



FOR APPROVAL

PUBLIC

OPEN SESSION

TO: UTSC Academic Affairs Committee

SPONSOR: William Gough, Vice-Principal Academic and Dean
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PRESENTER: Mark Schmuckler, Vice-Dean Undergraduate
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DATE: January 8, 2020 for January 15, 2020

AGENDA ITEM: 5

ITEM IDENTIFICATION:

Undergraduate Minor Curricular Modifications, Sciences

JURISDICTIONAL INFORMATION:

University of Toronto Scarborough Academic Affairs Committee (AAC) “is concerned with matters affecting the teaching, learning and research functions of the Campus” (*AAC Terms of Reference, Section 4*). Under section 5.6 of its terms of reference, the Committee is responsible for approval of “Major and minor modifications to existing degree programs.” The AAC has responsibility for the approval of Major and Minor modifications to existing programs as defined by the University of Toronto Quality Assurance Process (*UTQAP, Section 3.1*).

GOVERNANCE PATH:

1. UTSC Academic Affairs Committee [For Approval] (January 15, 2020)

PREVIOUS ACTION TAKEN:

No previous action in governance has been taken on this item.

HIGHLIGHTS:

This package includes minor modifications to undergraduate curriculum, submitted by the Sciences academic units identified below, which require governance approval. Minor modifications to curriculum are understood as those that do not have a significant impact on program or course learning outcomes. They require governance approval when they modestly change the nature of a program or course.

- The Department of Biological Sciences (Report: Biological Sciences)
 - 10 program changes
 - MAJOR PROGRAM IN BIOLOGY (SCIENCE)
 - MAJOR PROGRAM IN CONSERVATION AND BIODIVERSITY (SCIENCE)
 - MAJOR PROGRAM IN HUMAN BIOLOGY (SCIENCE)
 - MAJOR PROGRAM IN MOLECULAR BIOLOGY, IMMUNOLOGY AND DISEASE (SCIENCE)
 - MAJOR PROGRAM IN PLANT BIOLOGY (SCIENCE)
 - SPECIALIST (CO-OPERATIVE) PROGRAM IN MOLECULAR BIOLOGY AND BIOTECHNOLOGY (SCIENCE)
 - SPECIALIST PROGRAM IN CONSERVATION AND BIODIVERSITY (SCIENCE)
 - SPECIALIST PROGRAM IN HUMAN BIOLOGY (SCIENCE)
 - SPECIALIST PROGRAM IN INTEGRATIVE BIOLOGY (SCIENCE)
 - SPECIALIST PROGRAM IN MOLECULAR BIOLOGY AND BIOTECHNOLOGY (SCIENCE)
 - 4 new courses
 - BIOB90H3
 - BIOC90H3
 - BIOD13H3
 - BIOD34H3
 - 1 course change
 - BIOC99H3 – prerequisite CGPA change

FINANCIAL IMPLICATIONS:

There are no net financial implications to the campus operating budget.

RECOMMENDATION:

Be It Resolved,

THAT the minor modifications to undergraduate programs, submitted by UTSC undergraduate Sciences academic units, as described in Undergraduate Minor Curricular Modifications for Approval, Report: Biological Sciences, dated January 15, 2020, and recommended by the Vice-Principal Academic and Dean, William Gough, be approved effective Fall 2020 for the academic year 2020-21.

DOCUMENTATION PROVIDED:

1. 2020-21 Curriculum Cycle: Undergraduate Minor Curriculum Modifications for Approval Report: Biological Sciences, dated January 15, 2020.



2020-21 Curriculum Cycle

Undergraduate Minor Curriculum Modifications for Approval

Report: Biological Sciences

January 15, 2020

Biological Sciences (UTSC), Department of

10 Minor Program Modifications:

MAJOR PROGRAM IN BIOLOGY (SCIENCE)

Completion Requirements:

Program Requirements

This program consists of 8.0 required credits.

First Year

1. 1.0 Credit of Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit of Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 0.5 Credit in Mathematics or Statistics

Choose from:

MATA29H3 Calculus I for the Life Sciences

MATA30H3 Calculus I for Physical Sciences

STAB22H3 Statistics I

PSYB07H3 Data Analysis in Psychology

Second Year

4. 3.0 Credits of Biology Core Courses

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

{ BIOB34H3 Animal **Physiology** or (~~BIOB30H3~~) ~~Mammalian~~ Physiology }

{ BIOB38H3 Plants and Society or (~~BIOB31H3~~) ~~Plant~~ Physiology }

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

*Note: Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment

in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

5. 0.5 Credit of Biology Core Labs

Choose from:

BIOB12H3 Cell and Molecular Biology Laboratory

BIOB32H3 Animal Physiology Laboratory

BIOB33H3 Human Development and Anatomy Laboratory

BIOB52H3 Ecology and Evolutionary Biology Laboratory

Third Year

6. 1.5 Credits of Additional C-level Biology Courses

Choose from: Any BIO C-level courses offered by the department.

Note: NROC34H3 (Neuroethology) may also be used toward fulfilling this requirement .

BIOC90H3 Integrative Multimedia Documentary Project (CR/NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information.

Fourth Year

7. 0.5 Credit of Additional D-Level Biology Courses

Choose from: Any BIO D-level courses offered by the department. Note: that this includes the Biology Supervised Studies and Directed Research courses (BIOD95H3, BIOD98Y3 and BIOD99Y3).

Description of Proposed Changes:

1. Requirement 4: added BIOB90H3 (new course program requirement) note. Removed (BIOB30H3) and (BIOB31H3) as optional course
2. Requirement 6: added BIOC90H3 (new course program requirement)

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. (BIOB30H3) and (BIOB31H3) are retired courses that are no longer relevant to this program requirement.
2. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program.

Impact: None.

Consultation: DCC Approval: June 19 and September 17, 2019

Resource Implications: None.

MAJOR PROGRAM IN CONSERVATION AND BIODIVERSITY (SCIENCE)

Completion Requirements:

Program Requirements

This program consists of 8.5 required credits.

First Year

1. 1.0 Credit of Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit of Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 0.5 Credit in Mathematics or Statistics

Choose from:

MATA29H3 Calculus I for the Life Sciences
MATA30H3 Calculus I for Physical Sciences
STAB22H3 Statistics I
PSYB07H3 Data Analysis in Psychology

Second Year

4. 3.0 Credits of Biology Core Courses

BIOB10H3 Cell Biology
BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
BIOB34H3 Animal Physiology
† BIOB38H3 Plants and Society ~~or (BIOB31H3) Plant Physiology †~~
BIOB50H3 Ecology
BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

5. 0.5 Credit of Biology Core Labs

BIOB52H3 Ecology and Evolutionary Biology Laboratory

Third Year

6. 1.0 Credit of Ecology & Evolution Foundation Courses

Choose from:

BIOC16H3 Evolutionary Genetics and Genomics
BIOC50H3 Macroevolution
BIOC52H3 Field ~~BIOC59H3 Advanced Population~~ Ecology
BIOC61H3 Community Ecology and Environmental Biology
BIOC63H3 Conservation Biology

7. 1.0 Credit of Other C-level Courses

Choose from:

BIOC37H3 Plants: Life on the Edge
~~(BIOC38H3) Plants and Society~~
BIOC40H3 Plant Physiology
BIOC51H3 Tropical Biodiversity ~~Field Course~~
~~BIOC52H3 Ecology~~ Field Course
BIOC54H3 Animal Behaviour
BIOC58H3 Biological Consequences of Global Change
BIOC59H3 Advanced Population Ecology
BIOC60H3 Winter Ecology
BIOC62H3 Role of Zoos and Aquariums in ~~Conservation~~
~~BIOC63H3 Conservation Biology~~
BIOC65H3 Environmental Toxicology
(BIOC67H3) Inter-University Biology Field Course
EESC04H3 Biodiversity and Biogeography
EESC30H3 Environmental Microbiology

BIOC90H3 Integrative Multimedia Documentary Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

Fourth Year

8. 0.5 Credit of D-level Courses

Choose from:

BIOD25H3 Genomics

BIOD26H3 Fungal Biology & Pathogenesis

BIOD34H3 Conservation BIOD33H3 Comparative Animal Physiology

BIOD43H3 Animal Movement and Exercise

BIOD45H3 Animal Communication

BIOD48H3 Ornithology

BIOD52H3 Biodiversity and Conservation

BIOD53H3 Special Topics in Animal Behaviour

BIOD54H3 Applied Conservation Biology

BIOD55H3 Experimental Animal Behaviour

BIOD59H3 Models in Ecology, Epidemiology and Conservation

BIOD60H3 Spatial Ecology

BIOD62H3 Symbiosis : Interactions Between Species and Speciation

BIOD63H3 From Individuals to Ecosystems: Advanced Topics in Ecology

BIOD66H3 Causes & Consequences of Biodiversity

BIOD67H3 Inter-University Biology Field Course

EESD15H3 Fundamentals of Site Remediation

Description of Proposed Changes:

1. Requirement 4: added BIOB90H3 (new course program requirement) note. Removed (BIOB31H3) retired course as an optional course.
2. Requirement 6: added BIOC52H3 and BIOC63H3 as optional courses. Removed BIOC59H3 as an optional course
3. Requirement 7: added BIOC90H3 (new course program requirement) note. Removed (BIOC38H3) BIOC52H3, and BIOC63H3 as optional courses. Added BIOC59H3 as an optional course.
4. Requirement 8: added new course BIOD34H3 as an optional course. Changed BIOD62H3 title change. Removed BIOD33H3 as an optional course

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. Removed retired course (BIOB31H3) since this course was last offered 6 years ago and is no longer relevant to the program.
2. BIOC52H3 and BIOC63H3 will provide students with more laboratory-based ecology course options to complete this program requirement. BIOC59H3 is being removed as it is no longer relevant to this program requirement.
3. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. (BIOC39H3) is a retired course and BIOC52H3 and BIOC63H3 are more suited to be taken in requirement 6 rather in 7. BIOC59H3 is being added as it is a more suitable follow-up elective to the courses taken in earlier requirements.
4. BIOD34H3 is a new course that will provide students with more D-level options to complete this program requirement. BIOD62H3 updated course title to ensure consistency throughout the Calendar. BIOD33H3 is removed because it is no longer relevant to this program requirement.

Impact: None.

Consultation: DCC Approval: June 19, 2019

Resource Implications: None.

MAJOR PROGRAM IN HUMAN BIOLOGY (SCIENCE)

Completion Requirements:

Program Requirements:

This program consists of 8.5 credits.

Required Courses and Suggested Course Sequence

First Year

1. 1.0 Credit of Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit in Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 1.0 Credit in Introductory Psychology Courses

PSYA01H3 Introduction to Biological and Cognitive Psychology

PSYA02H3 Introduction to Clinical, Developmental, Personality and Social Psychology

4. 0.5 Credit in Mathematics or Statistics

Choose From:

MATA29H3 Calculus I for the Life Sciences

MATA30H3 Calculus I for Physical Sciences

STAB22H3 Statistics I

PSYB07H3 Data Analysis in Psychology

Second Year

5. 2.5 Credits of Biology Core Courses

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

BIOB34H3 Animal Physiology

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

6. 0.5 Credit in a Biology Core Lab

Choose From:

BIOB32H3 Animal Physiology Laboratory

BIOB33H3 Human Development and Anatomy

Third/Fourth Years

7. 1.5 Credits of C-Level Courses

Choose From:

BIOC10H3 Cell Biology: Proteins from Life to Death

BIOC14H3 Genes, Environment and Behaviour

BIOC15H3 Genetics

BIOC16H3 Evolutionary Genetics and Genomics

BIOC17H3 Microbiology

BIOC19H3 Animal Developmental Biology

BIOC20H3 Principles of Virology

BIOC21H3 Vertebrate Histology: Cells and Tissues

BIOC32H3 Human Physiology I

BIOC34H3 Human Physiology II

BIOC35H3 Principles of Parasitology

BIOC39H3 Immunology

BIOC54H3 Animal Behaviour

BIOC58H3 Biological Consequences of Global Change

BIOC65H3 Environmental Toxicology

NROC61H3 Learning and Motivation
NROC64H3 Sensorimotor Systems
NROC69H3 Synaptic Organisation and Physiology of the Brain

BIOC90H3 Integrative Multimedia Documentary Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

8. 0.5 Credit of D-Level Biology Courses

Choose From:

BIOD07H3 Advanced Topics and Methods in Neural Circuit Analysis
BIOD08H3 Theoretical Neuroscience
BIOD12H3 Protein Homeostasis
BIOD17H3 Seminars in Cellular Microbiology
BIOD19H3 Epigenetics in Health and Disease
BIOD20H3 Special Topics in Virology
BIOD26H3 Fungal Biology and Pathogenesis
BIOD29H3 Pathobiology of Human Disease
BIOD33H3 Comparative Animal Physiology
BIOD35H3 Sports Science
BIOD43H3 Animal Movement and Exercise
BIOD59H3 Models in Ecology, Epidemiology and Conservation
BIOD65H3 Pathologies of the Nervous System
BIOD95H3 Supervised Study in Biology (topic must be human-related and approved by the program supervisor)
NROD66H3 Drug Addiction
NROD67H3 **Neuroscience Psychobiology** of Aging

Description of Proposed Changes:

1. Requirement 5: added BIOB90H3 (new course program requirement) note
2. Requirement 7: added BIOC90H3 (new course program requirement) note
3. Requirement 8: have updated NROD67H3 title

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program.
2. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program.
3. NROD67H3 title has been updated to ensure consistency and accuracy throughout the Calendar

Impact: None.

Consultation: DCC Approval: June 19th and September 17, 2019.

Resource Implications: None.

MAJOR PROGRAM IN MOLECULAR BIOLOGY, IMMUNOLOGY AND DISEASE (SCIENCE)

Completion Requirements:

Program Requirements

This program consists of 8.5 credits.

First Year

1. 1.0 Credit of Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit of Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 0.5 Credit in Mathematics or Statistics

Choose from:

MATA29H3 Calculus I for the Life Sciences

MATA30H3 Calculus I for Physical Sciences

STAB22H3 Statistics I

PSYB07H3 Data Analysis in Psychology

Second Year

4. 2.5 Credits of Biology Core Courses

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

BIOB34H3 Animal Physiology

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

5. 0.5 Credit in a Biology Core Lab

Choose From:

BIOB12H3 Cell and Molecular Biology Laboratory

BIOB32H3 Animal Physiology Laboratory

BIOB33H3 Human Development and Anatomy

Third/Fourth Years

6. 1.5 Credit of Required C-level Courses

BIOC17H3 Microbiology

BIOC20H3 Principles of Virology

BIOC39H3 Immunology

7. 1.0 Credit of Additional C-level Courses

Choose from:

BIOC10H3 Cell Biology: Proteins from Life to Death

BIOC12H3 Biochemistry I: Proteins & Enzymes

BIOC13H3 Biochemistry II: Bioenergetics and Metabolism

BIOC14H3 Genes, Environment and Behaviour

BIOC15H3 Genetics

BIOC19H3 Animal Developmental Biology

BIOC31H3 Plant Development and Biotechnology

BIOC35H3 Principles of Parasitology

BIOC90H3 Integrative Multimedia Documentary Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

8. 0.5 credit of D-level Biology Courses

Choose from:

BIOD12H3 Protein Homeostasis

BIOD13H3 Herbolgy : The Science Behind Medicinal Plants

BIOD17H3 Seminars in Cellular Microbiology

BIOD19H3 Epigenetics in Health and Disease

BIOD20H3 Special Topics in Virology

BIOD23H3 Special Topics in Cell Biology

BIOD25H3 Genomics

BIOD26H3 Fungal Biology and Pathogenesis

BIOD27H3 Vertebrate Endocrinology

BIOD29H3 Pathobiology of Human Disease

Description of Proposed Changes:

1. Requirement 4: added BIOB90H3 (new course program requirement) note
2. Requirement 7: added BIOC90H3 (new course program requirement) note
3. Requirement 8: added new course BIOD13H3 as an optional course

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program.
2. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program.
3. BIOD13H3 is a new course that is well suited for this program and will provide students with an additional D-level option to complete this program requirement.

Impact: None.

Consultation: DCC Approval: June 19 and September 17, 2019

Resource Implications: None.

MAJOR PROGRAM IN PLANT BIOLOGY (SCIENCE)

Completion Requirements:

Program Requirements

Students are required to complete a total of 8.5 credits.

Required Courses and Suggested Course Sequence:

First Year

1. 1.0 credit as follows:

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 credit as follows:

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 0.5 credit from the following:

STAB22H3 Statistics I

PSYB07H3 Data Analysis in Psychology

Second Year

4. 2.5 credits as follows:

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

BIOB38H3 Plants and Society

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

5. 0.5 credit from the following:

BIOB12H3 Cell and Molecular Biology Laboratory
BIOB52H3 Ecology and Evolutionary Biology Laboratory

Third Year

6. 2.0 credits as follows:

BIOC31H3 Plant Development and Biotechnology
BIOC37H3 Plants: Life on the Edge
BIOC40H3 Plant Physiology
[BIOC13H3 **Biochemistry II : Bioenergetics and Metabolism** or BIOC15H3 Genetics or BIOC17H3 Microbiology or BIOC50H3 Macroevolution]

Third/Fourth Year

7. 0.5 credit from the following:

BIOC61H3 Community Ecology and Environmental Biology
BIOD13H3 **Herbology : The Science Behind Medicinal Plants**
BIOD21H3 Advanced Molecular Biology Laboratory
BIOD37H3 Biology of Plant Stress
BIOD62H3 **Symbiosis : Interactions Between Species and Speciation**
BIOD26H3 Fungal Biology and Pathogenesis

BIOC90H3 Integrative Multimedia Documentary Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

Fourth Year

8. 0.5 credit from the following:

[BIOD30H3 Plant Research and Biotechnology: Addressing Global Problems or [any of the following research-based courses if the research utilizes plants: BIOC99H3, BIOD95H3, BIOD98Y3 or BIOD99Y3]]

Description of Proposed Changes:

1. Requirement 4: added BIOB90H3 (new course program requirement) note
2. Requirement 6: added BIOC13H3 as an optional course
3. Requirement 7: added BIOC90H3 (new course program requirement) note. Added new course BIOD13H3 as an optional course. Updated course title for BIOD62H3

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program.
2. BIOC13H3 will allow students access to the new D-level courses and provide students with more flexibility to complete this program requirement.
3. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. BIOD13H3 is a new course that will provide students with an additional D-level option to complete this program requirement. BIOD62H3 course title has been updated to ensure consistency throughout the Calendar.

Impact:

None.

Consultation:

DCC Approval: June 19, 2019

Resource Implications:

None.

SPECIALIST (CO-OPERATIVE) PROGRAM IN MOLECULAR BIOLOGY AND BIOTECHNOLOGY (SCIENCE)**Completion Requirements:****Program Requirements**

The program requires students to complete a total of 14.5 credits.

*First Year***1. 1.0 Credit of Introductory Biology Courses**

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit of Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry I: Reactions and Mechanisms

3. 1.0 Credit in Mathematics

Choose from:

[MATA29H3 Calculus I for the Life Sciences and MATA35H3 Calculus II for Biological Sciences] or [MATA30H3 Calculus I for Physical Sciences and MATA36H3 Calculus II for Physical Sciences]

4. 1.0 Credit in Physics

[PHYA10H3 Physics I for the Physical Sciences or PHYA11H3 Physics I for the Life Sciences]

[PHYA21H3 Physics II for the Physical Sciences or PHYA22H3 Physics II for the Life Sciences]

5. 0.5 Credit in Statistics

Choose from:

STAB22H3 Statistics I (this course could also be taken in second year)

PSYB07H3 Data Analysis in Psychology (this course could also be taken in second year)

*Second Year***6. 3.0 Credits of Biology Core Courses**

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

BIOB34H3 Animal Physiology

{ BIOB38H3 Plants and Society or (~~BIOB31H3~~) ~~Plant Physiology~~ }

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

7. 0.5 Credit of Biology Core Labs

BIOB12H3 Cell and Molecular Biology Laboratory

8. 1.0 Credit of Organic Chemistry Courses

CHMB41H3 Organic Chemistry I

CHMB42H3 Organic Chemistry II

Computer Science might be taken in this year and will enhance Co-op placement options.

Third Year

9. 3.5 Credits of Biology C-level Courses

BIOC12H3 Biochemistry I: Proteins and Enzymes
BIOC13H3 Biochemistry II: Bioenergetics and Metabolism
BIOC15H3 Genetics
BIOC17H3 Microbiology
BIOC20H3 Principles of Virology
BIOC23H3 Practical Approaches to Biochemistry
BIOC39H3 Immunology (can be completed in third or fourth year)

10. 0.5 Credit in Computer Science

Choose from:

CSCA08H3 Introduction to Computer Science I (most appropriate course for computer science students)
CSCA20H3 Introduction to Programming (most appropriate course for non-computer science students)
PSCB57H3 Introduction to Scientific Computing

Third/Fourth Year

11. 0.5 Credit of Cognate Biology Courses

Choose from:

BIOC10H3 Cell Biology: Proteins from Life to Death
BIOC14H3 Genes, Environment and Behaviour
BIOC19H3 Animal Developmental Biology
BIOC21H3 Vertebrate Histology: Cells and Tissues
BIOC31H3 Plant Development and Biotechnology
BIOC35H3 Principles of Parasitology
BIOC40H3 Plant Physiology
BIOD37H3 Biology of Plant Stress

BIOC90H3 Integrative Multimedia Documentary Project (CR/NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

Fourth Year

12. 0.5 Credit in Advanced Molecular Techniques

BIOD21H3 Advanced Molecular Biology Laboratory

13. 0.5 Credit of D-level Research-Oriented "Cell & Molecular" Course Work

Choose from:

BIOD12H3 Protein Homeostasis
BIOD13H3 Herbiology : The Science Behind Medicinal Plants
BIOD17H3 Seminars in Cellular Microbiology
BIOD19H3 Epigenetics in Health and Disease
BIOD20H3 Special Topics in Virology
BIOD22H3 Molecular Biology of the Stress Response
BIOD23H3 Special Topics in Cell Biology
BIOD25H3 Genomics
BIOD26H3 Fungal Biology and Pathogenesis
BIOD27H3 Vertebrate Endocrinology
BIOD29H3 Pathobiology of Human Disease
BIOD30H3 Plant Research and Biotechnology: Addressing Global Problems
BIOD95H3 Supervised Study in Biology
BIOD98Y3 Directed Research in Biology

Note : Any of these courses not used to satisfy this requirement can be used to fulfill the '0.5 credit of Cognate Biology

Courses.'

Co-op Work Term Requirements

Students must satisfactorily complete two Co-op work terms, each of four-months duration. To be eligible for their first work term, students must be enrolled in the Specialist (Co-op) Program in Molecular Biology and Biotechnology and have completed at least 10.0 credits, including BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, [MATA29H3 and MATA35H3] or [MATA30H3 and MATA36H3], [PHYA10H3 or PHYA11H3], BIOB10H3, BIOB11H3, BIOB12H3, CHMB41H3 and CHMB42H3.

In addition to their academic program requirements, Co-op students complete up to four Co-op specific courses. These courses are designed to prepare students for their job search and work term experience, and to maximize the benefits of their Co-op work terms. They cover a variety of topics intended to assist students in developing the skills and tools required to secure work terms that are appropriate to their program of study, and to perform professionally in the workplace. These courses must be completed in sequence, and are taken in addition to a full course load. They are recorded on transcripts as credit/no credit (CR/NCR) and are considered to be additive credit to the 20.0 required degree credits. No additional course fee is assessed as registration is included in the Co-op Program fee.

Co-op Preparation Course Requirements:

1. COPB50H3/(COPD01H3) – Foundations for Success in Arts & Science Co-op
 - Students entering Co-op from outside of UTSC (high school or other postsecondary) will complete this course in Fall or Winter of their first year at UTSC. Enrolment in each section is based on admission category: Typically, students in Computer Science, Mathematics and Statistics enroll in the Fall semester while all other Arts & Science Co-op admission categories enroll in the Winter semester however this may vary year to year.
 - Current UTSC students entering Co-op in April/May will complete this course in the Summer semester.
 - Current UTSC students entering Co-op in July/August will complete this course in the Fall semester.
2. COPB51H3/(COPD03H3) – Preparing to Compete for your Co-op Work Term
 - This course will be completed eight months in advance of the first scheduled work term.
3. COPB52H3/(COPD11H3) – Managing your Work Term Search & Transition to Work
 - This course will be completed four months in advance of the first work scheduled work term.
4. COPC98H3/(COPD12H3) – Integrating Your Work Term Experience Part I
 - This course will be completed four months in advance of the second scheduled work term.
5. COPC99H3/(COPD13H3) – Integrating Your Work Term Experience Part II
 - This course will be completed four months in advance of the third scheduled work term (for programs that require the completion of 3 work terms and/or four months in advance of any additional work terms that have been approved by the Arts and Science Co-op Office.

Students must be available for work terms in each of the Fall, Winter and Summer semesters and must complete at least one of their required work terms in either a Fall or Winter semester. This, in turn, requires that students take courses during at least one Summer semester.

For information on fees, status in Co-op programs, and certification of completion of Co-op programs, see Section 6B.5 or the Arts and Science Co-op section in the UTSC *Calendar*.

Description of Proposed Changes:

1. Requirement 6: added BIOB90H3 (new course program requirement) note. Removed (BIOB31H3) as an optional course.
2. Requirement 11: added BIOC90H3 (new course program requirement) note
3. Requirements 13: Add BIOD13H3 as an optional course

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. (BIOB31H3) is being removed because it was last offered 6 years ago and is no longer relevant to the program.
2. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program

3. BIOD13H3 is a new course that will provide students with an additional D-level option to complete this program requirement.

Impact: None.

Consultation: DCC Approval: June 19 and September 17, 2019.

Resource Implications: None.

SPECIALIST PROGRAM IN CONSERVATION AND BIODIVERSITY (SCIENCE)

Completion Requirements:

Program Requirements

This program consists of 14.5 required credits.

A. Required Courses

First Year

1. 1.0 Credit of Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit of Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 1.0 Credit in Mathematics

Choose from:

[MATA29H3 Calculus I for the Life Sciences and MATA35H3 Calculus II for Biological Sciences] or

[MATA30H3 Calculus I for Physical Sciences and MATA36H3 Calculus II for Physical Sciences]

4. 0.5 Credit in Physics

Choose from:

PHYA10H3 Physics I for the Physical Sciences

PHYA11H3 Physics I for the Life Sciences

5. 0.5 Credit in Computer Science

Choose from:

CSCA08H3 Introduction to Computer Science I (most appropriate course for computer science students)

CSCA20H3 Introduction to Programming (most appropriate course for non-computer science students)

PSCB57H3 Introduction to Scientific Computing (this course could also be taken in second year)

Second Year

6. 3.0 Credits of Biology Core Courses

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

BIOB34H3 Animal Physiology

{ BIOB38H3 Plants and Society or (BIOB31H3) Plant Physiology }

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

7. 0.5 Credit of Biology Core Labs

8. 0.5 Credit in Statistics

Choose from:

STAB22H3 Statistics I

PSYB07H3 Data Analysis in Psychology

Third Year

9. 2.5 ~~2.0~~ Credits of C-level Ecology and Evolution Foundation Courses

BIOC16H3 Evolutionary Genetics and Genomics

BIOC50H3 Macroevolution

BIOC52H3 Field Ecology

~~BIOC59H3 Advanced Population Ecology~~

BIOC61H3 Community Ecology and Environmental Biology

BIOC63H3 Conservation Biology

Third/Fourth Year

10. 4.0 ~~4.5~~ credits of C- & D-level courses from Bins 1 and 2 below. This must include at least 1.0 ~~one~~ credit from each bin and at least 1.0 ~~one~~ credit total at the D-level.

Bin 1: C- & D-level Ecology and Evolution Courses

Choose from:

BIOC51H3 Tropical Biodiversity ~~Field Course~~

~~BIOC52H3 Ecology~~ Field Course

BIOC58H3 Biological Consequences of Global Change

BIOC60H3 Winter Ecology

~~BIOC63H3 Conservation Biology~~

BIOC65H3 Environmental Toxicology

(BIOC67H3) Inter-University Biology Field Course

BIOD25H3 Genomics

BIOD52H3 Biodiversity and Conservation

BIOD54H3 Applied Conservation Biology

BIOD55H3 Experimental Animal Behaviour

BIOD59H3 Models in Ecology, Epidemiology and Conservation

BIOD60H3 Spatial Ecology

BIOD62H3 Symbiosis : Interactions Between Species ~~and Speciation~~

BIOD63H3 From Individuals to Ecosystems: Advanced Topics in Ecology

BIOD66H3 Causes and Consequences of Biodiversity

BIOD67H3 Inter-University Biology Field Course

EESC04H3 Biodiversity and Biogeography

Bin 2: C- & D-level Organismal Biology Courses

Choose from:

BIOC37H3 Plants: Life on the Edge

~~(BIOC38H3) Plants and Society~~

BIOC40H3 Plant Physiology

BIOC54H3 Animal Behaviour

BIOC59H3 Advanced Population Ecology

BIOC62H3 Role of Zoos and Aquariums in Conservation

BIOD26H3 Fungal Biology & Pathogenesis

BIOD34H3 Conservation Physiology

~~BIOD33H3 Comparative Animal Physiology~~

BIOD37H3 Biology of Plant Stress

BIOD43H3 Animal Movement and Exercise

BIOD45H3 Animal Communication

BIOD48H3 Ornithology

BIOD53H3 Special Topics in Animal Behaviour

EESC30H3 Environmental Microbiology

BIOC90H3 Integrative Multimedia Documentary Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

B. Senior Research Courses (optional)

Students interested in graduate research are encouraged to take one or more of the independent research courses offered in Biological Sciences as part of their degree.

BIOD95H3 Supervised Study in Biology

BIOD98Y3 Directed Research in Biology

BIOD99Y3 Directed Research in Biology

Description of Proposed Changes:

1. Requirement 6 and Requirement 10: removed (BIOB31H3) and (BIOC38H3) as optional courses. Added BIOB90H3 program requirement course note
2. Requirement 9: Increased credit requirement from 2.0 to 2.5 credits. added BIOC52H3 and BIOC63H3 and removed BIOC59H3 as required courses.
3. Requirement 10: decreased total credit requirement from 4.5 credits to 4.0 credits. Removed BIOC52H3 and BIOC63H3 and BIOD33H3 as optional courses. Added BIOC59H3 and BIOD34H3 as optional courses to bins 1 and 2. Added note about the BIOC90H3 program course requirement. Changed BIOD62H3 course title. Added BIOD34H3 and removed BIOD33H3 to the C- & D-level Organismal Biology Courses bin.

Rationale:

1. (BIOB31H3) and (BIOC38H3) have been retired and were last offered 6 years ago. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. (BIOB31H3) is being removed because it was last offered 6 years ago and is no longer relevant to the program.
2. Increased credit requirement by 0.5 to ensure students are able to take additional courses added. Added BIOC52H3 and BIOC63H3 because these courses will better enhance C-level course knowledge for students. Removed BIOC59H3 because it is no longer relevant to this program requirement.
3. Decreased credit requirement by 0.5 to ensure the overall program competition credits remain 14.5 credits. Removed BIOC52H3, BIOC63H3 and BIOD33H3 as optional courses as they are no longer relevant to this program requirement. Added BIOC52H3, BIOD34H3 as optional courses to bin 1 and bin 2 to provide students with more options to complete these bins. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. Updated BIOD62H3 course title to ensure consistency throughout the Calendar.

Impact: None.

Consultation: DCC Approval: June 19, 2019

Resource Implications: None.

SPECIALIST PROGRAM IN HUMAN BIOLOGY (SCIENCE)

Completion Requirements:

Program Requirements

This Program consists of 15.0 credits.

Required Courses and Suggested Course Sequence

First Year

1. 1.0 credit in Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 credit in Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 1.0 credit in Mathematic

[MATA29H3 Calculus I for the Life Sciences and MATA35H3 Calculus II for Biological Sciences] or

[MATA30H3 Calculus I for Physical Sciences and MATA36H3 Calculus II for Physical Sciences]

4. 1.0 credit in Introductory Physics Courses

PHYA11H3 Physics I for the Life Sciences

PHYA22H3 Physics II for the Life Sciences

5. 0.5 credit in Statistics

Choose From:

STAB22H3 Statistics I

PSYB07H3 Data Analysis in Psychology

Second Year

6. 3.0 credits in Biology Core Courses

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

BIOB34H3 Animal Physiology

~~BIOB38H3 Plants and Society~~ **or (BIOB31H3) Plant Physiology**

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

*** Note :** Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

7. 1.0 credit in Biology Core Labs

BIOB32H3 Animal Physiology Laboratory

BIOB33H3 Human Development and Anatomy Laboratory

8. 1.0 credit in Organic Chemistry Courses

CHMB41H3 Organic Chemistry I

CHMB42H3 Organic Chemistry II

Third/Fourth Years

9. 2.5 credits in C-level Biology Core Courses

Choose From:

BIOC15H3 Genetics

BIOC17H3 Microbiology

BIOC20H3 Principles of Virology

BIOC32H3 Human Physiology I

BIOC34H3 Human Physiology II

BIOC39H3 Immunology

10. 1.5 credits in Additional C-level Biology Courses

Choose From:

BIOC10H3 Cell Biology: Proteins from Life to Death

BIOC12H3 Biochemistry I: Proteins and Enzymes

BIOC13H3 Biochemistry II: Bioenergetics and Metabolism

BIOC14H3 Genes, Environment and Behaviour

BIOC16H3 Evolutionary Genetics and Genomics
BIOC19H3 Animal Developmental Biology
BIOC21H3 Vertebrate Histology: Cells and Tissues
BIOC35H3 Principles of Parasitology
BIOC40H3 Plant Physiology
BIOC58H3 Biological Consequences of Global Change
BIOC65H3 Environmental Toxicology

BIOC90H3 Integrative Multimedia Documentary Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

11. 1.0 credit in D-level Biology Courses

Choose From:

BIOD12H3 Protein Homeostasis
BIOD13H3 Herbology : The Science Behind Medicinal Plants
BIOD17H3 Seminars in Cellular Microbiology
BIOD19H3 Epigenetics in Health and Disease
BIOD20H3 Special Topics in Virology
BIOD26H3 Fungal Biology and Pathogenesis
BIOD27H3 Vertebrate Endocrinology
BIOD29H3 Pathobiology of Human Disease
BIOD33H3 Comparative Animal Physiology
BIOD35H3 Sports Science
BIOD37H3 Biology of Plant Stress
BIOD43H3 Animal Movement and Exercise
BIOD59H3 Models in Ecology, Epidemiology and Conservation
BIOD65H3 Pathologies of the Nervous System

12. 0.5 credit in Psychology or Health Studies

Choose From:

HLTA02H3 Foundations in Health Studies I
HLTA03H3 Foundations in Health Studies II
HLTB15H3 Introduction to Health Research Methodology
HLTB16H3 Introduction to Public Health
(HLTB17H3) Conceptual Models of Health
HLTB20H3 Contemporary Human Evolution and Variation
(HLTB21H3) Infectious Diseases
HLTB22H3 Biological Determinants of Health
HLTB40H3 Health Policy and Health Systems
PSYA01H3 Introduction to Biological and Cognitive Psychology
PSYA02H3 Introduction to Clinical, Developmental, Personality and Social Psychology

Description of Proposed Changes:

1. Requirement 6: added BIOB90H3 (new course program requirement) note. Removed (BIOB31H3) as an optional course.
2. Requirement 10: added BIOC90H3 (new course program requirement) note
3. Requirement 11: Added BIOD13H3 as an optional course

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. (BIOB31H3) is being removed because it was last offered 6 years ago and is no longer relevant to the program.
2. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program
3. BIOD13H3 is a new course that will provide students with an additional D-level option to complete this program requirement.

Impact: None.

Consultation: DCC Approval: June 19, 2019

Resource Implications: None.

SPECIALIST PROGRAM IN INTEGRATIVE BIOLOGY (SCIENCE)

Description:

Previous:

~~In today's rapidly changing world, the development of solutions to combat some of the most pressing global challenges such as climate change, emerging diseases, hunger and species extinction, requires an integrative approach in which expertise is drawn from disparate biological and other disciplines. The specialist program in Integrative Biology provides the student with a solid knowledge base in key core and foundational areas of biology while also providing a breadth of knowledge to support more specialized studies and focused training in a range of disciplines (for examples, see below under "Routes to Specialization"). Students who complete this program will be well positioned for a career in many aspects of the biological sciences or to undertake further studies at the professional or graduate level.~~

Supervisor: R. Sturge Email: integrative-biology@utsc.utoronto.ca

The Integrative Biology program allows students to pursue a specialist program built on a broad, multi-perspective approach towards understanding biological complexity. This program provides students with a solid foundation in core biological areas (cellular and organismal biology, ecology and conservation, genes and development) and builds on this knowledge base in third and fourth years. A key advantage to this program is that it allows students to pursue specialization in more than one area at the same time, providing students with a broad understanding of biology. Many of the biggest issues facing today's planet require scientists that are capable of bringing different and complementary perspectives to look for solutions, and this program provides the coursework and training to help undergraduates build this knowledge base. Students who are interested in careers in conservation biology, ecology, environmental sciences, cellular/organismal biology, as well as ones interested in careers in medicine and other health professions, will benefit from this program.

Completion Requirements:

Program Requirements

This program consists of 14.5 required ~~credits including at least 4.0 credits at the C- or D-~~ level of which ~~at least 1.0 credit must be at the D-level.~~

~~A- Required Courses~~

First Year

1. 1.0 Credit of Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit of Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 1.0 Credit in Mathematics

Choose from:

[MATA29H3 Calculus I for the Life Sciences and MATA35H3 Calculus II for Biological Sciences] or

[MATA30H3 Calculus I for Physical Sciences and MATA36H3 Calculus II for Physical Sciences]

4. 0.5 Credit in Physics

Choose from:

PHYA10H3 Physics I for the Physical Sciences

PHYA11H3 Physics I for the Life Sciences

5. 0.5 Credit in Computer Science

Choose from:

CSCA08H3 Introduction to Computer Science I (most appropriate course for computer science students)
CSCA20H3 Introduction to Programming (most appropriate course for non-computer science students)
PSCB57H3 Introduction to Scientific Computing (this course could also be taken in the second year)

Second Year

6. 3.0 Credits of Biology Core Courses

BIOB10H3 Cell Biology
BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
BIOB34H3 Animal Physiology
{ BIOB38H3 Plants and Society or (BIOB31H3) Plant Physiology }
BIOB50H3 Ecology
BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR/NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program. Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3. Please see BIOB90H3 in the Calendar for important information.

7. 0.5 Credit of Biology Core Labs

Choose from:
BIOB12H3 Cell and Molecular Biology Laboratory
BIOB32H3 Animal Physiology Laboratory
BIOB33H3 Human Development and Anatomy Laboratory
BIOB52H3 Ecology and Evolutionary Biology Laboratory

8. 0.5 Credit in Statistics

Choose from:
STAB22H3 Statistics I
PSYB07H3 Data Analysis in Psychology

Third / Fourth Year

9. 2.5 ~~1.5~~ Credits of Biology Foundation Courses

BIOC15H3 Genetics
BIOC17H3 Microbiology
[BIOC37H3 Plants : Life on the Edge or BIOC40H3 Plant Physiology]
BIOC54H3 Animal Behaviour
BIOC61H3 Community Ecology
~~Third / Fourth Year~~

10. 1.0 ~~0.5~~ Credit of Advanced Courses

in Cellular Physiology, Biochemistry and Organismal Biology Neurobiology

Choose from:
BIOC12H3 Biochemistry I: Proteins and Enzymes
BIOC13H3 Biochemistry II: Bioenergetics and Metabolism
BIOC20H3 Principles of Virology
BIOC21H3 Vertebrate Histology : Cells and Tissues
BIOC23H3 Practical Approaches to Biochemistry
BIOC32H3 Human Physiology I
BIOC34H3 Human Physiology II
~~BIOC39H3 Immunology~~
[BIOC37H3 Plants : Life on the Edge or BIOC40H3 Plant Physiology ; whichever course is not used to fulfill Biology Foundation course requirement]
BIOC39H3 Immunology
BIOC65H3 Environmental Toxicology
~~ANTC67H3 Foundations in Epidemiology~~
NROC34H3 Neuroethology
~~NROC61H3 Learning and Motivation~~

NROC64H3 Sensorimotor Systems
PSYC31H3 Clinical Neuropsychology
BIOD07H3 Advanced Topics and Methods in Neural Circuit Analysis
BIOD08H3 Theoretical Neuroscience
BIOD12H3 Protein Homeostasis
BIOD27H3 Vertebrate Endocrinology
BIOD29H3 Pathobiology of Human Disease
BIOD35H3 Sports Science
BIOD43H3 Animal Movement and Exercise
BIOD65H3 Pathologies of the Nervous System
NROD67H3 Psychobiology of Aging

11. 1.0 0.5 Credit of Advanced Courses in Ecology and Conservation

Choose from:

BIOC50H3 Macroevolution
BIOC51H3 Tropical Biodiversity Field Course
BIOC52H3 Ecology Field Course
BIOC58H3 Biological Consequences of Global Change
BIOC59H3 Advanced Population Ecology
BIOC60H3 Winter Ecology
~~BIOC61H3 Community Ecology and Environmental Biology~~
BIOC62H3 Role of Zoos and Aquariums in Conservation
BIOC63H3 Conservation Biology
(BIOC67H3) Inter-University Biology Field Course
EESC04H3 Biodiversity and Biogeography
~~BIOD52H3 Biodiversity and Conservation~~
~~BIOD54H3 Applied Conservation Biology~~
~~BIOD55H3 Experimental Animal Behaviour~~
~~BIOD59H3 Models in Ecology; Epidemiology and Conservation~~
~~BIOD60H3 Spatial Ecology~~
~~BIOD62H3 Species and Speciation~~
~~BIOD63H3 From Individuals to Ecosystems: Advanced Topics in Ecology~~
~~BIOD66H3 Causes and Consequences of Diversity~~
~~BIOD67H3 Inter-University Biology Field Course~~

12. 1.0 0.5 Credit of Advanced Courses in Genes and Development

Choose from:

BIOC10H3 Cell Biology: Proteins from Life to Death
BIOC14H3 Genes, Environment and Behaviour
BIOC16H3 Evolutionary Genetics and Genomics
BIOC19H3 Animal Developmental Biology
BIOC31H3 Plant Development and Biotechnology
~~BIOD19H3 Epigenetics in Health and Disease~~
~~BIOD21H3 Advanced Molecular Biology Laboratory~~
~~BIOD22H3 Molecular Biology of the Stress Response~~
~~BIOD23H3 Special Topics in Cell Biology~~
~~BIOD25H3 Genomics~~

BIOC90H3 Integrative Multimedia Documentary Project (CR/NCR 0.0 credit)*

***Note:** Completion of BIOC90H3 is a graduation requirement for students in this program. Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3. Please see BIOC90H3 in the Calendar for important information.

13. 1.0 Credit of D-Level Biology Courses

Choose from:

Any BIO D-level course offered by the Biological Sciences department.

0.5 Credit of Advanced Courses in Organismal Biology

~~Choose from:-~~

~~-BIOC20H3 Principles of Virology-~~
~~-BIOC21H3 Vertebrate Histology: Cells and Tissues-~~
~~-BIOC35H3 Principles of Parasitology-~~
~~-ANTD22H3 Theory and Methodology of Primatology-~~
~~-ANTC68H3 Deconstructing Epidemics-~~
~~-EESC30H3 Environmental Microbiology-~~
~~-BIOC37H3 Plants: Life on the Edge-~~
~~-(BIOC38H3) Plants and Society BIOC60H3 Winter Ecology-~~
~~-BIOD17H3 Seminars in Cellular Microbiology-~~
~~-BIOD20H3 Special Topics in Virology-~~
~~-BIOD26H3 Fungal Biology and Pathogenesis-~~
~~-BIOD29H3 Pathobiology of Human Disease-~~
~~-BIOD33H3 Comparative Animal Physiology-~~
~~-BIOD37H3 Biology of Plant Stress-~~
~~-BIOD45H3 Animal Communication-~~
~~-BIOD48H3 Ornithology-~~
~~-BIOD53H3 Special Topics in Animal Behaviour~~

~~-14. 3.0 Credits of Additional C or D-Level Biology Courses-~~

~~-Choose from:-~~

~~-Any BIO (or formerly BGY) C or D-~~

~~level courses offered by the Biological Sciences department.~~

~~-Note: this includes the Biology Team Research, Supervised Studies, and Directed Research courses (BIOC99H3, BIOD95H3, BIOD98Y3 and BIOD99Y3).~~

~~-Note: NROC34H3 (Neuroethology) may also be used toward fulfilling this requirement, if not already used toward fulfilling one of the other requirements above.~~

~~-B. Routes to Specialization (optional)-~~

~~-A key advantage of~~

~~the specialist program in Integrative Biology is the ability for students to readily specialize in areas of particular interest. Please note that students are not required to follow any of these suggested routes. They are provided for guidance only.~~

~~-(a): For students with a particular interest in "The Impact of Environment and Climate Change on the Biology of Ecosystems", you should consider including some or all of the following courses in your program: BIOB52H3 Ecology and Evolutionary Biology Lab, BIOC52H3 Ecology Field Course, BIOC58H3 Biological Consequences of Global Change, BIOC59H3 Advanced Population Ecology, BIOC60H3 Winter Ecology, BIOC61H3 Community Ecology and Environmental Biology, BIOD59H3 Models in Ecology, Epidemiology and Conservation, and (BIOC67H3) Inter-University Biology Field Course.~~

~~-(b): For students with a particular interest in "The Conservation and Biodiversity of Organisms", you should consider including some or all of the following courses in your program: BIOC51H3 Tropical Biodiversity Field Course, BIOC62H3 Role of Zoos and Aquariums in Conservation, BIOC63H3 Conservation Biology, BIOD48H3 Ornithology, BIOD52H3 Biodiversity and Conservation, BIOD54H3 Applied Conservation Ecology, BIOD60H3 Spatial Ecology, and BIOD66H3 Causes and Consequences of Biodiversity.~~

~~-(c): For students with a particular interest in "Animal Physiology", you should consider including some or all of the following courses in your program: BIOB32H3 Animal Physiology Laboratory, BIOC32H3 Human Physiology I, BIOC34H3 Human Physiology II, BIOD29H3 Pathobiology of Human Disease, BIOD33H3 Comparative Animal Physiology, and BIOD43H3 Animal Movement and Exercise.~~

~~-(d): For students with a particular interest in "Ecophysiology", you should consider including some or all of the following courses in your program: BIOC65H3 Environmental Toxicology, BIOD33H3 Comparative Animal Physiology, and BIOD37H3 Biology of Plant Stress.~~

~~-(e): For students with a particular interest in "Infection and Disease" or "clinically-~~

~~oriented topics", you should consider including some or all of the following courses in your program: ANTC67H3 Foundations in Epidemiology, ANTC68H3 Deconstructing Epidemics, BIOB33H3 Human Development and Anatomy, BIOC20H3 Principles of Virology, BIOC21H3 Vertebrate Histology: Cells and Tissues, BIOC35H3 Principles in Parasitology, BIOC34H3 Human Physiology II, BIOC39H3 Immunology, BIOD12H3 Protein Homeostasis, BIOD17H3 Seminars in Cellular Microbiology, BIOD20H3 Special Topics in Virology, BIOD25H3 Genomics, BIOD26H3 Fungal Biology and Pathogenesis, BIOD29H3 Pathobiology of Human Disease, and BIOD65H3 Pathologies of the Nervous System.~~

~~-(f): For students with a particular interest in "Plant and Microbial Biology", you should consider including some or all the following courses in your program: BIOC31H3 Plant Development and Biotechnology, BIOD17H3 Seminars in Cellular Microbiology, and BIOD37H3 of Plant Stress.~~

~~-(g): For students with a particular interest in "Behavioural Biology" you should consider including some or all of the following courses in your program: BIOD45H3 Animal Communication, BIOD07H3 Advanced Topics and Methods in Neural Circuit Analysis, BIOD53H3 Special Topics in Animal Behaviour, NROC34H3 Neuroethology, and NROC61H3 Learning and Motivation.~~

~~-(h): For students with a particular interest in "Behavioural Genetics", you should consider including some or all of the following courses in your program: BIOC16H3 Evolutionary Genetics and Genomics, BIOD21H3 Advanced Molecular Biology Laboratory, BIOD22H3 Molecular Biology of the Stress Response, BIOD23H3 Special Topics in Cell Biology, BIOD25H3 Genomics, BIOD45H3 Animal Communication, BIOD53H3 Special Topics in Animal Behaviour, BIOD55H3 Experimental Animal Behaviour, BIOD63H3 From Individuals to Ecosystems: Advanced Topics in Ecology, and NROC34H3 Neuroethology.~~

~~-(i): For students with a particular interest in "The Evolution of Development" (a.k.a. "evo/devo"), you should consider including some or all of the following courses in your program: BIOC12H3 Biochemistry I: Proteins and Enzymes, BIOC13H3 Biochemistry II: Bioenergetics and Metabolism, BIOC16H3 Evolutionary Genetics and Genomics, BIOC19H3 Animal Developmental Biology, BIOC23H3 Practical Approaches to Biochemistry, BIOC31H3 Plant Development and Biotechnology, BIOC34H3 Human Physiology II, BIOD21H3 Advanced Molecular Biology Laboratory, BIOD22H3 Molecular Biology of the Stress Response, BIOD23H3 Special Topics in Cell Biology, BIOD35H3 Sports Science, and BIOD25H3 Genomics.~~

Description of Proposed Changes:

1. The program description has been revised.
2. Program Requirements: specific information regarding the required number of C- and D-level credits are removed. The title 'A. Required Courses' was removed.
3. Requirement 6: added BIOB90H3 (new course program requirement) note. Removed (BIOB31H3) currently in brackets.
4. The title 'Third Year' has been replaced with 'Third/Fourth Year', and the title 'Third/Fourth Year' was removed from a later section of the program description.
5. Requirement 9: increased credit requirement from 1.5 to 2.5 credits, and added BIOC37H3 or BIOC40H3 and BIOC61H3 as required courses.
6. Requirement 10: updated heading and increased credit requirement from 0.5 to 1.0 credit
 - (a) added the following optional courses: BIOC20H3, BIOC21H3, BIOC37H3 or BIOC40H3;
 - (b) removed the following optional courses: ANTC67H3, NROC61H3, NROC64H3, PSYC31H3, BIOD07H3, BIOD08H3, BIOD12H3, BIOD27H3, BIOD29H3, BIOD35H3, BIOD43H3, BIOD65H3 and NROD67H3.
7. Requirement 11: increased credit requirement from 0.5 to 1.0 credit.
 - (a) added BIOC60H3 as an optional course.
 - (b) removed the following optional courses: BIOC61H3, BIOD52H3, BIOD54H3, BIOD55H3, BIOD59H3, BIOD60H3, BIOD62H3, BIOD63H3, BIOD66H3, and BIOD67H3
8. Requirement 12: increased credit requirement from 0.5 to 1.0 credit.
 - (a) removed the following optional courses: BIOD19H3, BIOD21H3, BIOD22H3, BIOD23H3, and BIOD25H3;
 - (b) a note was added between Requirement 12 and 13 regarding BIOC90H3 (new course program requirement)
9. Requirement 13: Renamed and increased credit requirement by 0.5 credit. Added a note and removed all courses.
10. Requirement 14: Deleted requirement 14 entirely.
11. Removed Section 'B. Routes to Specialization (optional)' .

Rationale:

1. The program description has been updated to better reflect the program's strengths and to emphasize the career paths students within this program might follow.

2. The information regarding the number of C and D-level credits was removed to avoid unnecessary redundancy within each program requirement. Section B has been removed so there is no need for Section A.
3. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. (BIOB31H3) is being removed because it was last offered 6 years ago and is no longer relevant to the program.
4. "Third/Fourth Year" title ensures students understand they may choose to take some of these courses in their fourth year rather than taking all of them in their third year.
5. The number of required foundational courses was increased from 1.5 to 2.5 to reflect the breadth of knowledge required to excel in an integrative biology program and to better represent the other three requirements (10, 11, and 12) outlined later in the program. Adding BIOC61H3 prepares students for requirement 11 and having the students choose between two plant-focused courses (BIOC37H3 or BIOC40H3) will better prepare students for the plant-based courses.
6. Updated heading to reflect the courses taken in this program requirement. Increased credit requirement by 0.5 to ensure students are taking an additional C-level course in this program requirement. Added additional C-level courses to provide students with more options and removed all non-relevant courses.
7. Increased credit requirement by 0.5 to ensure students are taking an additional C-level course in this program. (a) added an additional C-level course to provide students with more options and (b) removed all non-relevant courses.
8. Increased credit requirement by 0.5 to ensure students are taking an additional C-level course in this program. (a) removed all non-relevant courses; (b) BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added between requirement 12 and 13 to update students on this requirement for this program.
9. Renamed program requirements to ensure accuracy. Increased credit requirement by 0.5 credit to ensure students are taking an additional D-level course.
10. Removal of requirement 14 to avoid redundancy. The credits used for this requirement were distributed to requirements 9, 10, 11, 12 and 13.
11. Section 'B. Routes to Specialization (optional)' was removed because the proposed program changes will better reflect the integrative nature of the program, and will lead students towards these types of specialization without the need for them to specifically plan these routes themselves, making this section repetitive/unnecessary. The removal of this section, which was confusing and complicated to understand, will simplify the program expectations and will perhaps lead to a higher program enrollment in the future. The removal of this section will not impact the program learning outcomes.

Impact: None.

Consultation: DCC Approval: June 19, 2019, September 17, 2019 and September 25, 2019

Resource Implications: None.

SPECIALIST PROGRAM IN MOLECULAR BIOLOGY AND BIOTECHNOLOGY (SCIENCE)

Completion Requirements:

Program Requirements

This program consists of 14.5 required credits.

First Year

1. 1.0 Credit of Introductory Biology Courses

BIOA01H3 Life on Earth: Unifying Principles

BIOA02H3 Life on Earth: Form, Function and Interactions

2. 1.0 Credit of Introductory Chemistry Courses

CHMA10H3 Introductory Chemistry I: Structure and Bonding

CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms

3. 1.0 Credit in Mathematics

Choose from:

[MATA29H3 Calculus I for the Life Sciences and MATA35H3 Calculus II for Biological Sciences] or

[MATA30H3 Calculus I for Physical Sciences and MATA36H3 Calculus II for Physical Sciences]

4. 1.0 Credit in Physics

[PHYA10H3 Physics I for the Physical Sciences or PHYA11H3 Physics I for the Life Sciences]
[PHYA21H3 Physics II for the Physical Sciences or PHYA22H3 Physics II for the Life Sciences]
and

0.5 Credit in Statistics

Choose from:

STAB22H3 Statistics I (this course could also be taken in second year)

PSYB07H3 Data Analysis in Psychology (this course could also be taken in second year)

Second Year

5. 3.0 Credits of Biology Core Courses

BIOB10H3 Cell Biology

BIOB11H3 Molecular Aspects of Cellular and Genetic Processes

BIOB34H3 Animal Physiology

{ BIOB38H3 Plants and Society ~~or (BIOB31H3) Plant Physiology~~ }

BIOB50H3 Ecology

BIOB51H3 Evolutionary Biology

BIOB90H3 Integrative Research Poster Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOB90H3 is a graduation requirement for students in this program . Concurrent enrolment in at least one of the BIO B-level courses listed above is required for enrolment in BIOB90H3 . Please see BIOB90H3 in the Calendar for important information .

6. 0.5 Credit of Biology Core Labs

BIOB12H3 Cell and Molecular Biology Laboratory

7. 1.0 Credit of Organic Chemistry Courses

CHMB41H3 Organic Chemistry I

CHMB42H3 Organic Chemistry II

Third Year

8. 3.5 Credits of Biology C-level Courses

BIOC12H3 Biochemistry I: Proteins & Enzymes

BIOC13H3 Biochemistry II: Bioenergetics and Metabolism

BIOC15H3 Genetics

BIOC17H3 Microbiology

BIOC20H3 Principles of Virology

BIOC23H3 Practical Approaches to Biochemistry

BIOC39H3 Immunology (can be completed in third or fourth year)

9. 0.5 Credit in Computer Science

Choose from:

CSCA08H3 Introduction to Computer Science I (most appropriate course for computer science students)

CSCA20H3 Introduction to Programming (most appropriate course for non-computer science students)

PSCB57H3 Introduction to Scientific Computing

(computer science could also be taken in an earlier year)

Third/Fourth Year

10. 0.5 Credit of Cognate Biology Courses

Choose from:

BIOC10H3 Cell Biology: Proteins from Life to Death

BIOC14H3 Genes, Environment and Behaviour

BIOC19H3 Animal Developmental Biology

BIOC21H3 Vertebrate Histology: Cells and Tissues

BIOC31H3 Plant Development and Biotechnology

BIOC35H3 Principles of Parasitology

BIOC40H3 Plant Physiology

BIOD37H3 Biology of Plant Stress

BIOC90H3 Integrative Multimedia Documentary Project (CR / NCR 0.0 credit) *

* **Note** : Completion of BIOC90H3 is a graduation requirement for students in this program . Concurrent enrolment in one of the participating BIO C-level courses is required for enrolment in BIOC90H3 . Please see BIOC90H3 in the Calendar for important information .

Fourth Year

11. 0.5 Credit in Advanced Molecular Techniques

BIOD21H3 Advanced Molecular Biology Laboratory

12. 0.5 credit of D-level Research-oriented "Cell & Molecular" Course Work

Choose from:

BIOD12H3 Protein Homeostasis

BIOD13H3 Herbology : The Science Behind Medicinal Plants

BIOD17H3 Seminars in Cellular Microbiology

BIOD19H3 Epigenetics in Health and Disease

BIOD20H3 Special Topics in Virology

BIOD22H3 Molecular Biology of the Stress Response

BIOD23H3 Special Topics in Cell Biology

BIOD25H3 Genomics

BIOD26H3 Fungal Biology and Pathogenesis

BIOD27H3 Vertebrate Endocrinology

BIOD29H3 Pathobiology of Human Disease

BIOD30H3 Plant Research and Biotechnology: Addressing Global Problems

BIOD95H3 Supervised Study in Biology

BIOD98Y3 Directed Research in Biology

Note : Any of these courses not used to satisfy this requirement may be used to fulfill the '0.5 Credit of Cognate Biology Courses'.

Description of Proposed Changes:

1. Requirement 5: added BIOB90H3 (new course program requirement) note. Removed (BIOB31H3) as an optional course.
2. Requirement 10: added BIOC90H3 (new course program requirement) note
3. Requirements 12: Add BIOD13H3 as an optional course

Rationale:

1. BIOB90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program. (BIOB31H3) is being removed because it was last offered 6 years ago and is no longer relevant to the program.
2. BIOC90H3 is a new course that is required for all Major and Specialist Bio students in order to graduate from their programs. This note has been added to update students on this requirement for this program
3. BIOD13H3 is a new course that will provide students with an additional D-level option to complete this program requirement.

Impact: None

Consultation: DCC Approval: June 19 and September 17, 2019.

Resource Implications: None.

4 New Courses:

BIOB90H3: Integrative Research Poster Project

Description:

In this course, students will develop scientific communication skills by working collaboratively with peers to create an informative scientific poster that will be presented in a poster session modelled on those held at most major scientific

conferences. Successful posters will engage the interest of the audience in the topic, clearly and concisely outline understanding gained from the primary literature, and discuss how understanding is enhanced by integrating knowledge.

Notes:

1. Students in all Specialist/Specialist Co-op and Major programs in Biological Sciences are required to complete BIOB90H3 prior to graduation. In order to enroll in BIOB90H3, students must be concurrently enrolled in at least one of the corequisites listed.
2. No specific grade will be assigned to BIOB90H3 on transcripts; instead, the grade assigned to work in BIOB90H3 will constitute 10% of the final grade in each of the corequisite courses that the students are concurrently enrolled in.
3. Students must receive a grade of 50% or higher for work in BIOB90H3 in order to fulfill this graduation requirement.

Prerequisites: Restricted to students in the Specialist/Specialist Co-op programs and Major Programs in Biological Sciences.

Corequisites: Concurrently enrolled in at least one of the following: BIOB10H3, BIOB11H3, BIOB34H3, BIOB38H3, BIOB50H3 or BIOB51H3

Learning Outcomes:

1. Integrate knowledge across various biological sub-disciplines.
2. Communicate scientific concepts and ideas effectively in both oral and written forms.
3. Work collaboratively with diverse group members while managing workload, time, and group dynamics.
4. Acquire information literacy skills (such as searching, evaluating, and critically reading scientific sources) and academic skills (such as formulating research questions, thinking critically and creatively, and respecting academic integrity).

These learning outcomes support the following program-level outcomes:

Application of Knowledge: Acquire and collate the information and data relevant to a given biological question, and objectively interpret these data to draw an informed conclusion.

Application of Knowledge: Integrate and apply knowledge across all levels of biological scale and complexity.

Application of Knowledge: Contribute to interdisciplinary research exchange.

Awareness of Limits of Knowledge: Evaluate recent advances in biological knowledge, and recognize the limits of the scientific process, including the inherent uncertainty in scientific knowledge, data and models.

Awareness of Limits of Knowledge: Identify the gaps of knowledge in the scientific literature.

Communication Skills: Disseminate biological information in a poster format.

Communication Skills: Represent data using effective visuals.

Communication Skills: Defend hypotheses and data to an audience employing appropriate scientific terminology.

Communication Skills: Work effectively and collaboratively with others (from diverse varied academic and cultural backgrounds).

Autonomy and Professional Capacity: Demonstrate both professional work habits and ethical conduct, when working individually, or as part of a team.

Autonomy and Professional Capacity: Demonstrate the ability to meet deadlines and expectations based on self-directed learning and teamwork.

Autonomy and Professional Capacity: Develop effective teamwork skills including:

1. leadership skills
2. attentive listening
3. utilizing appropriate methods for conflict resolution and managing group dynamics
4. accepting and providing constructive criticism

Autonomy and Professional Capacity: Ethically identify the contributions of others' work within the written, oral, and visual work that the student has produced, through the use of proper citations.

In addition, several LOs listed under the category of Depth and Breadth of Knowledge would be supported by these BIOB90H3 LOs but would vary depending on the type of research topic chosen by the students (for e.g. Describe how biomolecules, cell assemblies, organs, and organisms, develop structure and carry out the function.)

Topics Covered:

The course will provide a series of scaffolding tutorials and online videos/guides. The attached syllabus style information document provides an overview of the topics and expectations over the course of the 12-week semester.

Methods of Assessment:

The grade assigned to work in BIOB90H3 will constitute 10% of the final grade in each of the co-requisite courses (please see co-requisites above) that the students are concurrently enrolled in during that semester (e.g. a student enrolled in both BIOB10H3 and BIOB50H3 in the Fall will have their BIOB90H3 grade count towards 10% of their final grade in BIOB10H3 and in BIOB50H3). Students must receive a grade of 50% or higher for work in BIOB90H3 in order to fulfill

this graduation requirement.

The grade for BIOB90H3 will be based on the final poster presentation in Week 12 of each semester. Students will be required to complete multiple tasks, including four mini-deadlines, during the semester leading up to the poster presentation day. A penalty of 2% (of the final grade) will be applied for each mini-deadline that is not completed on time.

The attached syllabus style information document contains a grading rubric that provides a detailed breakdown of the final assessment, which aligns with each of the learning outcomes for BIOB90H3.

Mode of Delivery: Hybrid

Breadth Requirements: Natural Sciences

Rationale:

In August 2017, the department undertook an initial round of curriculum mapping in which they specifically examined transferable skill development in their undergraduate programs. In general, discussions advocated for mechanisms to promote oral and written communication skills among all the graduates during foundation years. Hence, to develop such skills in foundation years would set students up for success in the upper years. This new course will help develop these skills in the context of the department's core courses at the B-level. BIOB90H3 represents a model by which skill development is promoted in multiple courses through a shared project that does not duplicate demands on instructor time and resources. The unique grading structure of BIOB90H3, which accounts for 10% of the final grade in each of the corequisite courses that the students are concurrently enrolled in during that semester, would incentivize students to enroll in their B-level core courses concurrently. This course will be graded and will constitute 10% of the final grade in each of the corequisite courses (please see co-requisites above) that the students are concurrently enrolled in, during that semester. There will be no grade listed for BIOB90H3 on degree explorer but will instead be denoted as "complete" or "incomplete".

Consultation: DCC Approval: September 17, 2019

RO Approval: July 18, 2019

Resources:

The course will require a faculty coordinator; this will be assigned by the Chair as part of the regular faculty members course coordination roles. The course will also additional TA support in each semester (Fall and Winter) and will be covered by the department's existing budget. The course will require poster board rentals and delivery in both the Fall and Winter semesters. This will also be covered by the department's existing budget.

BIOC90H3: Integrative Multimedia Documentary Project

Description:

In this course, students will produce engaging, documentary-style multimedia narratives that relay scientific evidence on a topic of interest to a lay audience. In order to create their documentaries, students will distill research findings reported in the primary literature and integrate knowledge from multiple fields of biology.

Notes:

1. Students in all Specialists/Specialist Co-op and Major programs in Biological Sciences are required to complete BIOC90H3 prior to graduation. In order to enroll in BIOC90H3, students must be enrolled in at least one of the following corequisite courses listed.
2. No specific grade will be assigned to BIOC90H3 on transcripts; instead, the grade assigned to work in BIOC90H3 will constitute 10% of the final grade in one of the corequisite courses that the students are concurrently enrolled in.
3. Students must receive a grade of 50% or higher for work in BIOC90H3 in order to fulfill this graduation requirement.

Prerequisites: BIOB90H3. Restricted to students in the Specialist/Specialist Co-op programs and Major Programs in Biological Sciences.

Corequisites: Concurrently enrolled in at least one of the following: BIOC12H3, BIOC14H3, BIOC20H3, BIOC32H3, BIOC34H3, BIOC39H3, BIOC40H3, BIOC54H3, or BIOC61H3.

Learning Outcomes:

- 1) Critically analyze scientific evidence and formulate logical, scientific arguments
- 2) Mine, dissect and cite published scientific literature to support reasoning
- 3) Employ effective oral communication to engage a broad audience
- 4) Collaborate effectively with members of the team
- 5) Integrate ideas across sub-disciplines of biology to articulate a problem or concept
- 6) Develop multimedia skills

These LOs support the following program-level outcomes (a full list of the BioSci program level LOs is attached):

Knowledge of Methodologies: Identify and depict patterns in biological data

Application of Knowledge: Acquire and collate the information and data relevant to a given biological question, and objectively interpret these data to draw an informed conclusion.

Application of Knowledge: Integrate and apply knowledge across all levels of biological scale and complexity.

Application of Knowledge: Contribute to interdisciplinary research exchange.

Awareness of Limits of Knowledge: Evaluate recent advances in biological knowledge, and recognize the limits of the scientific process, including the inherent uncertainty in scientific knowledge, data and models.

Awareness of Limits of Knowledge: Describe the relevance and limitations of model systems/ organisms and methodologies.

Awareness of Limits of Knowledge: Identify the gaps of knowledge in the scientific literature.

Awareness of Limits of Knowledge: Differentiate between the objective and subjective interpretation of data.

Communication Skills: Communicate scientific knowledge to a lay audience.

Communication Skills: Represent data using effective visuals.

Communication Skills: Defend hypotheses and data to an audience employing appropriate scientific terminology.

Communication Skills: Work effectively and collaboratively with others (from diverse varied academic and cultural backgrounds).

Autonomy and Professional Capacity: Demonstrate both professional work habits and ethical conduct, when working individually, or as part of a team.

Autonomy and Professional Capacity: Be a strong advocate for biology and research.

Autonomy and Professional Capacity: Demonstrate the ability to meet deadlines and expectations based on self-directed learning and teamwork.

Autonomy and Professional Capacity: Develop effective teamwork skills including:

- 1) leadership skills
- 2) attentive listening
- 3) utilizing appropriate methods for conflict resolution and managing group dynamics
- 4) accepting and providing constructive criticism

Autonomy and Professional Capacity: Ethically identify the contributions of others' work within the written, oral, and visual work that the student has produced, through the use of proper citations.

Autonomy and Professional Capacity: Follow appropriate scientific practices in collecting data, and in ensuring data are shared with others as appropriate. Share knowledge of biological phenomena with non-scientists (e.g. citizen science, outreach efforts).

Topics Covered:

1. Video production guidelines
2. Storyboarding (with template and examples)
3. Interview guidelines (with consent form)
4. Team planning (with worksheet)
5. Guide and quiz on how to cite videos and images
6. Elements of a good video documentary

Methods of Assessment:

BIOC90H3 constitutes 10% of the final grade for students in one of the co-requisite courses (please see co-requisites above) that the students are concurrently enrolled in. If students are enrolled in multiple C-level co-requisite courses, they would choose one C-level course to which the 10% value would be assigned. Students must receive a grade of 50% or higher for work in BIOC90H3 in order to fulfill this graduation requirement.

The grade for BIOC90H3 will be based on the final video documentary submitted in Week 11 as well as a series of deliverables over the course of the semester. A list of all deliverables and their grade values is provided below.

Deliverables:

1. Team planning worksheet, including details on how the group members will communicate and schedule meetings outside of class time. Value = 10% of assignment grade.

Due date: Sunday at the beginning of Week 4.

2. Detailed team plan for their assignment, including topic selection and a draft title.

Due date: Sunday at the beginning of Week 5. Value = 10% of assignment grade.

3. Video outlines that include draft script or storyboard, visuals, interview plans and a timeline.

Read a short guide on citing video and images; complete Quercus quiz.

Due date: Monday after reading week. Value = 20% of assignment grade.

4. Final videos and final scripts are uploaded to relevant submission links on Quercus.

Due date: Sunday at the beginning of Week 12. Value = 50% of assignment grade.

5. If the final video includes interview clips or clips of people, interview consent forms must be handed in along with the final video and script in Week 12. If this is not provided, the final video will not be graded. The penalty is hence 50% of assignment grade.

6. Group work assessment must be turned in at the same time as final videos and scripts via links on Quercus. Value =10% of assignment grade.

The attached information document contains the grading rubric, which provides a detailed breakdown of the final assessment and is aligned with each of the LOs for BIOC90H3.

Mode of Delivery: Hybrid

Breadth Requirements: Natural Sciences

Rationale:

BIOB90H3 (new course), explores topics in biology for which insight can be gained by considering empirical research from at least two different sub-fields (as represented by the B-level core courses in the department). This successful model of a multi-course assignment motivated the department to propose a design for a C-level assignment BIOC90H3, that would build on the foundation laid by BIOB90H3. BIOC90H3 will allow students to continue to hone their information literacy, communication, teamwork and knowledge integration skills. In addition, the department seeks to motivate students to use evidence-based reasoning when considering everyday problems as well as to refine their capacity for effective communication with a lay audience. There are many calls for future scientists to be better trained in their ability to communicate with the public, given the importance of public opinion and support to the future of fundamental biological research. Several funding agencies (including Canadian governmental funding agencies) now require scientists to provide lay abstracts or summaries of their grant applications. Media sharing platforms such as YouTube and Instagram are now important ways in which scientists share the work that they do with a large number of consumers who are interested in succinct and impactful accounts of scientific research. Most importantly, the ability to communicate ideas to a broad audience is an essential skill that should hone in all biology graduates. In addition, the recent curriculum mapping exercise done by the department suggests that there are very limited courses that address an important program learning outcome: Communicate scientific knowledge to a lay audience. Hence, BIOC90H3 would be a mandatory course that would allow students in our programs to develop this important skill, despite variation in the types of elective C-level courses that they might choose within their respective programs. This course will be graded and will constitute 10% of the final grade of one of the co-requisite courses (please see co-requisites above) that the students are concurrently enrolled in, during that semester. If students are enrolled in multiple participating C-level courses, they would choose one C-level course to which the 10% value would be assigned. There will be no grade listed for BIOC90H3 on degree explorer but will instead be denoted as “complete” or “incomplete”.

Consultation: DCC Approval - September 17, 2019
RO Approval - July 18, 2019

Resources:

The course will require a faculty coordinator; this will be assigned by the department's Chair as part of the regular faculty members course coordination roles. The course will also require additional TA support in each semester (Fall and Winter) and will be covered by the department's existing budget.

BIOD13H3: Herbology: The Science Behind Medicinal Plants

Description:

The use of plants in medicine has been documented for over 2,000 years. Their use is immersed in major ancient civilizations from around the World. This lecture/seminar/lab course will take the knowledge from indigenous medicine as a starting point and expand it with more recent advances in plant biochemistry, genetics and biotechnology.

Prerequisites: BIOC13H3

Enrolment Limits: 24

Learning Outcomes:

The main goal of this course is to study Medicinal Plants, a multidisciplinary area that utilizes techniques as diverse as plant tissue culture and metabolic engineering. To accomplish this, students will be expected to integrate knowledge from different disciplines, including biochemistry, genetics, plant physiology and biotechnology.

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

1. Identify and describe the most common pathways involved in the biosynthesis of plant compounds.
2. Explain the analytical techniques and methods used to characterize plant specialized metabolites.

3. Perform experiments to extract plant metabolites.
4. Utilize sterile techniques to handle plants under tissue culture conditions.
5. Develop good record-keeping practices by using an electronic laboratory notebook.
6. Integrate indigenous knowledge on the role of medicinal plants with new evidence provided by biochemistry and genetics.
7. Conduct a literature review using key scientific databases.
8. Analyze scientific papers and synthesize the information in a research paper.
9. Design experiments using genetic and biochemical methods to uncover the biosynthesis and regulation of novel metabolites.
10. Identify the value of plant metabolites, not only in traditional and conventional medicine practices but also in the food industry.

Topics Covered:

The first part of the course will be lecture-based and cover the topics listed below. Recently published literature will be used to prepare students to analyze primary literature for their research paper.

1. Indigenous knowledge of medicinal plants.
 - Learning from Ayurveda, Traditional Chinese Medicine, First Nations healers, and other indigenous health care systems.
 2. Analytical methods in plant metabolite profiling.
 - Gas and liquid chromatography, mass spectrometry, nuclear magnetic resonance.
 3. Biosynthetic origin of medicinal compounds.
 - Terpenoids, phenylpropanoid-derived, nitrogen-containing and sulphur-containing compounds.
 4. Uncovering the molecular basis of medicinal compounds.
 - Forward and reverse genetics, biochemical and systems biology approaches (genomics, proteomics, metabolomics).
 5. Strategies for the production of medicinal compounds.
 - in vitro propagation of plants, cell cultures, engineering of plant biosynthetic pathways in microbes, directed enzyme evolution.
 6. Guest lectures
 - UTSC Biological Sciences librarian (in-class workshop to teach students how to conduct an extensive literature review using key scientific databases such as PubMed and Web of Science)
 - Writing Centre (students will learn about the resources available through the Centre to improve their writing and manage their time effectively while preparing their research paper)
- In addition, three laboratories are being proposed to give students hands-on experience in the analytical techniques used in the field of plant biochemistry.
1. Growth of plants in controlled environments.
 - Preparation of plant growth media
 - In vitro propagation
 2. Determination of alkaloid content.
 - Metabolite extraction
 - Thin-layer chromatography
 3. Terpene composition.
 - Metabolite extraction
 - Gas chromatography-mass spectrometry (samples submitted to TRACES at DPES)

Methods of Assessment:

1. Laboratory notebooks and performance (learning outcomes 3, 4 and 5) – Maintaining a detailed record of experimental data is crucial in Science. An electronic record facilitates collaboration, access to the data, and integration of data in different formats. As part of this course, students will keep an electronic laboratory notebook. Students will create a free account on SciNote, or similar platform, and learn how to maintain proper records of their research. The notebook will be assessed after each laboratory activity.
2. Research paper (learning outcomes 6, 7, 8 and 10) – Being able to collect, read, synthesize and critically evaluate primary literature will be one of the main goals of this course. At the beginning of the semester, groups of 2-3 students will be assigned a medicinal plant to work on. Students will be responsible for preparing the following:
 - Outline and literature search - Three weeks after topics are assigned, groups will present an outline of their written report containing the abstract, major sections of the paper and a list of references. This will be an opportunity to get feedback on the structure of their paper.
 - Oral presentation - Communicating knowledge and leading discussions are important skills in all professional environments. For the second half of the course, groups will give a 25 min presentation, followed by a discussion period led by the students themselves. The presentation can be a PowerPoint or a video.
 - Written report - It will summarize information on the traditional knowledge, the properties of the active compound(s) on

human health, as well as the genetics and biochemistry behind its medicinal properties.

3. Participation (learning outcome 2, 9 and 10) - Active engagement during lectures and oral presentations will be expected. Students will submit questions to their peers presenting and participate in the discussion of papers in class.

4. Final exam (learning outcome 1, 2, 9 and 10) – The final exam will assess the understanding of the topics covered during the lectures, laboratories and student presentations. Students will be presented with a case study, asked to interpret the data presented and recommend experiments based on what they have learned throughout the semester

Mode of Delivery: In Class

Breadth Requirements: Natural Sciences

Rationale:

To be able to address biological questions, the department need to put together disciplines that are traditionally taught separately, like biochemistry, plant biotechnology and genetics. BIOD13H3 provides students with the opportunity to bridge their knowledge on these different disciplines and appreciate how they are tightly intertwined in research. This course will go in-depth by analyzing recent primary literature. Using Medicinal Plants as a case study will allow students to gain an appreciation for ethnobotany – the indigenous knowledge that preceded the use of plants for medicine. This course will also provide important preparation for students pursuing careers around medical and pharmaceutical sciences, plant biotechnology, and the agriculture and agri-food sectors.

The skills taught in this course will position students in high demand for jobs in the medicinal plant's industry, the agriculture and the biotechnology sector. This D-level course will fit into the Major programs in Plant Biology, Molecular Biology, Immunology and Disease, as well as in the Specialist programs in Integrative Biology, and Molecular Biology and Biotechnology.

Consultation:

DCC Approval – Sept 17, 2019

Consultation with DPES: September 11, 2019

RO Approval: June 13, 2019

Resources:

The course will be taught by Eliana Gonzales-Vigil, a full-time faculty member in the Department as part of her regular teaching load. This course will require additional TA support, the TA resources will be covered by the department's existing budget. The lab component will be conducted in one of the departments teaching labs for four 3 hour-sessions (three laboratory experiments), as well as access to the TRACES facility at the Department of Physical and Environmental Sciences for the analysis of terpenes. The TRACES costs will be covered by the department's existing budget.

BIOD34H3: Conservation Physiology

Description:

This is a combined lecture and seminar course that will discuss topics such as climate change and plastics/microplastics effects on the physiology of animals, and physiological tools and techniques used in conservation efforts. The course will focus on how physiological approaches have led to beneficial changes in human behaviour, management or policy.

Prerequisites: BIOB34H3 and [BIOC58H3 or BIOC60H3 or BIOC63H3]

Enrolment Limits: 35

Learning Outcomes:

The main goal of this course is to expose students to advanced topics in animal physiology and to develop their teamwork, research, and science communication skills (reading and writing).

PLO = program learning objective

Be the end of the course students should be able to:

1. Use and apply physiological concepts first introduced in prerequisite courses to new case studies and more advanced topics. PLO: Depth and Breadth of Knowledge
2. Critically evaluate the scientific literature in the physiology field, process information and use it to communicate persuasive arguments during small group debates on a given topic. PLO: Application of Knowledge
3. Through small group debates, recognize the limits of the scientific process, including the inherent uncertainty in scientific knowledge data and models and identify the limitation of model systems/organisms and methodologies. PLO: Awareness of Limits of Knowledge
4. Develop effective teamwork skills (including leadership skills, attentive listening, utilizing appropriate methods for conflict resolution and managing group dynamics) when working collaboratively with peers during group assignments,

debates and oral presentations. PLO: Autonomy and Professional Capacity

5. Create presentations based on scientific research literature and present data using effective visuals. PLO: Communication Skills

6. Acquire and collate the information and data relevant to a chosen topic, and objectively interpret these data to draw an informed conclusion as part of a review paper. PLO: Application of Knowledge

7. Ethically identify the contributions of others' work within the written, oral, and visual work through the use of proper citations. PLO: Autonomy and Professional Capacity

8. Accept and provide constructive criticism while evaluating the review papers of their peers and receiving feedback on their own work. PLO: Autonomy and Professional Capacity

Topics Covered:

The topics covered will be chosen from the primary literature and recommended textbook, focusing on success stories where physiological work has led to downstream management effects and have the potential to include:

1. Conservation physiology's roots and purpose
2. Conservation physiology toolbox: tools, techniques, and their application
3. Physiological markers of health and stress in wild animals
4. Climate change effects on animal physiology
5. Using conservation physiology to address human-wildlife conflicts
6. Sensory physiology-based conservation strategies
7. Energy use and metabolism
8. The oxygen transport cascade (advanced respiratory physiology)
9. Oxygen and capacity-limited thermal tolerance theory
10. Nutritional physiology
11. Ecotoxicology and reproductive physiology
12. Plastics and Microplastics

Methods of Assessment:

1) Small group debates – Each group of 3 students will be assigned a topic and either a pro or con stance on the topic. The group will have to research the primary literature on the topic and formulate an argument for the given topic. They will then present their argument in front of the class, followed by the presentation from the group presenting the opposite stance. Both groups will be given 5 minutes to respond to the counter-argument. This will be followed by a final discussion by the whole class. Students will be assessed on their presentation, the strength of the arguments, and understanding of the topic. The debates are designed to support learning outcomes 2, 3, 4, 5 and 7.

2) Review paper on a conservation physiology topic of choice – each student will choose a topic of choice within the conservation physiology field and will write a small review paper (3000 words) on the topic. Students will prepare a draft part-way through the course and provide peer-review on the drafts of others. Students will be assessed on their ability to interpret the scientific literature, their feedback on the work of others, and their written communication skills including the originality of their topic presentation. The final paper is designed to support learning outcomes 1, 2, 6, 7 and 8.

3) Final exam – the final exam will include short and long answer questions and will assess students on their understanding of topics covered and their ability to interpret the scientific literature. These exams will test the students who have met learning outcomes 1, 2, 6 and 7.

Mode of Delivery: In Class

Breadth Requirements: Natural Sciences

Rationale:

BIOD34H3 will expose students to more advanced topics in animal physiology using examples from this very new area of research. Students will be better prepared for taking up positions in government agencies, consulting firms, or graduate studies with much better knowledge and understanding of this cutting-edge area of study. This course has been designed for students taking either the Conservation and Biodiversity or the Integrative Biology programs. This course is being proposed also to fill a gap in the current curriculum. The Conservation and Biodiversity program, in particular, has a strong focus on ecology and evolution in upper-year courses, but less so on physiology. The proposed course would allow students interested in these subjects to learn how physiology can be used in preserving biodiversity and informing conservation efforts, by building on foundational physiology courses.

Consultation: DCC Approval: September 17, 2019

RO Approval: September 17, 2019

Resources: The course will be taught by Cosima Porteus, a full-time faculty member in the department, as part of her teaching load. This course will require additional TA support, this will be covered by the department's existing budget.

1 Course Modification:

BIOC99H3: Biology Team Research

Prerequisites:

- (1) Enrolment in a UTSC Major or Specialist Subject POSt offered by Biological Sciences and (2) completion of all second year core program requirements and (3) have at least 8.0 ~~10.0~~ credits and
(4) a ~~cumulative GPA of at least 3.0 and (5)~~ a commitment from a Biology faculty member to serve as supervisor and (~~5~~ ~~6~~) formation of a group that includes at least 2 other students

Rationale:

The course prerequisite have been revised to:

- (a) reduce 10.0 credits to 8.0 credits, this better reflects the average number of courses completed by students in their second year of study.
(b) remove the GPA requirement to ensure consistency with other research courses in the department and to provide students more enrolment flexibility.

Consultation: DCC Approval: June 19, 2019

Resources: None.