 credits, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed and a minimum cumulative credit-weighted grade point average of 6.00 (B) over all biology courses completed.

To proceed in each year of a Specialized Honours program requires a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed and a minimum cumulative credit-weighted grade point average of 6.00 (B) over all biology courses completed.

To graduate in a Specialized Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 6.00 (B) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
Students may follow a stream within the Honours Major program in biomedical science.

A. General education:

- non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component).
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

B. Major requirements:

**Biology stream**

- the program core as specified above (24 credits);
- additional credits from biology courses, as required, for an overall total of at least 45 credits from biology courses (42 credits if SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 are chosen in the core);

In addition, the following must be completed for the international component:

- a minimum of 12 credits of language study in one of the languages offered at York University;
- a minimum of 12 credits of non-science courses with an international component (refer to sample list of courses in the section on international degrees), which will also serve to meet the non-science requirement of the general education component;
- an additional six credits of language study or non-science international component courses, for a total of 30 credits;
- one to two exchange terms abroad as a full-time student at an institution with which York University has a formal exchange agreement.
C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the above requirements.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 85 credits from science disciplines (including the major) and an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

- one to two exchange terms abroad as a full-time student at an institution with which York University has a formal exchange agreement.

C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the above requirements.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 85 credits from science disciplines (including the major) and an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
### Honours Major/Minor Program (iBSc)

Students may follow a stream within the Honours Major/Minor program in biomedical science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors.

#### A. General Education:

- **non-science requirement:** 12 credits (may be satisfied in whole or part by courses in the international component);
- **mathematics:** \(SC/MATH 1505\ 6.00\), or six credits from \(SC/MATH 1013\ 3.00\), \(SC/MATH 1014\ 3.00\), \(SC/MATH 1025\ 3.00\);
- **computer science:** \(LE/EECS 1520\ 3.00\) or \(LE/EECS 1530\ 3.00\) or \(LE/EECS 1540\ 3.00\);
- **foundational science:** one of \(SC/CHEM 1000\ 3.00\) and \(SC/CHEM 1001\ 3.00\) (prerequisites for \(SC/BIOL 2020\ 3.00\) and \(SC/CHEM 2020\ 3.00\); \(SC/PHYS 1410\ 6.00\); \(SC/PHYS 1420\ 6.00\); \(SC/PHYS 1010\ 6.00\); \(SC/ISCI 1310\ 6.00\); \(SC/PHYS 1411\ 3.00\) and \(SC/PHYS 1412\ 3.00\); \(SC/PHYS 1421\ 3.00\) and \(SC/PHYS 1422\ 3.00\); \(SC/PHYS 1011\ 3.00\) and \(SC/PHYS 1012\ 3.00\); \(SC/ISCI 1301\ 3.00\) and \(SC/ISCI 1302\ 3.00\).

#### B. Major requirements:

**Biology stream**

- the program core as specified above (24 credits);
- additional credits from biology courses, as required, for an overall total of at least 45 credits from biology courses (42 if \(SC/CHEM 2020\ 3.00\) and \(SC/CHEM 2021\ 3.00\) are chosen in the core), including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level;
- the course requirements for the minor.

In addition, the following must be completed for the international component:

- a minimum of 12 credits of language study in one of the languages offered at York University;
- a minimum of 12 credits of non-science courses with an international component (refer to sample list of courses in the section on international degrees), which will also serve to meet the non-science requirement of the general education component;
- an additional six credits of language study or non-science international component courses, for a total of 30 credits;
- one to two exchange terms abroad as a full-time student at an institution with which York University has a formal exchange agreement.

C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. On the biology stream, 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science stream this requirement is fully satisfied by the above requirements. Satisfied if the minor is another science discipline.

D. Upper level: 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
Program Proposal

1. Program: Biology, iBSc Biology

2. Degree Designation:
   Specialized Honours Program, Biomedical Science Stream;
   Honours Major Program, Biomedical Science Stream;
   Honours Major/Minor, Biology major, Biomedical Science Stream

   iBSc Honours Major, Biomedical Science Stream;
   iBSc Honours Major/Minor, Biology major, Biomedical Science Stream

3. Type of Modification: update of program core

4. Effective Date: Fall 2021

5. Provide a general description of the proposed changes to the program.
   We are making biostatistics (SC/BIOL 2060 3.00) mandatory for this stream.
   We are also making some minor housekeeping changes (eg adding courses that should be part of this stream).

6. Provide the rationale for the proposed changes.
   - Addition of SC/BIOL 2060 3.00 (Biostatistics) as a required course for all programs ensures that students have a foundational understanding of statistics necessary to understand primary literature, experimental design, and data analyses. The AAAS Vision & Change in Undergraduate Biology Education Report (2011) has listed the abilities of Biology students to use quantitative reasoning, modeling and simulation, and connect biology to other sciences, including math as necessary core competencies.

   - Calendar clean-up: adding new courses BIOL 4120, 4040, 4160; adding missing minor requirements under the Major/Minor, adding missing SC/BIOL 4410 3.00 in the list of accepted Biology courses under the IBSC Major/Minor. (note BIOL 3100 is removed here as it was retired in a separate recent package of changes).

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives. If changes to the admission requirements are being proposed, comment on the appropriateness of the revised requirements to the achievement of the program learning outcomes.

Under the OCAV Degree Level Expectation Category of “Knowledge of Methodologies”, all above-listed programs require students to be able to “evaluate and carry out appropriate experimental and observational methodologies to answer questions in biology, safely and effectively”, while “Application of Knowledge” requires that students be able to “Apply the process of science by formulating questions, developing hypotheses, designing and carrying out experiments to test hypotheses, collecting, analyzing and interpreting data to draw conclusions and, where appropriate, propose solutions.” The requirement of Biostatics (SC/BIOL 2060 3.00) will help to ensure that our students in the Biomedical Science stream meet these learning outcomes.

8. If relevant, summarize the consultation undertaken with relevant academic units, including
commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

9. Describe any resource implications and how they are being addressed (e.g., through a reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

   There are no resource implications.

10. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.
### SPECIALIZED HONOURS PROGRAM

Students may follow a stream in biology, biomedical science or biotechnology.

#### A. General education:

- non-science requirement: 12 credits;
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00. Note that the biomedical science and biotechnology streams require specific courses (see below).

#### B. Major requirements:

##### Biomedical Science Stream

- **SC/CHEM 1000 3.00** and **SC/CHEM 1001 3.00**;
- one of **SC/PHYS 1410 6.00**; **SC/PHYS 1420 6.00**; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- **SC/BIOL 1000 3.00** and **SC/BIOL 1001 3.00**;
- **SC/BIOL 2010 3.00**; **SC/BIOL 2020 3.00**; **SC/BIOL 2040 3.00**; **SC/BIOL 2070 3.00**; **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00**; a minimum of one of **SC/BIOL 2030 4.00** or **SC/BIOL 2060 3.00**; **SC/BIOL 4000 8.00** or **SC/BIOL 4000 3.00**;
- a minimum of nine credits chosen from the following courses: **SC/BIOL 3060 4.00**; **SC/BIOL 3070 4.00**; **SC/BIOL 3110 3.00**; **SC/BIOL 3130 3.00**; **SC/BIOL 3150 4.00**; **SC/BIOL 3155 3.00**; **SC/BIOL 4010 3.00**; **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00**; **SC/BIOL 2060 3.00**; **SC/BIOL 2070 3.00**; **SC/BIOL 4000 8.00** or **SC/BIOE 4000 3.00**;
- a minimum of nine credits chosen from the following courses: **SC/BIOL 3060 4.00**; **SC/BIOL 3070 4.00**; **SC/BIOL 3110 3.00**; **SC/BIOL 3130 3.00**; **SC/BIOL 3150 4.00**; **SC/BIOL 3155 3.00**; **SC/BIOL 4010 3.00**; **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00**; **SC/BIOL 2060 3.00**; **SC/BIOL 2070 3.00**; **SC/BIOL 4000 8.00** or **SC/BIOE 4000 3.00**;
- a minimum of nine credits chosen from the following courses: **SC/BIOL 3060 4.00**; **SC/BIOL 3070 4.00**; **SC/BIOL 3110 3.00**; **SC/BIOL 3130 3.00**; **SC/BIOL 3150 4.00**; **SC/BIOL 3155 3.00**; **SC/BIOL 4010 3.00**; **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00**; **SC/BIOL 2060 3.00**; **SC/BIOL 2070 3.00**; **SC/BIOL 4000 8.00** or **SC/BIOE 4000 3.00**; **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00**; **SC/BIOL 2060 3.00**; **SC/BIOL 2070 3.00**; **SC/BIOL 4000 8.00** or **SC/BIOE 4000 3.00**; **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00**; **SC/BIOL 2060 3.00**; **SC/BIOL 2070 3.00**; **SC/BIOL 4000 8.00** or **SC/BIOE 4000 3.00**; **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00**; **SC/BIOL 2060 3.00**; **SC/BIOL 2070 3.00**; **SC/BIOL 4000 8.00** or **SC/BIOE 4000 3.00**.
SC/BIOL 3130 3.00; SC/BIOL 3150 4.00; SC/BIOL 3155 3.00; SC/BIOL 4010 3.00;

within the 68 biology credits, at least 18 credits must be at the 3000 level or higher, of which at least 12 credits must be at the 4000 level. This must also include a minimum of seven credits from 3000 level or higher biology courses with an associated laboratory component.

C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science and biotechnology streams, this requirement is fully satisfied by the above requirements.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirements: to declare Specialized Honours requires successful completion of at least 24 credits, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed and a minimum cumulative credit-weighted grade point average of 6.00 (B) over all biology courses completed.
### HONOURS MAJOR PROGRAM

Students may follow a stream in biology, biomedical science or biotechnology.

#### A. General education:
- non-science requirement: 12 credits;
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/Biol 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

Note that the biomedical science stream requires specific courses (see below).

#### B. Major requirements:

**Biomedical Science Stream**
- SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00;
- one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/Biol 1000 3.00 and SC/Biol 1001 3.00, SC/Biol 2020 3.00, SC/Biol 2021 3.00, SC/Biol 2040 3.00, SC/Biol 2070 3.00, SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/Biol 2030 4.00 or SC/Biol 2060 3.00;
- a minimum of nine credits chosen from the following courses: SC/Biol 3060 4.00; SC/Biol 3070 4.00; SC/Biol 3100 2.00; SC/Biol 3110 3.00; SC/Biol 3130 3.00; SC/Biol 3150 4.00; SC/Biol 3155 3.00; SC/Biol 4010 3.00;

Note students intending to take physiology courses must also complete SC/Biol 2030 4.0; SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/Biol 2030 4.00 or SC/Biol 2060 3.00;

- SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00;
  - a minimum of nine credits chosen from the following courses: SC/Biol 3060 4.00; SC/Biol 3070 4.00; SC/Biol 3100 2.00; SC/Biol 3110 3.00; SC/Biol 3130 3.00; SC/Biol 3150 4.00; SC/Biol 3155 3.00; SC/Biol 4010 3.00;
• additional biology credits from the following courses, as required, for an overall total of 51 biology credits: SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2060 3.00, SC/BIOL 3010 3.00, SC/BIOL 3060 4.00, SC/BIOL 3070 4.00, SC/BIOL 3071 3.00, SC/BIOL 3100 2.00, SC/BIOL 3110 3.00, SC/BIOL 3130 3.00, SC/BIOL 3140 4.00, SC/BIOL 3150 4.00, SC/BIOL 3350 4.00, SC/BIOL 4000 8.00, SC/BIOL 4020 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4110 4.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4155 3.00, SC/BIOL 4200 3.00, SC/BIOL 4220 4.00, SC/BIOL 4265 3.00, SC/BIOL 4270 3.00, SC/BIOL 4285 3.00, SC/BIOL 4290 4.00, SC/BIOL 4310 3.00, SC/BIOL 4320 3.00, SC/BIOL 4360 3.00, SC/BIOL 4370 3.00, SC/BIOL 4410 3.00, SC/BIOL 4450 4.00, SC/BIOL 4510 3.00; within the 51 biology credits at least 18 credits must be at the 3000 level or higher, of which at least 12 credits must be at the 4000 level. This must also include a minimum of seven credits from 3000 level or higher biology courses with an associated laboratory component.

C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science stream this requirement is fully satisfied by the above requirements.

D. Upper level: 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall minimum total of 85 credits from science disciplines (including the major) and an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

• additional biology credits from the following courses, as required, for an overall total of 51 biology credits: SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2060 3.00, SC/BIOL 3010 3.00, SC/BIOL 3060 4.00, SC/BIOL 3070 4.00, SC/BIOL 3071 3.00, SC/BIOL 3100 2.00, SC/BIOL 3110 3.00, SC/BIOL 3130 3.00, SC/BIOL 3140 4.00, SC/BIOL 3150 4.00, SC/BIOL 3350 4.00, SC/BIOL 4000 8.00, SC/BIOL 4020 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4110 4.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4155 3.00, SC/BIOL 4200 3.00, SC/BIOL 4220 4.00, SC/BIOL 4265 3.00, SC/BIOL 4270 3.00, SC/BIOL 4285 3.00, SC/BIOL 4290 4.00, SC/BIOL 4310 3.00, SC/BIOL 4320 3.00, SC/BIOL 4360 3.00, SC/BIOL 4370 3.00, SC/BIOL 4410 3.00, SC/BIOL 4450 4.00, SC/BIOL 4510 3.00; within the 51 biology credits at least 18 credits must be at the 3000 level or higher, of which at least 12 credits must be at the 4000 level. This must also include a minimum of seven credits from 3000 level or higher biology courses with an associated laboratory component.

C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science stream this requirement is fully satisfied by the above requirements. In the biomedical science stream this requirement is fully satisfied by the above requirements.

D. Upper level: 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall minimum total of 85 credits from science disciplines (including the major) and an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
HONOURS MAJOR/MINOR PROGRAM

An Honours Major in biology may be combined with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section.

Students may follow a stream within the Honours Major/Minor program in Biomedical Science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors.

A. General education:

- non-science requirement: 12 credits;
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/Biol 2030 4.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

B. Major requirements:

Biomedical Science Stream

- SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/Biol 1000 3.00 and SC/Biol 1001 3.00, SC/Biol 2020 3.00, SC/Biol 2021 3.00, SC/Biol 2040 3.00, SC/Biol 2070 3.00, SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/Biol 2030 4.00 or SC/Biol 2060 3.00;
- SC/Biol 1000 3.00 and SC/Biol 1001 3.00; one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/Biol 1000 3.00 and SC/Biol 1001 3.00, SC/Biol 2020 3.00, SC/Biol 2021 3.00, SC/Biol 2040 3.00, SC/Biol 2070 3.00; Note students intending to take physiology courses must also complete SC/Biol 2030 4.00; SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/Biol 2030 4.00 or SC/Biol 2060 3.00;
- SC/Biol 1000 3.00 and SC/Biol 1001 3.00, SC/Biol 2020 3.00, SC/Biol 2021 3.00, SC/Biol 2040 3.00, SC/Biol 2070 3.00; Note students intending to take physiology courses must also complete SC/Biol 2030 4.00; SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/Biol 2030 4.00 or SC/Biol 2060 3.00;
- a minimum of nine credits chosen from the following courses: SC/Biol 3060 4.00; SC/Biol 3070 4.00; SC/Biol 3100 2.00; SC/Biol 3110 3.00; SC/Biol 3130 3.00; SC/Biol 3150 4.00; SC/Biol 3155 3.00; SC/Biol 4010 3.00;
- within the 51 biology credits at least 18 credits must be at the 3000 level or higher, of which at least 12 credits must be at the 4000 level. This must also include a minimum of seven credits from 3000 level or higher biology courses with an associated laboratory component.

C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. Satisfied if the minor is another science discipline.

D. Upper level: 42 credits at the 3000 level or above.

E. Additional elective credits, as required for an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

- SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00;
- a minimum of nine credits chosen from the following courses: SC/Biol 3060 4.00; SC/Biol 3070 4.00; SC/Biol 3100 2.00; SC/Biol 3110 3.00; SC/Biol 3130 3.00; SC/Biol 3150 4.00; SC/Biol 3155 3.00; SC/Biol 4010 3.00;
- within the 51 biology credits at least 18 credits must be at the 3000 level or higher, of which at least 12 credits must be at the 4000 level. This must also include a minimum of seven credits from 3000 level or higher biology courses with an associated laboratory component.

**The course requirements for the minor.**

C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the General Education requirement. Satisfied if the minor is another science discipline.

D. Upper level: 42 credits at the 3000 level or above.

E. Additional elective credits, as required for an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
### HONOURS MAJOR PROGRAM (iBSc)

All Honours iBSc degree candidates must complete an international component in addition to the normal requirements of biology and the BSc. For further information about the international Bachelor of Science, refer to the International Bachelor of Arts and International Bachelor of Science in the Faculty of Science programs of study section.

#### A. General education:

- **non-science requirement:** 12 credits (may be satisfied in whole or part by courses in the international component).
- **mathematics:** SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- **computer science:** LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- **foundational science:** one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOI 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

#### B. Major requirements:

**Biomedical Science Stream (iBSc)**

- SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00;
- one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/BIOI 1000 3.00 and SC/BIOI 1001 3.00, SC/BIOI 2020 3.00, SC/BIOI 2021 3.00, SC/BIOI 2040 3.00, SC/BIOI 2070 3.00, SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/BIOI 2030 4.00 or SC/BIOI 2060 3.00;
- a minimum of nine credits chosen from the following courses: SC/BIOI 3060 4.00, SC/BIOI 3070 4.00, SC/BIOI 3110 3.00, SC/BIOI 3130 3.00, SC/BIOI 3150 4.00, SC/BIOI 3155 3.00, SC/BIOI 4010 3.00;
- SC/CHEM 2021 3.00 and SC/CHEM 2022 3.00; a minimum of nine credits chosen from the following courses: SC/BIOI 3060 4.00, SC/BIOI 3070 4.00, SC/BIOI 3110 3.00, SC/BIOI 3130 3.00, SC/BIOI 3150 4.00, SC/BIOI 3155 3.00, SC/BIOI 4010 3.00;
- SC/PHYS 1010 6.00; SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/BIOI 1000 3.00 and SC/BIOI 1001 3.00, SC/BIOI 2020 3.00, SC/BIOI 2021 3.00, SC/BIOI 2040 3.00, SC/BIOI 2070 3.00; Note students intending to take physiology courses must also complete SC/BIOI 2060 3.00; SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/BIOI 2030 4.00 or SC/BIOI 2060 3.00;
- SC/PHYS 1010 6.00; SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; a minimum of nine credits chosen from the following courses: SC/BIOI 3060 4.00, SC/BIOI 3070 4.00, SC/BIOI 3110 3.00, SC/BIOI 3130 3.00, SC/BIOI 3150 4.00, SC/BIOI 3155 3.00, SC/BIOI 4010 3.00;
In addition, the following must be completed for the international component:

- a minimum of 12 credits of language study in one of the languages offered at York University;
- a minimum of 12 credits of non-science courses with an international component (refer to sample list of courses in the section on international degrees), which will also serve to meet the non-science requirement of the general education component;
- an additional six credits of language study or non-science international component courses, for a total of 30 credits;
- one to two exchange terms abroad as a full-time student at an institution with which York University has a formal exchange agreement.

In addition, the following must be completed for the international component:

- a minimum of 12 credits of language study in one of the languages offered at York University;
- a minimum of 12 credits of non-science courses with an international component (refer to sample list of courses in the section on international degrees), which will also serve to meet the non-science requirement of the general education component;
- an additional six credits of language study or non-science international component courses, for a total of 30 credits;
- one to two exchange terms abroad as a full-time student at an institution with which York University has a formal exchange agreement.
C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. On the biology stream, 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science stream this requirement is fully satisfied by the above requirements. Satisfied if the minor is another science discipline.

D. Upper level: 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
HONOURS MAJOR/MINOR PROGRAM (iBSc)

Students may follow a stream within the Honours Major/Minor program in biomedical science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors.

A. General Education:

- non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component);
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

B. Major requirements:

Biomedical science stream

- SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00, SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 2040 3.00, SC/BIOL 2070 3.00, SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/BIOL 2030 4.00 or SC/BIOL 2060 3.00;

Note students intending to take physiology courses must also complete SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/BIOL 2030 4.00 or SC/BIOL 2060 3.00.

HONOURS MAJOR/MINOR PROGRAM (iBSc)

Students may follow a stream within the Honours Major/Minor program in biomedical science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors.

A. General Education:

- non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component);
- mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

B. Major requirements:

Biomedical science stream

- SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00; HH/PSYC 1010 6.00;
- SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00, SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 2040 3.00, SC/BIOL 2070 3.00, SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00; a minimum of one of SC/BIOL 2030 4.00 or SC/BIOL 2060 3.00; SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00.
In addition, the following must be completed for the international component:

- a minimum of nine credits chosen from the following courses: SC/Biol 3060 4.00, SC/Biol 3070 4.00, SC/Biol 3110 3.00, SC/Biol 3130 3.00, SC/Biol 3150 4.00, SC/Biol 3155 3.00, SC/Biol 4010 3.00;
- within the 42 biology credits at least 18 credits must be at the 3000 level or higher, of which at least 12 credits must be at the 4000 level. This must also include a minimum of seven credits from 3000 level or higher biology courses with an associated laboratory component;
- the course requirements for the minor.

In addition, the following must be completed for the international component:

- a minimum of 12 credits of language study in one of the languages offered at York University;
- a minimum of 12 credits of non-science courses with an international component (refer to sample list of courses in the section on international degrees), which will also serve to meet the non-science requirement of the general education component;
- an additional six credits of language study or non-science international component courses, for a total of 30 credits;
- one to two exchange terms abroad as a full-time student at an institution with which York University has a formal exchange agreement.
C. Science breadth: a total of 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. On the biology stream, 15 of these 24 credits are satisfied by the General Education requirement. In the biomedical science stream this requirement is fully satisfied by the above requirements. Satisfied if the minor is another science discipline.

D. Upper level: 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
Program Proposal

1. Program: Environmental Biology

2. Degree Designation:
   Environmental Biology Bachelor;
   Environmental Biology, Honours Major;
   Environmental Biology, Honours Double Major;
   Environmental Biology Honours Major/Minor;
   Environmental Biology Honours Minor

3. Type of Modification: update of Environmental Biology program core

4. Effective Date: Fall 2021

5. Provide a general description of the proposed changes to the program.

   We are making biostatistics (SC/BIOL 2060 3.00) mandatory for all programs, introducing a new second year research methods course (resulting in a credit change to SC/BIOL 2050 4.00), and removing SC/CHEM 2020 and 2021 as an option to replace second year core Biology credits.

   We are also making some housekeeping updates – removing unnecessary cross-lists, removal of the proposed retired BIOL 3001 2.0 and BIOL 3002 2.0, removal of courses required in the core from lists of Biology courses to choose from, incorporating two new courses SC/BIOL 3171 3.0 and SC/BIOL 3172 3.0.

6. Provide the rationale for the proposed changes.

   - Modifications reflect changes to second year BIOL courses (addition of laboratory course SC/BIOL 2080 3.00 and removal of laboratory component from and change in credit value of SC/BIOL 2050 4.00). Addition of SC/BIOL 2060 3.00 (Biostatistics) as a required course for all programs ensures that students have a foundational understanding of statistics necessary to understand primary literature, experimental design, and data analyses. The AAAS Vision & Change in Undergraduate Biology Education Report (2011) has listed the abilities of Biology students to use quantitative reasoning, modeling and simulation, and connect biology to other sciences, including math as necessary core competencies.

   - SC/BIOL 2080 3.00 is the ecology/evolution sister laboratory course to the cell/molecular laboratory course SC/BIOL 2070 3.00. Previously students in the ecology/evolution disciplinary stream had to take 3 courses, each with 1 credit of lab (SC/BIOL 2010 4.00 + SC/BIOL 2030 4.00 + SC/BIOL 2050 4.00 = 9 hours of lab per week). With the addition of SC/BIOL 2080, students will have to take one of the two research methods (laboratory) courses. Students opting for the ecology/evolution disciplinary stream will have more choice with their second-year courses and have a similar load (6 hours per week) of laboratory time to those in the cell/molecular disciplinary stream. As well, BIOL 2080 will better prepare students in the ecology/evolution disciplinary stream for higher level courses in experimental design and application of experimental methods.

   - Previously students could replace portions of the second-year Biology core with both SC/CHEM 2020 3.00 and CHEM 2021 3.00. Removing these will provide Biology students with a more well-rounded understanding of foundational (second-year) Biology concepts and is in line with expectations at the second year for Chemistry and Physics where only courses within the major satisfy second year core requirements. There is still room in the degree programs for CHEM
2020 and CHEM 2021. Furthermore, this will reduce student confusion as many think the CHEM courses will count for BIOL credits.

- Calendar clean-up: Information showing cross-lists of BIOL 2020 and BIOL 2021 to BCHM 2020 and BCHM 2021 are unnecessary. BIOL 3001 2.0 and BIOL 3002 2.0 have not been offered in 10 years and we are in the process of officially retiring these courses. Duplicate notes about CHEM 2020 and CHEM 2021 requiring CHEM 1000 and CHEM 1001 have been removed. Two new courses, SC/BIOL 3171 3.0 and SC/BIOL 3172 3.0 have been incorporated into degree requirements.

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives. If changes to the admission requirements are being proposed, comment on the appropriateness of the revised requirements to the achievement of the program learning outcomes.

Under the OCAV Degree Level Expectation Category of “Knowledge of Methodologies”, all above-listed programs require students to be able to “evaluate and carry out appropriate experimental and observational methodologies to answer questions in biology, safely and effectively”, while “Application of Knowledge” requires that students be able to “Apply the process of science by formulating questions, developing hypotheses, designing and carrying out experiments to test hypotheses, collecting, analyzing and interpreting data to draw conclusions and, where appropriate, propose solutions.” The requirement of Biostatics (SC/BIOL 2060 3.00) will help to ensure that our students meet these learning outcomes. The addition of SC/BIOL 2080 3.00 supports these program learning outcomes for student in the ecology/evolution stream.

Removal of SC/CHEM 2020 and 2021 as options to replace BIOL courses in the second-year core supports disciplinary program learning outcomes.

8. If relevant, summarize the consultation undertaken with relevant academic units, including commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

   The Department of Chemistry has been consulted.

9. Describe any resource implications and how they are being addressed (e.g., through a reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

   There are no resource implications.

10. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.
### Existing Program Core

The program core (35 or 36 credits) is defined as:

- SC/Biol 1000 3.00 and SC/Biol 1001 3.00;
- SC/Envb 2050 4.00;
- SC/Biol 2060 3.00;
- SC/Biol 2070 3.00 or SC/Biol 2010 4.00; SC/Biol 2030 4.00 (both SC/Chem 2020 3.00 and SC/Chem 2021 3.00 may replace one of the two 4 credit biology courses);
- SC/Biol 2030 4.00 (both SC/Chem 2020 3.00 and SC/Chem 2021 3.00 may replace one of the two 4 credit biology courses);
- additional courses as required for a total of at least 18 2000-level credits chosen from the following:
  - SC/Biol 2010 4.00,
  - SC/Biol 2020 3.00 (cross-listed to SC/Bchm 2020 3.00),
  - SC/Biol 2021 3.00 (cross-listed to SC/Bchm 2021 3.00),
  - SC/Biol 2030 4.00,
  - SC/Biol 2040 3.00,
  - SC/Biol 2070 3.00,
  - SC/Chem 2020 3.00,
  - SC/Chem 2021 3.00;
- SC/Envb 3001 2.00 (cross-listed to SC/Biol 3001 2.00) or SC/Envb 3001 3.00 (cross-listed to SC/Biol 3001 3.00);
- SC/Envb 3170 3.00;
- SC/Envb 4245 3.00 (cross-listed to SC/Biol 4245 3.00);
- SC/Biol 4255 3.00 (cross-listed to EU/Envs 4111 3.00).

**Note:** both SC/Chem 1000 3.00 and SC/Chem 1001 3.00 are required as prerequisites for SC/Biol 2000 3.00 and SC/Chem 2020 3.00 if they are chosen in the program core.

### Proposed Program Core

The program core (35 or 36 credits) is defined as:

- SC/Biol 1000 3.00 and SC/Biol 1001 3.00;
- SC/Envb 2050 4.00 (cross-listed to BIOL 2050 4.00), SC/Biol 2010 4.00, and SC/Biol 2030 4.00; OR SC/Envb 2050 3.00 (cross-listed to BIOL 2050 3.00 and SC/Envb 2080 3.00 (cross-listed to SC/Biol 2080 3.00)
- SC/Biol 2060 3.00;
- SC/Biol 2070 3.00 or SC/Biol 2010 4.00; SC/Biol 2030 4.00 (both SC/Chem 2020 3.00 and SC/Chem 2021 3.00 may replace one of the two 4 credit biology courses);
- additional courses as required for a total of at least 18 2000-level credits chosen from the following:
  - SC/Biol 2010 4.00,
  - SC/Biol 2020 3.00 (cross-listed to SC/Bchm 2020 3.00),
  - SC/Biol 2021 3.00 (cross-listed to SC/Bchm 2021 3.00),
  - SC/Biol 2030 4.00,
  - SC/Biol 2040 3.00,
  - SC/Biol 2070 3.00,
  - SC/Chem 2020 3.00,
  - SC/Chem 2021 3.00;
- SC/Envb 3001 2.00 (cross-listed to SC/Biol 3001 2.00) or SC/Envb 3001 3.00 (cross-listed to SC/Biol 3001 3.00);
- SC/Envb 3170 3.00 SC/Envb 3171 3.00 (cross-listed to SC/Biol 3170 3.00);
- SC/Envb 4245 3.00 (cross-listed to SC/Biol 4245 3.00);
- SC/Biol 4255 3.00 (cross-listed to EU/Envs 4111 3.00).

**Note:** both SC/Chem 1000 3.00 and SC/Chem 1001 3.00 are required as prerequisites for SC/Biol 2000 3.00 and SC/Chem 2020 3.00 if they are chosen in the program core.

### Bachelor Program

#### A. General education:

- non-science requirement: 12 credits. **EU/Envs 1000 6.00** is recommended for students interested in taking additional environmental studies courses;
- mathematics: **SC/Math 1505 6.00** or six credits from **SC/Math 1013 3.00, SC/Math 1014 3.00, SC/Math 1025 3.00**;

### Bachelor Program

#### A. General education:

- non-science requirement: 12 credits. **EU/Envs 1000 6.00** is recommended for students interested in taking additional environmental studies courses;
- mathematics: **SC/Math 1505 6.00** or six credits from **SC/Math 1013 3.00, SC/Math 1014 3.00, SC/Math 1025 3.00**;
B. Major requirement:

- the program core, as specified above (35 or 36 credits);
- additional credits from the following list of courses for an overall total of at least 42 credits from environmental biology and biology courses of which at least 12 credits are at the 3000 or higher level:
  - SC/ENVB 3002 2.00 (cross-listed to: SC/Biol 3002 2.00),
  - SC/ENVB 3002 3.00 (cross-listed to: SC/Biol 3002 3.00),
  - SC/Biol 3150 4.00,
  - SC/Biol 3200 3.00,
  - SC/ENVB 3170 3.00,
  - SC/ENVB 3250 4.00 (cross-listed to: SC/Biol 3250 4.00),
  - SC/ENVB 3270 3.00 (cross-listed to: SC/Biol 3270 3.00),
  - SC/ENVB 3280 4.00 (cross-listed to: SC/Biol 3280 4.00),
  - SC/ENVB 3290 4.00 (cross-listed to: SC/Biol 3290 4.00),
  - SC/Biol 3500 3.00 (cross-listed to: EU/GEOG 3500 3.00, SC/GEOG 3500 3.00),
  - SC/Biol 4085 4.00,
  - SC/ENVB 4095 3.00 (cross-listed to: SC/Biol 4095 3.00),
  - SC/ENVB 4230 4.00 (cross-listed to: SC/Biol 4230 4.00),
  - SC/ENVB 4245 3.00 (cross-listed to: SC/Biol 4245 3.00),
  - SC/ENVB 4250 3.00 (cross-listed to: SC/Biol 4250 3.00),
  - SC/ENVB 4255 3.00,
  - SC/ENVB 4265 3.00 (cross-listed to: SC/Biol 4265 3.00),
  - SC/Biol 4305 3.00,
  - SC/Biol 4390 3.00,
  - SC/ENVB 4700 3.00 (cross-listed to: SC/Biol 4700 3.00),
  - SC/Biol 4710 3.00;
C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements.

D. Upper level: a minimum of 18 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 90 credits.

F. Standing requirements: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program).

<table>
<thead>
<tr>
<th>Honours Major Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. General education:</td>
</tr>
<tr>
<td>• non-science requirement: 12 credits. EU/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses;</td>
</tr>
<tr>
<td>• mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (Note: students intending to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics, mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.);</td>
</tr>
<tr>
<td>• computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;</td>
</tr>
<tr>
<td>• foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/Biol 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.</td>
</tr>
</tbody>
</table>

Note: both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 are required as prerequisites for SC/Biol 2020 3.00 and SC/CHEM 2020 3.00 in the program core.

B. Major requirements: 

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<td>A. General education:</td>
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</tr>
<tr>
<td>• mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (Note: students intending to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics, mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.);</td>
</tr>
<tr>
<td>• computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;</td>
</tr>
<tr>
<td>• foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/Biol 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.</td>
</tr>
</tbody>
</table>

Note: both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 are required as prerequisites for SC/Biol 2020 3.00 and SC/CHEM 2020 3.00 in the program core.
The program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty

- The program core as specified above (35 or 36 credits):
- SC/ENVB 4700 3.00:
- additional credits from the following list of courses for an overall total of at least 51 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level:
  - SC/ENVB 3002 2.00 (cross-listed to: SC/Biol 3002 2.00),
  - SC/ENVB 3002 3.00 (cross-listed to: SC/Biol 3002 3.00),
  - SC/Biol 3150 4.00,
  - SC/Biol 3200 3.00,
  - SC/ENVB 3250 4.00 (cross-listed to: SC/Biol 3250 4.00),
  - SC/ENVB 3270 3.00 (cross-listed to: SC/Biol 3270 3.00),
  - SC/ENVB 3280 4.00 (cross-listed to: SC/Biol 3280 4.00),
  - SC/ENVB 3290 4.00 (cross-listed to: SC/Biol 3290 4.00),
  - SC/Biol 3500 3.00 (cross-listed to: EU/GEOG 3500 3.00, SC/GEOG 3500 3.00),
  - SC/ENVB 4000 3.00 or SC/ENVB 4000 8.00,
  - SC/Biol 4085 4.00,
  - SC/ENVB 4095 3.00 (cross-listed to: SC/Biol 4095 3.00),
  - SC/ENVB 4200 3.00,
  - SC/ENVB 4230 4.00 (cross-listed to: SC/Biol 4230 4.00),
  - SC/ENVB 4250 3.00 (cross-listed to: SC/Biol 4250 3.00),
  - SC/ENVB 4265 3.00 (cross-listed to: SC/Biol 4265 3.00),
  - SC/Biol 4305 3.00,
  - SC/Biol 4390 3.00,
  - SC/Biol 4710 3.00;
- SC/GEOG 1400 6.00.

C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall minimum total of 85 credits from science disciplines (including the major) and an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty Standing requirements: to graduate in an Honours program requires successful completion of all Faculty

- The program core as specified above (35 or 36 credits):
- SC/ENVB 4700 3.00:
- additional credits from the following list of courses for an overall total of at least 51 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level:
  - SC/ENVB 3002 2.00 (cross-listed to: SC/Biol 3002 2.00),
  - SC/ENVB 3002 3.00 (cross-listed to: SC/Biol 3002 3.00),
  - SC/Biol 3150 4.00,
  - SC/Biol 3200 3.00,
  - SC/ENVB 3250 4.00 (cross-listed to: SC/Biol 3250 4.00),
  - SC/ENVB 3270 3.00 (cross-listed to: SC/Biol 3270 3.00),
  - SC/ENVB 3280 4.00 (cross-listed to: SC/Biol 3280 4.00),
  - SC/ENVB 3290 4.00 (cross-listed to: SC/Biol 3290 4.00),
  - SC/Biol 3500 3.00 (cross-listed to: EU/GEOG 3500 3.00, SC/GEOG 3500 3.00),
  - SC/ENVB 4000 3.00 or SC/ENVB 4000 8.00,
  - SC/Biol 4085 4.00,
  - SC/ENVB 4095 3.00 (cross-listed to: SC/Biol 4095 3.00),
  - SC/ENVB 4200 3.00,
  - SC/ENVB 4230 4.00 (cross-listed to: SC/Biol 4230 4.00),
  - SC/ENVB 4250 3.00 (cross-listed to: SC/Biol 4250 3.00),
  - SC/ENVB 4265 3.00 (cross-listed to: SC/Biol 4265 3.00),
  - SC/Biol 4305 3.00,
  - SC/Biol 4390 3.00,
  - SC/Biol 4710 3.00;
- SC/GEOG 1400 6.00.

C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall minimum total of 85 credits from science disciplines (including the major) and an overall total of 120 credits.
requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
Honours Double Major Program

All BSc Honours degree candidates should consult departmental advisors as early as possible concerning course requirements for particular Honours Double Major programs. Possible subject combinations for BSc Honours Double Major degree programs are listed in the Undergraduate Degree and Certificate Programs section of the Faculty Rules.

A. General education:

- non-science requirement: 12 credits. EU/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses;
- mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (Note: students intending to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics, mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.);
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/Biol 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

B. Major requirements:

- SC/Biol 1000 3.00 and SC/Biol 1001 3.00;
- SC/ENVB 2050 4.00;
- SC/Biol 2060 3.00;
- any two of:
  - SC/Biol 2010 4.00;
  - SC/Biol 2020 3.00;
  - SC/Biol 2021 3.00;
  - SC/Biol 2030 4.00;
  - SC/Biol 2040 3.00;
  - SC/Biol 2070 3.00.
  - Both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 may replace one of these two biology courses.
- SC/ENVB 3001 2.00 or SC/ENVB 3001 3.00;
- additional credits from the following list of courses for an overall total of at least 42 credits from environmental biology and biology

Honours Double Major Program

All BSc Honours degree candidates should consult departmental advisors as early as possible concerning course requirements for particular Honours Double Major programs. Possible subject combinations for BSc Honours Double Major degree programs are listed in the Undergraduate Degree and Certificate Programs section of the Faculty Rules.

A. General education:

- non-science requirement: 12 credits. EU/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses;
- mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (Note: students intending to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics, mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.);
- computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00;
- foundational science: one of SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/Biol 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.

B. Major requirements:

- SC/Biol 1000 3.00 and SC/Biol 1001 3.00;
- SC/ENVB 2050 4.00 (cross-listed to SC/Biol 2050 4.00); SC/ENVB 2050 3.00 (cross-listed to SC/Biol 2050 3.00) and SC/ENVB 2080 3.00 (cross-listed to SC/Biol 2080 3.00)
- SC/Biol 2060 3.00;
- any two of:
  - SC/Biol 2010 4.00;
  - SC/Biol 2020 3.00;
  - SC/Biol 2021 3.00;
  - SC/Biol 2030 4.00;
  - SC/Biol 2040 3.00;
  - SC/Biol 2070 3.00.
  - Both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 may replace one of these two biology courses.
courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level:
- **SC/ENVB 3002 2.00** (cross-listed to SC/BIOL 3002 2.00),
- **SC/ENVB 3003 3.00** (cross-listed to SC/BIOL 3002 3.00),
- **SC/BIOL 3150 4.00**,  
- **SC/ENVB 3170 3.00**,  
- **SC/BIOL 3250 3.00**,  
- **SC/ENVB 3250 4.00** (cross-listed to SC/BIOL 3250 4.00),  
- **SC/ENVB 3270 3.00** (cross-listed to SC/BIOL 3270 3.00),  
- **SC/ENVB 3280 4.00** (cross-listed to SC/BIOL 3280 4.00),  
- **SC/ENVB 3290 4.00** (cross-listed to SC/BIOL 3290 4.00),  
- **SC/BIOL 3500 3.00** (cross-listed to SC/ENVB 3500 3.00),  
- **SC/ENVB 4000 3.00** or **SC/ENVB 4000 8.00**,  
- **SC/BIOL 4085 4.00**,  
- **SC/ENVB 4095 3.00** (cross-listed to SC/BIOL 4095 3.00),  
- **SC/ENVB 4200 3.00**,  
- **SC/ENVB 4230 4.00** (cross-listed to SC/BIOL 4230 4.00),  
- **SC/ENVB 4245 3.00** (cross-listed to SC/BIOL 4245 3.00),  
- **SC/ENVB 4250 3.00** (cross-listed to SC/BIOL 4250 3.00),  
- **SC/ENVB 4255 3.00**,  
- **SC/ENVB 4265 3.00** (cross-listed to SC/BIOL 4265 3.00),  
- **SC/BIOL 4305 3.00**,  
- **SC/BIOL 4390 3.00**,  
- **SC/ENVB 4700 3.00** (cross-listed to SC/BIOL 4700 3.00),  
- **SC/BIOL 4710 3.00**

C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the above requirements. Satisfied if the second major is another science discipline.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a

- **SC/ENVB 3001 2.00** or **SC/ENVB 3001 3.00** (cross-listed to SC/BIOL 3001 3.00);
- additional credits from the following list of courses for an overall total of at least 42 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level:
  - **SC/ENVB 3002 2.00** (cross-listed to SC/BIOL 3002 2.00),
  - **SC/ENVB 3003 3.00** (cross-listed to SC/BIOL 3002 3.00),
  - **SC/BIOL 3150 4.00**,
  - **SC/ENVB 3170 3.00** SC/ENVB 3171 3.00 (cross-listed to SC/BIOL 3171 3.00)
  - **SC/ENVB 3172 3.00** (cross-listed to SC/BIOL 3172 3.00)
  - **SC/ENVB 3250 3.00** (cross-listed to SC/BIOL 3250 4.00),
  - **SC/ENVB 3270 3.00** (cross-listed to SC/BIOL 3270 3.00),
  - **SC/ENVB 3280 4.00** (cross-listed to SC/BIOL 3280 4.00),
  - **SC/BIOL 3500 3.00** (cross-listed to SC/ENVB 3500 3.00),  
  - **SC/ENVB 4000 3.00** or **SC/ENVB 4000 8.00**,
  - **SC/BIOL 4085 4.00**,  
  - **SC/ENVB 4095 3.00** (cross-listed to SC/BIOL 4095 3.00),  
  - **SC/ENVB 4200 3.00**,  
  - **SC/ENVB 4230 4.00** (cross-listed to SC/BIOL 4230 4.00),  
  - **SC/ENVB 4245 3.00** (cross-listed to SC/BIOL 4245 3.00),  
  - **SC/ENVB 4250 3.00** (cross-listed to SC/BIOL 4250 3.00),  
  - **SC/ENVB 4255 3.00**,  
  - **SC/ENVB 4265 3.00** (cross-listed to SC/BIOL 4265 3.00),  
  - **SC/BIOL 4305 3.00**,  
  - **SC/BIOL 4390 3.00**,  
  - **SC/ENVB 4700 3.00** (cross-listed to SC/BIOL 4700 3.00),  
  - **SC/BIOL 4710 3.00**

C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied...
<table>
<thead>
<tr>
<th>minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.</th>
<th>by the above requirements. Satisfied if the second major is another science discipline.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Upper level: a minimum of 42 credits at the 3000 level or above.</td>
<td>E. Additional elective credits, as required, for an overall total of 120 credits.</td>
</tr>
<tr>
<td>F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.</td>
<td></td>
</tr>
</tbody>
</table>
B. Major requirements:

- the program core as specified above (35 to 36 credits);
- SC/ENVB 4700 3.00;
- additional credits from the following list of courses for an overall total of at least 51 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level:
  - SC/ENVB 3002 2.00 (cross-listed to: SC/BIOL 3002 2.00),
  - SC/ENVB 3002 3.00 (cross-listed to: SC/BIOL 3002 3.00),
  - SC/BIOL 3150 4.00,
  - SC/BIOL 3200 3.00,
  - SC/ENVB 3250 4.00 (cross-listed to: SC/BIOL 3250 4.00),
C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements. Satisfied if the minor is another science discipline.

D. Upper level: a minimum of 42 credits at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits.

F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.
Honours Minor

An Honours minor in environmental biology may be combined with an Honours major in another subject area. Possible subject combinations are listed in the Undergraduate Degree and Certificate Programs section of the Faculty Rules.

- **SC/Biol 1000 3.00** and **SC/Biol 1001 3.00**;
- **SC/Envb 2050 4.00**;
- **SC/Biol 2060 3.00**;
- any two of:
  - **SC/Biol 2010 4.00**,
  - **SC/Biol 2020 3.00**,
  - **SC/Biol 2030 4.00**,
  - **SC/Biol 2040 3.00**,
  - **SC/Biol 2070 3.00**;
- Both **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00** may substitute for one of these two biology courses.
- **SC/Envb 3001 2.00** (cross-listed to: **SC/Biol 3001 2.00**) or **SC/Envb 3001 3.00** (cross-listed to: **SC/Biol 3001 3.00**);
- additional credits from the following list of courses for an overall total of at least nine credits from environmental biology and biology courses at the 3000 or 4000 level:
  - **SC/Envb 3002 2.00** (cross-listed to: **SC/Biol 3002 2.00**),
  - **SC/Envb 3002 3.00** (cross-listed to: **SC/Biol 3002 3.00**),
  - **SC/Biol 3150 4.00**,
  - **SC/Envb 3170 3.00**,
  - **SC/Biol 3200 3.00**,
  - **SC/Envb 3250 4.00** (cross-listed to: **SC/Envb 3250 4.00**),
  - **SC/Envb 3270 3.00** (cross-listed to: **SC/Envb 3270 3.00**),
  - **SC/Envb 3280 4.00** (cross-listed to: **SC/Envb 3280 4.00**),
  - **SC/Envb 3290 4.00** (cross-listed to: **SC/Envb 3290 4.00**),
  - **SC/Biol 3500 3.00** (cross-listed to: **EU/Geog 3500 3.00**, **SC/Geog 3500 3.00**),
  - **SC/Biol 4085 4.00**,
  - **SC/Envb 4095 3.00** (cross-listed to: **SC/Biol 4095 3.00**),
  - **SC/Biol 4200 3.00**,
  - **SC/Envb 4095 3.00**,
  - **SC/Envb 4230 4.00** (cross-listed to: **SC/Biol 4230 4.00**),
  - **SC/Envb 4245 3.00** (cross-listed to: **SC/Biol 4245 3.00**),
  - **SC/Envb 4250 3.00** (cross-listed to: **SC/Biol 4250 3.00**),
  - **SC/Envb 4300 3.00**,
  - **SC/Envb 4500 3.00** (cross-listed to: **SC/Biol 4500 3.00**),
  - **SC/Envb 4650 3.00** (cross-listed to: **SC/Biol 4650 3.00**).

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Honours Minor

An Honours minor in environmental biology may be combined with an Honours major in another subject area. Possible subject combinations are listed in the Undergraduate Degree and Certificate Programs section of the Faculty Rules.

- **SC/Biol 1000 3.00** and **SC/Biol 1001 3.00**;
- **SC/Envb 2050 4.00** **SC/Envb 2050 3.00** (cross-listed to **SC/Biol 2050 3.00**) and **SC/Envb 2080 3.00** (cross-listed to **SC/Biol 2080 3.00**)**;
- **SC/Biol 2060 3.00**;
- any two of:
  - **SC/Biol 2010 4.00**,
  - **SC/Biol 2020 3.00**,
  - **SC/Biol 2030 4.00**,
  - **SC/Biol 2040 3.00**,
  - **SC/Biol 2070 3.00**;
- Both **SC/CHEM 2020 3.00** and **SC/CHEM 2021 3.00** may substitute for one of these two biology courses.
- **SC/Envb 3001 2.00** (cross-listed to: **SC/Biol 3001 2.00**) or **SC/Envb 3001 3.00** (cross-listed to: **SC/Biol 3001 3.00**);
- additional credits from the following list of courses for an overall total of at least nine credits from environmental biology and biology courses at the 3000 or 4000 level:
  - **SC/Envb 3002 2.00** (cross-listed to: **SC/Biol 3002 2.00**),
  - **SC/Envb 3002 3.00** (cross-listed to: **SC/Biol 3002 3.00**),
  - **SC/Biol 3150 4.00**,
  - **SC/Envb 3170 3.00**,
  - **SC/Biol 3200 3.00**,
  - **SC/Envb 3250 4.00** (cross-listed to: **SC/Envb 3250 4.00**),
  - **SC/Envb 3270 3.00** (cross-listed to: **SC/Envb 3270 3.00**),
  - **SC/Envb 3280 4.00** (cross-listed to: **SC/Envb 3280 4.00**),
  - **SC/Envb 3290 4.00** (cross-listed to: **SC/Envb 3290 4.00**),
  - **SC/Biol 3500 3.00** (cross-listed to: **EU/Geog 3500 3.00**, **SC/Geog 3500 3.00**),
  - **SC/Biol 4085 4.00**,
  - **SC/Envb 4095 3.00** (cross-listed to: **SC/Biol 4095 3.00**),
  - **SC/Biol 4200 3.00**,
  - **SC/Envb 4095 3.00**,
  - **SC/Envb 4230 4.00** (cross-listed to: **SC/Biol 4230 4.00**),
  - **SC/Envb 4245 3.00** (cross-listed to: **SC/Biol 4245 3.00**),
  - **SC/Envb 4250 3.00** (cross-listed to: **SC/Biol 4250 3.00**),
  - **SC/Envb 4300 3.00**,
  - **SC/Envb 4500 3.00** (cross-listed to: **SC/Biol 4500 3.00**),
  - **SC/Envb 4650 3.00** (cross-listed to: **SC/Biol 4650 3.00**).
- additional credits from the above listed environmental biology and biology courses at the 2000 or higher level, as required for an overall total of at least 30 environmental biology or biology credits.
Changes to Existing Course

Faculty: Biology
Department: Biology
Date of Submission: September 2020
Course Number: BIOL 2021 3.0
Effective Session: Fall 2021
Course Title: Cell Biology

Type of Change:
- [x] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [ ] in title (max. 40 characters for short title)
- [ ] in Calendar description (max. 40 words or 200 characters)
- [ ] other (please specify):

Change From:
SC/BIOL 2021 3.0 Cell Biology
A study of cell biology and aspects of related biochemistry. Topics include membranes, the endomembrane system, the cytoskeleton, cellular motility, the extracellular matrix, intercellular communication and intracellular regulation. Three lecture hours.
Prerequisite: One of the following: (1) SC/BIOL 2020 4.00, (2) SC/BCHM 2020 4.00, (3) SC/BIOL 2020 3.00, (4) SC/BCHM 2020 3.00, (5) SC/BIOL 1010 6.00 and SC/CHEM 2050 4.00, (6) SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 and SC/CHEM 2050 4.00.
This course cannot be taken at the same time as BIOL2020.

To:
SC/BIOL 2021 3.0 Cell Biology
A study of cell biology and aspects of related biochemistry. Topics include membranes, the endomembrane system, the cytoskeleton, cellular motility, the extracellular matrix, intercellular communication and intracellular regulation. Three lecture hours.
Prerequisite: One of the following: (1) SC/BIOL 2020 4.00, (2) SC/BCHM 2020 4.00, (3) SC/BIOL 2020 3.00, (4) SC/BCHM 2020 3.00, (5) SC/BIOL 1010 6.00 and SC/CHEM 2050 4.00, (6) SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 and SC/CHEM 2050 4.00.
This course cannot be taken at the same time as BIOL2020.
Prerequisites: One of the following: (1) SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 and SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00
(2) SC/ISCI 1110 6.00 and SC/ISCI 1210 6.00
(3) SC/ISCI 1101 3.00 and SC/ISCI 1102 3.00 and SC/ISCI 1201 3.00 and SC/ISCI 1202 3.00
### Rationale:

The SC/BIOL 2020 prereq to BIOL 2021 exists for historical reasons (the two were once a single full year course). Having a second year prereq for a second year course is unusual, and can impede student progression, especially when not all courses are offered in all semesters. To align this course’s prerequisites better with other second year courses (all of which have first year prereqs), and to improve student choice and student progression, we are proposing this change.

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Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
### Changes to Existing Course

**Faculty:**

**Department:** Biology  
**Date of Submission:** August 2020

**Course Number:** SC/BIOL 3001 2.0  
Cross-listed to SC/ENVB 3001 2.0  
**Effective Session:** August 2020

**Course Title:** Field course

**Type of Change:**

- [ ] in pre-requisite(s)/co-requisite(s)  
- [ ] in course number/level  
- [ ] in credit value  
- [ ] in title (max. 40 characters for short title)  
- [X] in Calendar description (max. 40 words or 200 characters)  
- [ ] retire/expire course  
- other (please specify):

**Change From:**

A course given at one of several biological stations, the objective of which is to give the student the opportunity to study plants and animals in their natural surroundings. The departmental brochure should be consulted for further details. One-week field course. Prerequisites: SC/BIOL 2050 4.00 and SC/BIOL 2060 3.00; plus other prerequisites if specified for a given module. Note: Students must be manually enrolled in this course through the Biology Department early in January or prior to the session in which the course is offered. Enrolment is not possible at any other time of year. In addition to the tuition fee levied by the University, each student must pay for transportation, room and board.

Cross-listed to SC/ENVB 3001 2.0

**To:**

**Rationale:** Calendar clean up. Course has not been offered in more than 10 years.
Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
# Changes to Existing Course

**Faculty:**

**Department:** Biology  
**Date of Submission:** August 2020  
**Course Number:** SC/BIOL 3002 2.0  
**Effective Session:** August 2020  
**Course Title:** Field course

## Type of Change:

- [ ] in pre-requisite(s)/co-requisite(s)  
- [x] in cross-listing  
- [ ] in course number/level  
- [ ] in degree credit exclusion(s)  
- [ ] in credit value  
- [ ] regularize course (from Special Topics)  
- [ ] in title (max. 40 characters for short title)  
- [ ] in course format/mode of delivery *  
- [ ] retire/expire course  
- [ ] in Calendar description (max. 40 words or 200 characters)  
- [ ] other (please specify):

## Change From:

This is a second field course, which may be taken for credit, the contents of which must differ materially from SC/BIOL 3001 2.00 or SC/BIOL 3001 3.00 as determined by the Instructor. The departmental brochure should be consulted for further details. Two-week field course. Prerequisites: SC/BIOL 2050 4.00 and SC/BIOL 2060 3.00; plus other prerequisites if specified for a given module. Note: Students must be manually enrolled in this course through the Biology Department early in January or prior to the session in which the course is offered. Enrolment is not possible at any other time of year. In addition to the tuition fee levied by the University, each student must pay for transportation, room and board.

Cross-listed to SC/ENVB 3002.0

<table>
<thead>
<tr>
<th>Rationale:</th>
<th>Calendar clean up. Course has not been offered in more than 10 years.</th>
</tr>
</thead>
</table>
Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised 'Course Design' and 'Method of Instruction' information.
# Changes to Existing Course

**Faculty:**

**Department:** Mathematics and Statistics  
**Date of Submission:**

**Course Number:** MATH 4011  
**Effective Session:** 2020-2021

**Course Title:** Analysis III

**Type of Change:**

- [x] in pre-requisite(s)/co-requisite(s)
- [] in course number/level
- [] in credit value
- [] in title (max. 40 characters for short title)
- [x] in Calendar description (max. 40 words or 200 characters)
- [] other (please specify):
- [] in cross-listing
- [] in degree credit exclusion(s)
- [] regularize course (from Special Topics)
- [] in course format/mode of delivery *
- [] retire/expire course

## Change From:

**Title:** Analysis III  
**Course description:**
Cardinality, metric spaces, the Cantor set, metrics and norms, metric topology, continuity, connectedness, completeness and compactness of metric spaces. Functions and function spaces, including the Inverse and Implicit Function Theorems, the Stone-Weierstrass Theorem, the Riesz Representation Theorem and Fourier series

**Prerequisites:**
SC/MATH 3001, SC/MATH 2310

## To:

**Title:** Metric Spaces  
**Course description:**
Metric spaces, norms, metric topology, continuity, connectedness, completeness, Baire category, compactness of metric spaces, Stone-Weierstrass Theorem, Heine-Borel Theorem, Banach Contractive Mapping Theorem, Hilbert spaces

**Prerequisites:**
SC/MATH 3001, SC/MATH 2022
Rationale: Recently changes were implemented to the analysis program due to low enrollments in SC/MATH 4001 6.00. MATH 3001 was refocused and SC/MATH 4001 6.00 was split into two courses, SC/MATH 4011 3.00 and SC/MATH 4012 3.00. Since the split, enrolments in MATH 4011 have substantially exceeded those in MATH 4001, making the fourth-year analysis stream viable. But MATH 4012 has yet to be offered with MATH 4011 as a prerequisite.

The purpose of this proposal is to further update the fourth-year analysis courses in order to give students more access to courses at the fourth year level. Rather than have a fixed ordering in which MATH 4011 is prerequisite to MATH 4012, the courses are being reorganized to be independent of one another, allowing students to choose one or both, according to whatever best suits their program needs and personal interest.

In order not to add an additional teaching load to our program, we propose that MATH 4011 be offered in the fall semester of odd-numbered calendar years and MATH 4012 be offered in the fall semester of even-numbered calendar years. This should also help preserve or even enhance enrollments in these courses in a given calendar year as many students will desire to take both. This format is viable as students can take MATH 3001 in the winter semester of their second year to ensure they have the opportunity to take which fourth-year course they desire in either third or fourth year. The PMATH major requirements will need to be changed from requiring MATH 4011 to requiring MATH 4011 or MATH 4012. As MATH 4011 and MATH 4012 will be of equal difficulty, it is not a reduction in program quality nor will one course be favoured over the other.

The specific changes to MATH 4011 are as follows. First a title change is in order as Analysis III and Analysis IV are not appropriate titles for MATH 4011 and MATH 4012 respectively following these changes. The prerequisites of MATH 2310 for MATH 4011 will be changed to MATH 2022 as it is important for students to have a knowledge of vector spaces to discuss normed linear spaces and the abstraction of vector spaces in MATH 2022 will prepare students for the abstraction of metric spaces. The course description has changed to exclude some material that makes more sense in MATH 4012 and to update the material.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required. Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
### Changes to Existing Course

**Faculty:**  
**Department:** Mathematics and Statistics  
**Course Number:** MATH 4012  
**Date of Submission:**  
**Effective Session:** 2020-2021  
**Course Title:** Analysis IV

**Type of Change:**
- [x] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [x] in title (max. 40 characters for short title)
- [x] in Calendar description (max. 40 words or 200 characters)
- [ ] in cross-listing
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [ ] in course format/mode of delivery *
- [ ] retire/expire course
- [ ] other (please specify):

**Change From:**

<table>
<thead>
<tr>
<th>Title: Analysis IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course description: Lesesgue measure and integration on the real line, Hilbert space, Lp spaces, Fourier analysis</td>
</tr>
<tr>
<td>Prerequisites: SC/MATH 4011</td>
</tr>
</tbody>
</table>

**To:**

<table>
<thead>
<tr>
<th>Title: Lebesgue Measure Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course description: Cardinality, Axiom of Choice, Zorn’s Lemma, Lebesgue measure and integration on the real line, completeness of L2 and relation to Fourier series, convergence in measure, absolutely continuous function, Fundamental Theorem of Calculus, Fubini’s Theorem</td>
</tr>
<tr>
<td>Prerequisites: SC/MATH 3001</td>
</tr>
</tbody>
</table>
Recently changes were implemented to the analysis program due to low enrollments in SC/MATH 4001 6.00. MATH 3001 was refocused and SC/MATH 4001 6.00 was split into two courses, SC/MATH 4011 3.00 and SC/MATH 4012 3.00. Since the split, enrolments in MATH 4011 have substantially exceeded those in MATH 4001, making the fourth-year analysis stream viable. But MATH 4012 has yet to be offered with MATH 4011 as a prerequisite.

The purpose of this proposal is to further update the fourth-year analysis courses in order to give students more access to courses at the fourth year level. Rather than have a fixed ordering in which MATH 4011 is prerequisite to MATH 4012, the courses are being reorganized to be independent of one another, allowing students to choose one or both, according to whatever best suits their program needs and personal interest.

In order not to add an additional teaching load to our program, we propose that MATH 4011 be offered in the fall semester of odd-numbered calendar years and MATH 4012 be offered in the fall semester of even-numbered calendar years. This should also help preserve or even enhance enrollments in these courses in a given calendar year as many students will desire to take both. This format is viable as students can take MATH 3001 in the winter semester of their second year to ensure they have the opportunity to take which fourth-year course they desire in either third or fourth year. The PMATH major requirements will need to be changed from requiring MATH 4011 to requiring MATH 4011 or MATH 4012. As MATH 4011 and MATH 4012 will be of equal difficulty, it is not a reduction in program quality nor will one course be favoured over the other.

The specific changes to MATH 4012 are as follows. First a title change is in order as Analysis III and Analysis IV are not appropriate titles for MATH 4011 and MATH 4012 respectively following these changes. The prerequisites of MATH 4012 will be changed to just MATH 3001 as it will be run independently from MATH 4011. The course description has changed to include some of the extensive material listed in MATH 4011 and to reflect what the course is about.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course.
Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised “Course Design” and “Method of Instruction” information.
Proposed Changes to the Specialized Honours, Honours Majors and Bachelors (BA and BSc) Requirements of the Pure Math Program in the Academic Calendar

Rationale:

- SC/MATH 4001 6.00 was split into two courses; SC/MATH 4011 3.00 and SC/MATH 4012 3.00 due to low enrolments. Enrolments in MATH 4011 have substantially exceeded those being observed in MATH 4001 since the changes making the fourth-year analysis stream viable whereas MATH 4012 has yet to be offered as MATH 4011 is listed as a prerequisite.
- A proposed change is in the works to make MATH 4011 and MATH 4012 independent courses whose offerings alternate in order to give students the choice of picking the analysis course of their interest, or picking both. Thus as only one of these courses will be offered each year, a change to the degree requirements needs to be made: instead of requiring MATH 4011, we will only require MATH 4011 or MATH 4012. As these courses are of equal difficulty, this does not decrease the difficulty of the degree.

<table>
<thead>
<tr>
<th>Change from Specialized Honours BA Program</th>
<th>Changes</th>
<th>Change to Specialized Honours BA Program</th>
</tr>
</thead>
<tbody>
<tr>
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<td>• at least six additional credits in mathematics courses without second digit 5 at the 4000 level for a total of 51 credits from major mathematics courses;</td>
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B. Major requirements:

Honours BSc Major

the mathematics/statistics core (24 credits);

- SC/MATH 2001 3.00;
- SC/MATH 3001 3.00;
- SC/MATH 3010 3.00;
- SC/MATH 3021 3.00;
- SC/MATH 3022 3.00;
- SC/MATH 4011 3.00;
- SC/MATH 4021 3.00;

at least six additional major (i.e. without second digit 5) mathematics credits at the 4000 level, for a total of at least 51 credits from major mathematics courses.

the course requirements for the second major or the minor.

- SC/MATH 3010 3.00;
- SC/MATH 3021 3.00;
- SC/MATH 3022 3.00;
- SC/MATH 4011 3.00
  or SC/MATH 4012 3.00;
- SC/MATH 4021 3.00;

at least six additional credits from major mathematics courses at the 4000 level; at least 15 additional credits from major mathematics courses or approved or equivalent courses, for a total of at least 66 credits from major mathematics courses;

Honours BSc Major

the mathematics/statistics core (24 credits);

- SC/MATH 2001 3.00;
- SC/MATH 3001 3.00;
- SC/MATH 3010 3.00;
- SC/MATH 3021 3.00;
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the mathematics/statistics core (24 credits);

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- SC/MATH 3001 3.00;
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- SC/MATH 3022 3.00;
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  or SC/MATH 4012 3.00;
- SC/MATH 4021 3.00;

at least six additional credits from major mathematics courses at the 4000 level; at least 15 additional credits from major mathematics courses or approved or equivalent courses, for a total of at least 66 credits from major mathematics courses.

the course requirements for the second major or the minor.
|     |     | minor. |     |
Changes to Existing Course

Faculty: 

Department: STS/NATS  

Date of Submission: March 2020  

Course Number: NATS 1510  

Effective Session: 2021/2022  

Course Title: History of the Environment  

Type of Change:

- [ ] in pre-requisite(s)/co-requisite(s)  
- [ ] in course number/level  
- [ ] in credit value  
- [ ] in title (max. 40 characters for short title)  
- [ ] in Calendar description (max. 40 words or 200 characters)  
- [x] other (please specify): CCE/NCRs  
- [ ] in cross-listing  
- [ ] in degree credit exclusion(s)  
- [ ] regularize course (from Special Topics)  
- [ ] in course format/mode of delivery *  
- [ ] retire/expire course

Change From:

How the Earth's environment came to be what it is now. From the formation of the Earth through all stages of human civilization, this course traces the factors that have given the planet the environment that we live in today. Course credit exclusion: SC/NATS 1840 6.00.

To:

How the Earth's environment came to be what it is now. From the formation of the Earth through all stages of human civilization, this course traces the factors that have given the planet the environment that we live in today.
Rationale: CCE with NATS 1840 removed as is no longer needed.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
Changes to Existing Course

Faculty: STS/NATS  
Department: STS/NATS  
Date of Submission: March 2020

Course Number: NATS 1840  
Effective Session: 2021/2022

Course Title: Science, Technology and the Environment

Type of Change:
- [ ] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [ ] in title (max. 40 characters for short title)
- [ ] in Calendar description (max. 40 words or 200 characters)
- [x] other (please specify): CCE/NCRs

<table>
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<tr>
<td>Course credit exclusions: ES/ENVS 1500 6.00, SC/NATS 1510 3.00. Note: Not open to any students enrolled in the Faculty of Environmental Studies.</td>
<td>NCR: No credit will be retained for any student who has passed or is taking SC/NATS 1512 3.0, SC/NATS 1515 3.0, EN/ENVS 1500 6.0. Note: Not open to any student enrolled in an Environmental Studies program.</td>
</tr>
</tbody>
</table>
Rationale: Updating CCEs and NCRs. To address overlap with NATS 1512 and NATS 1515. To address the new name of the Faculty of Environmental Studies. CCE with NATS 1510 removed as is no longer needed.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
I have reviewed the course proposal and bibliography for NATS 1595 – The Mathematics of Biology and can state that the York University Libraries have the required resources to support this undergraduate level course.

Please be aware that the library offers the following services to help students with their research:

- A librarian can go to the classroom or tutorial and introduce students to the various resources available at the library including electronic journals, e-books, and databases.
- A librarian is also available for individual consultations with students to help them find the materials they need for their research.
- A librarian can be available as a user on the course Moodle page to answer student questions using the Forum discussion, provide links to resources in the course, and post handouts presented in face-to-face instruction.

Our library staff will search the books listed in the course bibliography and will be ordering those titles that are not currently available through the library.

If you would like to select print books or digitize course reading content and place them on reserve at the library for students’ use, please place a reserve request by visiting reserves.library.yorku.ca. For more information about course reserves, please visit: http://www.library.yorku.ca/web/ask-services/facultyinstructor-support/places-items-on-reserve/.

If the course will provide additional readings to students on Moodle, copyright compliance instruction may be requested through York University’s Copyright Support Office: http://copyright.info.yorku.ca.

The following electronic resources licensed by the library may be of help to the students in this course:

- **Web of Science** is a multidisciplinary citation database that indexes over 12,000 of the highest impact journals worldwide in the sciences, social sciences and humanities.
- **Biological Abstracts** Indexes over 5200 biological and medical research journals comprehensively. It covers every modern life science discipline including agriculture, agronomy, biochemistry, biotechnology, botany, ecology and the environment, genetics, medicine, microbiology, neurology, pharmacology and zoology.
- **MathSciNet (at Ebscohost)** is the best source for mathematics research. The online version of Mathematical Reviews, which indexes and reviews the mathematical literature since 1940. Over 80,000 new items are added each year, most of them classified according to the Mathematics Subject Classification.

A more complete listing of resources is available at the following Research Guides:

- Natural Science: http://researchguides.library.yorku.ca/nats
- Biology: https://researchguides.library.yorku.ca/biology
- Mathematics: https://researchguides.library.yorku.ca/mathematics
Please note that the Steacie Library has extensive collections of books and reference materials that are relevant to this course.

In summary, I state that we are well positioned to support this course. If you have any questions, please do not hesitate to contact me.

Sincerely,

Minglu Wang, Research Data Management / Science Librarian
Steacie Science & Engineering Library
416-736-2100 x40075
mingluwa@yorku.ca
<table>
<thead>
<tr>
<th>Faculty:</th>
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<tbody>
<tr>
<td>Department:</td>
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</tr>
<tr>
<td>Date of Submission:</td>
<td>September 2020</td>
</tr>
<tr>
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<tr>
<td>Course Title:</td>
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<tr>
<td>Short Title:</td>
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With every new course proposal it is the Department’s responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.
Have you ever wondered why many flowers have 5 or 8 petals, why honeycombs form perfect hexagons, or why pineapples look like pinecones? Mathematics is an incredible tool that helps us better understand the complexities of the natural world, from the petal patterning of a flower to the spread of infectious disease. In this course students observe the mathematics of nature, exploring how simple mathematical rules and calculations give rise to complex biological phenomena such as the spiraling of a nautilus (sea) shell, the fractal patterning of a fern, the exact symmetry of honeycombs or the shape of pinecones. In this course students also use mathematical modelling software to simulate infectious disease outbreaks, allowing them to make predictions about the future, such as how many people will become infected during an epidemic.

Prerequisites: None
Co-requisites: None

Not open to any students enrolled in a Mathematics program.
Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

Topics: This course develops a student’s basic mathematical skills as well as deepens their logical reasoning and critical thinking ability. Each mathematical concept is taught in the context of a biological problem or phenomenon. Students will discover the mathematics of biology and will use mathematical modelling to better understand the past and make predictions about the future. A brief introduction of what sections will be covered in the course is provided below:

1) Math in Nature: In this section of the course students explore how nature has evolved to optimize space and resources. For example, how and why the Fibonacci sequence and the golden ratio can be observed everywhere in nature. Students recreate natural patterns through the use of sequences, series, the golden ratio and tessellations. Students systematically apply mathematical rules to create realistic drawings of natural objects, such as nautilus shells, pinecones, honeycombs and ferns, while developing a deeper understanding of the mathematics behind their design.

2) Mathematical Modelling: In this section of the course students model infectious disease outbreaks using computer software and modules. Students discover how to represent model equations with flow-diagrams. This approach allows students to easily alter existing models and create new ones. Through the use of easy to use specially design software, students explore how models can be used to study the course of an epidemic and how to stop it. In this section of the course students are assigned to groups and are given a scenario in which a novel infectious disease emerges in Toronto. Using modelling they must determine how to best stop a pandemic.

Learning outcomes:

Upon successful completion of this course students should be able to:

1) Distinguish between sequences and series and identify natural Phenomena that can be represented through the use of them.

2) Distinguish between logarithmic and geometric growth.

3) Identify mathematical properties in natural objects and understand the significance (i.e. geometric patterns, fractals, Fibonacci numbers etc.).

4) Express mathematical models through flow diagrams.

5) Define the basic reproductive number, R0, and explain its importance.

6) Interpret graphics such as time-series graphs; Explain the biological significance of graph trends and graph anomalies.

7) Think critically about how to approach open ended mathematical problems of biological significance; construct mathematical representations.
8) Describe, in non-technical terms, the biological significance of mathematical results, such as the output from disease simulations or the solution to a series; demonstrate how changes in parameters, such as an increase in the growth rate, effect model outputs, such as the population size in the future.

9) Explain the limitations and purpose of infectious disease modelling; explain the biological significance and constraints of parameter and variable values.

10) Demonstrate a deeper awareness of how mathematics can be utilized to study biological problems; Classify and compare models; make alterations to model diagrams (flow diagrams) to incorporate novel biological processes (such as vaccination, immunity etc.).
Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve “face-to-face” communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained OR in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

This course consists of three lecture hours per week, for a total of 36 hours. Lectures serve to introduce students to course concepts, such as infectious disease modelling and observable mathematical patterns in nature. Lectures are also used to clarify and expand on text readings, assigned videos and are used to help guide students on how to utilize the modelling software developed for this course.

In this course, students work together in small groups on a term project that evaluates or implements a government policy (environmental or health) based on mathematical reasoning and modelling. In addition, students engage with the instructor face-to-face in lectures and during office hours which are held both in person as well as online (through Zoom or Microsoft Teams).

1. One section is offered in the fall term and one section is offered in the winter term.

2. This course could be taught by faculty from the Department of Mathematics and Statistics, particularly those in the Mathematical Biology and Disease Modelling Group, or members in the Division of Natural Science with a PhD in Applied Mathematics or a related area. In addition, faculty in the Department of Biology, with a background in Computational Biology or Applied Mathematics could also teach this course.

3. Carly Rozins is expected to teach this course in the coming year.
Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Weekly Online Quizzes: 10% (Using Webwork or Moodle – to promote student engagement and facilitate learning)

In-Class Quiz (4 in total): 20%

Assignments: 40% (may include a term project)

Cumulative Final Exam: 30%

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

There is no assigned text for this course. Resources will include lecture notes, online videos and engagement with mathematical modelling software developed by Carly Rozins and accessible for free through RStudio Pro.

Additional course/background readings may include excerpts from:


This course requires a classroom that can accommodate approximately 200 students, and must include regular AV equipment, such as a projector for PowerPoint presentations, that capability to project slides/videos/programs from a personal computer, as well as lecture recording capabilities. In addition, teaching assistants as normally assignment by the department will be required. Furthermore, students will access an interactive program, written by Carly Rozins, hosted online by York University. There have been ongoing discussions with Violeta Gotcheva, Director of IT Services for the Faculty of Science, on how to best host the program so it is as easy as possible for the students to access.
This course meets the requirements of York University’s general education offerings in science, by introducing non-science students to the applications and theory of applied mathematics in a biological context. Students will engage in activities in class and at home through computer modules. Throughout students will develop the critical thinking skills necessary to tackle open ended mathematical problems of biological significance, such as what policy should be enacted to slow or stop the spread of infectious disease in a population.

This course will broaden students’ perspective on the applicability of mathematics. Students will develop a strong understanding of how models can be utilized to answer specific questions of interest to epidemiologists, policy makers, conservationists, etc. Through computer modules students will be able to use mathematical modelling, without requiring an extensive understanding of complex mathematical methods. As such, Students will develop a strong understanding of what mathematical models represent, how to utilize them and how to interpret their results. Students will also learn to communicate the biological significance of mathematical modelling results.

Throughout this course, students regularly observe and express mathematics through graphical representations. For example, in the math in nature section of this course, students apply a calculated quantity (called the golden ratio) to drawings of natural objects. Students will see firsthand how this simple angle and rule will allow them to draw very realistic plants, pinecones, fruit etc. In doing so, students develop an understanding of why this “rule” is optimal and why it has been adopted by countless organisms across the globe.

In order to continue to offer students flexibility in meeting their general education requirements in science, the Division of Natural Science has sought to increase the number of 3 credit courses. There are currently no NATS courses that focus on mathematical biology or mathematical modelling.
Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women’s Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept: ____________________________
Signature (Authorizing cross-listing) Department Date

Dept: ____________________________
Signature (Authorizing cross-listing) Department Date

Dept: ____________________________
Signature (Authorizing cross-listing) Department Date

Accessible format can be provided upon request.
Proposed Changes to the Program-Specific Degree Requirements of the Physics and Astronomy Program in the Academic Calendar

**Rationale:**
- Addition of PHYS 2030 3.0 to Honours degree requirements.
- Change of PHYS 4270 4.0 to PHYS 4270 3.0 in all applicable degrees.

<table>
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<tr>
<th>Change from</th>
<th>Changes</th>
<th>Change to</th>
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The program core is defined to be (24 credits): SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00, or SC/PHYS 1010 6.00; SC/PHYS 2010 3.00; SC/PHYS 2020 3.00; SC/PHYS 2040 3.00; SC/PHYS 2060 3.00; SC/PHYS 3040 6.00. (Note: all program core courses require mathematics prerequisites or corequisites.) | **Program Core**  
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| **BACHELOR PROGRAM** | **BACHELOR PROGRAM** | **BACHELOR PROGRAM** |
| [...] | [...] | [...] |
| **B. Major requirements:** | **B. Major requirements:** | **B. Major requirements:** |
| **Physics Stream**  
SC/MATH 1025 3.00; the program core, as specified above (24 credits, including 6 credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3090 3.00; SC/PHYS 3220 3.00; SC/PHYS 4061 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00; six | **Physics Stream**  
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Students may follow a stream emphasizing physics, applied physics or astronomy and astrophysics. A. General education: non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.

B. Major requirements:

**Physics Stream**

SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 4270 4.00.
3020 3.00; SC/PHYS 3030
3.00; SC/PHYS 3090
3.00; SC/PHYS 3220
3.00; SC/PHYS 4010
3.00; SC/PHYS 4020
3.00; SC/PHYS 4061 3.00; two
of SC/PHYS 4011 3.00, SC/PHYS
4040 3.00, SC/PHYS 4050 3.00;
six credits from SC/PHYS 4062
3.00 or SC/PHYS 4210
3.00 or SC/PHYS 4211 3.00; three
additional credits in PHYS courses at the
3000 level or higher.

3020 3.00; SC/PHYS 3030
3.00; SC/PHYS 3090
3.00; SC/PHYS 3220
3.00; SC/PHYS 4010
3.00; SC/PHYS 4020
3.00; SC/PHYS 4061 3.00; two
of SC/PHYS 4011 3.00, SC/PHYS
4040 3.00, SC/PHYS 4050 3.00;
six credits from SC/PHYS 4062
3.00 or SC/PHYS 4210
3.00 or SC/PHYS 4211 3.00; three
additional credits in PHYS courses at the
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3020 3.00; SC/PHYS 3030
3.00; SC/PHYS 3090
3.00; SC/PHYS 3220
3.00; SC/PHYS 4010
3.00; SC/PHYS 4020
3.00; SC/PHYS 4061 3.00; two
of SC/PHYS 4011 3.00, SC/PHYS
4040 3.00, SC/PHYS 4050 3.00;
six credits from SC/PHYS 4062
3.00 or SC/PHYS 4210
3.00 or SC/PHYS 4211 3.00; three
additional credits in PHYS courses at the
3000 level or higher.
**HONOURS MAJOR**

Students may follow a stream emphasizing physics or astronomy and astrophysics.

A. General education: non-science: 12 credits; Mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.

B. Major requirements:

**Physics Stream**

SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

**Astronomy and Astrophysics Stream**

SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

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**HONOURS MAJOR**

Students may follow a stream emphasizing physics or astronomy and astrophysics.

A. General education: non-science: 12 credits; Mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.

B. Major requirements:

**Physics Stream**

SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

**Astronomy and Astrophysics Stream**

SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00;
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00; eight additional credits in PHYS at the 4000 level for an overall total of at least 54 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

HONOURS MINOR

Students may follow a stream in physics or a stream in astronomy in the minor subject area.

Note: the following courses are required as prerequisites or corequisites for the courses below: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00.

Physics Stream

the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00 for an overall total of 33 credits from PHYS courses.

Astronomy and Astrophysics Stream

the program core, as specified above (24 credits including six credits at the 3000 level); six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00 3.00; eight additional credits in PHYS at the 4000 level for an overall total of at least 54 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

HONOURS MINOR

Students may follow a stream in physics or a stream in astronomy in the minor subject area.

Note: the following courses are required as prerequisites or corequisites for the courses below: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00.

Physics Stream

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Astronomy and Astrophysics Stream

the program core, as specified above (24 credits including six credits at the 3000 level); six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 3.00; nine additional credits in PHYS at the 4000 level for an overall total of at least 57 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

HONOURS MINOR

Students may follow a stream in physics or a stream in astronomy in the minor subject area.

Note: the following courses are required as prerequisites or corequisites for the courses below: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00.

Physics Stream

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Astronomy and Astrophysics Stream

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For an overall total of at least 39 credits from PHYS courses.
**Program Proposal**

1. Program:

   PHYS (Physics and Astronomy)

2. Degree Designation:

   Honours BSc in Physics and Astronomy (Astronomy and Astrophysics Stream)
   Honours BSc in Physics and Astronomy (Physics Stream)

3. Type of Modification:

   Changes to program requirements.

4. Effective Date:

   Fall 2021

5. Provide a general description of the proposed changes to the program.

   This proposal seeks to add a required (existing) three-credit course, PHYS 2030 3.0, to both Honours Streams and both Double Major Streams.

6. Provide the rationale for the proposed changes.

   Adding PHYS 2030 3.0, Computational Methods for Physicists and Engineers, as a required course to both Honours Streams and both Double Major Streams will help ensure basic training in scientific computing for Honours students applying to graduate school or seeking positions in industry. This course builds on the 1000-level computing course required of all majors in the Faculty of Science. It will be the only required course in the major focusing on computation. Ensuring that all physics majors take this course enables a wider latitude for the exploration of physical phenomena in third- and fourth-year courses.

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives. If changes to the admission requirements are being proposed, comment on the appropriateness of the revised requirements to the achievement of the program learning outcomes.
 PHYS 2030 is already a required course in our Specialized Honours degrees in both streams. PHYS 2030 will make the same contributions to the program learning outcomes in our Honours degree streams as it does in our Specialized Honours degree streams. Our curriculum mapping spreadsheets have been updated to reflect these changes.

8. If relevant, summarize the consultation undertaken with relevant academic units, including commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

   Not relevant.

9. Describe any resource implications and how they are being addressed (e.g., through a reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

   No resource implications. TA resources are sufficient to handle slightly increased enrolment in PHYS 2030 3.0.

10. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.

   See attached.
Proposed Changes to the Program-Specific Degree Requirements of the Physics and Astronomy Program in the Academic Calendar

**Rationale:**
- Addition of PHYS 2030 3.0 to Honours degree requirements.
- Change of PHYS 4270 4.0 to PHYS 4270 3.0 in all applicable degrees.

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<td>In addition to the programs defined below, the Department of Physics and Astronomy also offers a Specialized Honours BSc degree stream in space science whose degree requirements are specified in a separate entry in the Faculty of Science Programs of Study section.</td>
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HONOURS PROGRAMS, SPECIALIZED HONOURS PROGRAM

Students may follow a stream emphasizing physics, applied physics or astronomy and astrophysics. A. General education: non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.

B. Major requirements:

Physics Stream

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Astronomy and Astrophysics Stream

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**Physics Stream**

SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

**Astronomy and Astrophysics Stream**

SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

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**HONOURS MAJOR**

Students may follow a stream emphasizing physics or astronomy and astrophysics.

A. General education: non-science: 12 credits; Mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.

B. Major requirements:

**Physics Stream**

SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.

**Astronomy and Astrophysics Stream**

SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; SC/PHYS 2070 3.00; SC/PHYS 3220 3.00;
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00;  
SC/PHYS 4270 4.00; eight  
additional credits in PHYS at the  
4000 level for an overall total of  
least 54 credits from PHYS  
courses; the requirements for the  
second major or the minor, in  
Honours Double Major or Honours  
Major/Minor BSc programs.

...[...]

**HONOURS MINOR**

Students may follow a stream in  
physics or a stream in astronomy in  
the minor subject area.

**Note:** the following courses are  
required as prerequisites or  
corequisites for the courses  
below: SC/MATH 1013  
3.00; SC/MATH 1014  
3.00; SC/MATH 1025  
3.00; SC/MATH 2015  
3.00; SC/MATH 2271 3.00.

**Physics Stream**

the program core, as specified  
above (24 credits including six  
credits at the 3000 level);  
SC/PHYS 2213 3.00; SC/PHYS  
3220 3.00; three credits  
from SC/PHYS 3010  
3.00, SC/PHYS 3020  
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00 for an  
overall total of 33 credits from  
PHYS courses.

**Astronomy and Astrophysics  
Stream**

the program core, as specified  
above (24 credits including six  
credits at the 3000 level);  
six credits from SC/PHYS 3010  
3.00, SC/PHYS 3020  
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00; eight  
ine additional credits in PHYS at  
the 4000 level for an overall total of  
least 54 credits from PHYS  
courses; the requirements for the  
second major or the minor, in  
Honours Double Major or Honours  
Major/Minor BSc programs.

...[...]

**HONOURS MINOR**

Students may follow a stream in  
physics or a stream in astronomy in  
the minor subject area.

**Note:** the following courses are  
required as prerequisites or  
corequisites for the courses  
below: SC/MATH 1013  
3.00; SC/MATH 1014  
3.00; SC/MATH 1025  
3.00; SC/MATH 2015  
3.00; SC/MATH 2271 3.00.

**Physics Stream**

the program core, as specified  
above (24 credits including six  
credits at the 3000 level);  
SC/PHYS 2213 3.00; SC/PHYS  
3220 3.00; three credits  
from SC/PHYS 3010  
3.00, SC/PHYS 3020  
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00 for an  
overall total of 33 credits from  
PHYS courses.

**Astronomy and Astrophysics  
Stream**

the program core, as specified  
above (24 credits including six  
credits at the 3000 level);  
six credits from SC/PHYS 3010  
3.00, SC/PHYS 3020  
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00; nine  
ine additional credits in PHYS at the  
4000 level for an overall total of at  
least 57 credits from PHYS  
courses; the requirements for the  
second major or the minor, in  
Honours Double Major or Honours  
Major/Minor BSc programs.

...[...]

**HONOURS MINOR**

Students may follow a stream in  
physics or a stream in astronomy in  
the minor subject area.

**Note:** the following courses are  
required as prerequisites or  
corequisites for the courses  
below: SC/MATH 1013  
3.00; SC/MATH 1014  
3.00; SC/MATH 1025  
3.00; SC/MATH 2015  
3.00; SC/MATH 2271 3.00.

**Physics Stream**

the program core, as specified  
above (24 credits including six  
credits at the 3000 level);  
SC/PHYS 2213 3.00; SC/PHYS  
3220 3.00; three credits  
from SC/PHYS 3010  
3.00, SC/PHYS 3020  
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00 for an  
overall total of 33 credits from  
PHYS courses.

**Astronomy and Astrophysics  
Stream**

the program core, as specified  
above (24 credits including six  
credits at the 3000 level);  
SC/PHYS 2213 3.00; SC/PHYS  
3220 3.00; six credits from SC/PHYS  
3010 3.00, SC/PHYS 3020  
3.00, SC/PHYS 3030  
3.00, SC/PHYS 3090 3.00; eight  
ine additional credits in PHYS at the  
4000 level for an overall total of at  
least 54 credits from PHYS  
courses; the requirements for the  
second major or the minor, in  
Honours Double Major or Honours  
Major/Minor BSc programs.
| SC/PHYS 1070 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3070 3.00 or SC/PHYS 4270 4.00; three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00, for an overall total of at least 39 credits from PHYS courses. | SC/PHYS 1070 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3070 3.00 or SC/PHYS 4270 4.00-3.00; three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00, for an overall total of at least 39 credits from PHYS courses. | SC/PHYS 1070 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3070 3.00 or SC/PHYS 4270 3.00; three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00, for an overall total of at least 39 credits from PHYS courses. |
Changes to Existing Course

Faculty: [Space for name]
Department: Physics and Astronomy
Date of Submission: Oct 21, 2020

Course Number: PHYS 4270
Effective Session: Fall 2021
Course Title: Astronomical Techniques

Type of Change:

- [ ] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [X] in credit value
- [ ] in title (max. 40 characters for short title)
- [ ] in Calendar description (max. 40 words or 200 characters)
- [ ] other (please specify):
- [ ] in cross-listing
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [ ] in course format/mode of delivery *
- [ ] retire/expire course

Change From:
PHYS 4270 4.0 Astronomical Techniques

To:
PHYS 4270 3.0 Astronomical Techniques
Rationale: This change will align the undergraduate credit value of this course with current practice. This two-semester-long integrated course involves learning about and conducting observational astronomy projects and data analysis. The work entailed has evolved away from a four-credit course to a three-credit course, making it consistent with the graduate designation, PHYS 5390 3.0. Specifically, as the course has moved to a project-based course, the utility of final exams each semester has been greatly diminished, and they have been eliminated. The subject matter covered in the course is unaffected by this change. By reducing this course by one credit, a number of "book-keeping" challenges will be avoided for some undergraduates and their advisors without compromising the academic integrity of the course. Currently, some astronomy students graduate with 121 credits because of the "4.0" and the lack of available 1.0 or 2.0 credit courses. There are no resource implications to this change.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised ‘Course Design’ and ‘Method of Instruction’ information.
COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY
TEMPLATE

NEW COURSE PROPOSAL FORM

<table>
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<th>Faculty:</th>
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<td>Science</td>
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<th>Department:</th>
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<tbody>
<tr>
<td>Chemistry</td>
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<table>
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<tr>
<th>Date of Submission:</th>
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<tr>
<td>October, 2020</td>
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<table>
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<tr>
<th>Course Number:</th>
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<tr>
<td>CHEM 2000 3.0</td>
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<th>Academic Credit Weight:</th>
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<table>
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<tr>
<th>Course Title:</th>
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<tr>
<td>Problem Solving in Chemistry</td>
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<th>Short Title:</th>
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<tr>
<td>Prob. Solv. in Chem.</td>
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With every new course proposal it is the Department’s responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.
This course introduces students to fundamental methods and techniques that are needed to view and solve problems in chemistry. The instructor first gives a brief overview and introduction of mathematical knowledge that is needed in solving general chemistry problems. The knowledge is then applied to develop concepts of a variety of fields in chemistry. The concepts include: (1) thermodynamic state functions and their analyses; (2) numerical analysis in experiments; (3) evolution of material quantities in chemical kinetics; (4) linear algebra application in chemistry; (5) vector analysis in chemistry. Overall, the purpose of this course is to prepare students for the more advanced third- and fourth-year chemistry courses.

Prerequisites: SC/CHEM 1000 3.0, SC/CHEM 1001 3.0, SC/MATH 1013. Prerequisite or corequisite: SC/MATH 1014.

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This course introduces students to fundamental methods and techniques that are needed to view and solve problems in chemistry. The course prepares students for the more advanced third and fourth year chemistry courses.

---

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.
Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

The first six topics below will be covered in this course. It is planned to spend on average two weeks on each topic. One of the other optional topics might be taught if there is additional time.

1. State functions and their quantification. Introduction to multivariable calculus and partial differentiation. Application to thermodynamic state functions. Their differentiation and integration are also discussed.
2. Error analysis and numerical analysis in chemistry. Gaussian function, error function, normal distribution, skewed distribution, linear and nonlinear regression. Application to the treatment of experimental data in chemistry.
3. Evolution of material quantities in chemical kinetics. Time differential equations for concentrations of reactants, intermediates, and products are set and solved. Typical types of reactions, such as first-order and second-order reactions, are included.

Optional topics:

7. Normal mode analysis of molecular motion. The eigenvalue problem applied to the concerted motions of atoms in a molecule.
8. Distribution of states in chemistry. Introduction to combinatorics and probability. Application to state degeneracy and equilibrium distributions of states.

Given the mathematical content involved, we have consulted and discussed with our colleagues at the Department of Mathematics and Statistics about this course. We have come to the following agreement: (1) the knowledge is needed for chemistry undergraduate students; (2) it would require too many MATH courses to cover the content for the Chemistry programs to accommodate, given the existing heavy course load; (3) given the purely chemistry orientation, it is better to have a chemist teach this course.
Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours, what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).

2. Number of department members currently competent to teach the course.

3. Instructor(s) likely to teach the course in the coming year.

4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained OR in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

The course will be taught in the traditional lecture way. Assignments will be given to assess students’ progress. The course materials will be correspondingly modified.

The proposed course will be offered in the fall term once every year. There will be one section.

Several faculty members in the Department are competent to teach the course.

Prof. Tao Zeng is likely to be the first instructor of this course. Other possible instructors are Professor René Fournier and Professor William Pietro.

The students will have 3h of lecture per week. They are also meant to spend 3h a week to private study and to their assignments.
Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Mid Term 1: 20%
Mid Term 2: 20%
Problem set: 20%
Final Exam: 40%

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Donald A. McQuarrie, Mathematics for Physical Chemistry, University Science Books, Sausalito, California. This book is available in our library.
Other Resources:
A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain.

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

A classroom with multiple layers of chalkboards is desired. A standard Audio-Visual System will be used to show PowerPoint slides. The course can also be taught over Zoom, with lots of math writing on an iPad.

Course Rationale:
The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

Over the years, the mathematical skills of chemistry majors have become largely insufficient to adequately understand and master third- and fourth-year topics and the third- and fourth-year have had to step in to teach those missing skills. This scattered arrangement is not ideal for students to fully understand the knowledge and to connect the different fields in chemistry, and unify them under the same set of concepts.

This course was designed to fill those gaps early on and it is viewed as being of significant importance for all students in chemistry.

The expected enrolment in the course: up to 50 students from Chemistry.
Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women’s Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

<table>
<thead>
<tr>
<th>Dept: ______________________________</th>
<th>Signature (Authorizing cross-listing)</th>
<th>Department</th>
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<td>Department</td>
<td>Date</td>
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</tbody>
</table>

Accessible format can be provided upon request.
I have reviewed the course proposal and bibliography for **CHEM 2000 – Problem Solving in Chemistry** and can state that the York University Libraries have the required resources to support this graduate level course.

Please be aware that the library offers the following services to help students with their research:

- A librarian is also available for individual consultations, both face-to-face and online, with students to help them find the materials they need for their projects.
- A librarian can create a custom workshop tailored to the course. Content can include both introductory and in-depth instruction on searching for chemical information in SciFinder, Reaxys, Web of Science, Scopus, and elsewhere. Reference management using software such as Mendeley and Zotero can also be introduced.
- A custom online research guide tailored to the course can be created upon request.

The following book in the course bibliography is currently available in the library:


If you would like copies of this book to be placed on reserve at the library for students’ use, please place a reserve request by visiting reserves.library.yorku.ca. For more information about course reserves, please visit: http://www.library.yorku.ca/web/ask-services/facultyinstructor-support/places-items-on-reserve/.

The following electronic resources licensed by the library may be of help to the students in this course:

- SciFinder
- Reaxys
- Web of Science
- Scopus
A more complete listing of resources is available at the following Research Guide:

- Chemistry: [http://researchguides.library.yorku.ca/chemistry](http://researchguides.library.yorku.ca/chemistry)

Please note that the Steacie Library has extensive collections of books and reference materials that are relevant to this course.

In summary, I state that we are well positioned to support this course. If you have any questions, please do not hesitate to contact me.

Sincerely,

Minglu Wang, Research Data Management Librarian
Steacie Science & Engineering Library
416-736-2100 x40075 mingluwa@yorku.ca