UNIVERSITY OF TORONTO SCARBOROUGH

OFFICE OF THE CAMPUS COUNCIL

FOR APPROVAL **PUBLIC** **OPEN SESSION**

TO: UTSC Academic Affairs Committee

SPONSOR: William Gough, Vice-Principal Academic and Dean
CONTACT INFO: 416-208-7027, vpdean@utsc.utoronto.ca

PRESENTER: Mark Schmuckler, Vice-Dean Undergraduate
CONTACT INFO: 416-208-2978, vdundergrad@utsc.utoronto.ca

DATE: January 8, 2020 for January 15, 2020

AGENDA ITEM: 3

ITEM IDENTIFICATION:

Undergraduate Major Modifications - Specialist/Specialist Co-op programs in Neuroscience

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:

The departments of Psychology and Biological Sciences at the University of Toronto Scarborough (UTSC) co-sponsor programs in Neuroscience. This is a proposal for major modifications to the Specialist and Specialist (Co-op) programs in Neuroscience that will address the needs of both academic units. These changes are designed to achieve two important goals:

First: to address a number of curricular and pedagogical challenges, including an overly rigid curricular structure, the need for an earlier introduction to neurophysiology and research methodology, and the need to ensure students have access to, and are better prepared for, courses at the upper-levels, the following changes will be implemented:

- Adding a new course focused on neurophysiology (NROB61H3 Neurophysiology) as a requirement. Neurophysiology is an essential part of a neuroscience education and this new course will ensure that students are introduced to the field in a more cohesive and fulsome manner than is currently the case.
- Adding an existing research methodology course as a requirement (PSYB70H3 Methods in Psychological Science). This course focuses on scientific literacy skills central to effectively consuming and critiquing research in psychological science.
- Increasing program flexibility by reducing the number of specified required courses. The existing Specialist and Specialist (Co-op) programs are highly prescriptive, which creates challenges in the form of increased resource demands given the large number of required courses, an increased likelihood of attrition since students may not be able to complete necessary course prerequisites, and limited opportunities for students to explore their particular areas of interest within neuroscience.
- Strengthening pre-requisites of C-level courses to promote better preparation for courses at the upper-levels. Students have frequently voiced concerns about the increased expectations in upper-level courses prompting the re-examination of the way in which skills-development is scaffolded in the programs – particularly in NRO required courses prior to the C-level. To resolve this issue, the C-level course prerequisites have been updated to ensure students are able to develop the skills they need to be successful in upper-level courses, and efforts have been made to ensure that Neuroscience students also have fair and reasonable access to upper-level required courses in the Biological Sciences.

Second: to leverage existing teaching and research strength in the Department of Psychology in the areas of cognitive science and neuroscience, by establishing cognitive neuroscience as a distinct stream in the program, while at the same time maintaining the programs' existing areas of focus, the Specialist and Specialist Co-op programs in Neuroscience will be restructured to have a common core and three streams: (A) Systems/Behavioural; (B) Cellular/Molecular; and (C) Cognitive:

- The common core will consist of 6.5 credits;
- The Systems/Behavioural stream will require an additional 6.5 credits, for a total of 13.0 credits. This stream examines the neural mechanisms underlying behaviour and how brain circuits work together to analyze external stimuli, internal biological states and past experiences in order to coordinate appropriate responses, predominantly

through the use of *in vivo* approaches in behaving subjects (e.g., optogenetics, chemogenetics).

- The Cellular/Molecular stream will require an additional 6.5 credits, for a total of 13.0 credits. This stream explores the nervous system at its most fundamental level, investigating the influence of genes, signalling molecules, and cellular morphology on the development and maintenance of brain function, predominantly through the use of *in vitro* techniques (e.g., immunohistochemistry, patch clamp).
- The Cognitive stream will require an additional 7.0 credits, for a total of 13.5 credits. This stream focuses on understanding the neural basis of human cognition (e.g., language, memory, attention, decision-making) predominantly through the use of patient neuropsychology and neuroimaging techniques (e.g., magnetic resonance imaging (MRI), electroencephalography (EEG)).

The existing Specialist and Specialist (Co-op) programs in Neuroscience are comprehensive programs that explore the nervous system from many different levels of organization. The programs are focused on two broad domains of neuroscience research: Systems/Behavioural and Cellular/Molecular. These domains fall naturally into distinct formal streams, and re-structuring the programs to support this will provide an opportunity for students to obtain in-depth content knowledge and skills in the subdiscipline that interests them most, while at the same time improving curricular flexibility. There is an additional opportunity to move these programs forward in a new direction by adding a third stream in Cognitive Neuroscience that will leverage existing teaching and research expertise in cognitive science and neuroscience found in the Department of Psychology, and will also address a growing interest among students in cognitive neuroscience.

A stream approach distinguishes our campus from UTSG and UTM in a useful way. The creation of three streams of focus provides our students with a potent opportunity to develop depth in the subdisciplines of neuroscience that interest them most, and the creation of a Cognitive Neuroscience stream, which does not exist in any form currently, offers a powerful new learning opportunity and focus for our students.

Students who are already enrolled in the programs will be grandfathered, and will be able to continue with the program if they choose. However, students will be allowed to switch to the new pathway, if appropriate, and departmental advising resources will be allocated to work with individual students to evaluate the appropriateness of such a move given where they are at in their studies.

New students will be required to follow a new two-stage enrolment pathway. This admission process will ensure that: students have the foundation they need to be successful at each stage; and students are introduced to the three streams and can make appropriate decisions regarding the stream that best meets their needs and interests. Stage 1: provides entry to the Specialist and Specialist (Co-op) programs, but not to any of the three streams; normally, students will be able to apply to Stage 1 after completing Year 1 of their studies. Stage 2: provides entry to one of the three streams; normally, students will be able to apply to Stage 2 after completing Year 2 of their studies.

The Department recognizes that students may require some additional advising, and they are prepared to meet that need. The Department also understands that not all students will meet the Stage 2 requirements of the program; these students will be guided towards to the Major program in Neuroscience; there is strong alignment between the Stage 1 and 2 requirements of the Specialist program and the Major program in Neuroscience to make it easier for students to transfer between them.

Additional resources required to support the new course NROB61H3 have been approved by the Dean's Office.

There has been extensive consultation regarding the proposed changes within the Department of Psychology, and with the Department of Biological Sciences. The Department of Biological Sciences approved the proposed changes on July 3, 2019. There has also been consultation with the Department of Computer and Mathematical Sciences, the Arts and Science Co-op Office, the Office of the Registrar and the Dean's Office. The proposal has been reviewed by the Campus Curriculum Committee.

FINANCIAL IMPLICATIONS:

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

RECOMMENDATION:

Be It Resolved,

THAT the major modifications to the Specialist/Specialist (Co-operative) programs in Neuroscience (BSc), as described in the proposal dated December 2, 2019 and recommended by the Vice-Principal Academic and Dean, William Gough, be approved effective Fall 2020 for the 2020-21 academic year.

DOCUMENTATION PROVIDED:

1. Major Modification to the Specialist/Specialist (Co-operative) programs in Neuroscience (BSc), dated December 2, 2019.

UNIVERSITY OF TORONTO

University of Toronto
Major Modification Proposal: Significant Modifications to Existing Undergraduate Programs

Programs being modified:	Specialist in Neuroscience (BSc) Specialist (Co-operative) in Neuroscience (BSc)
Type of Major Modification:	1. Re-structuring the program requirements to address curricular and pedagogical challenges; 2. Transitioning the existing undifferentiated programs to programs with three streams: (A) Systems/Behavioural; (B) Cellular/Molecular; (C) Cognitive
Effective Date of Change:	Fall 2020
Department / Unit where the programs reside:	Psychology
Discipline Area/Calendar Section:	Neuroscience
Faculty / Academic Division:	University of Toronto Scarborough
Faculty / Academic Division contact:	Annette Knott, Academic Programs Officer; aknott@utsc.utoronto.ca
Department / Unit contact:	Suzanne Erb, Chair Michael Souza, Project Lead
Date of this version of the proposal:	December 2, 2019

1 Summary

The departments of Psychology and Biological Sciences at the University of Toronto Scarborough (UTSC) co-sponsor programs in Neuroscience, currently consisting of undifferentiated existing Specialist and Specialist (Co-op) programs and a Major – all leading to a Bachelor of Science degree. These programs are highly popular with students; as of November 2018, there are 65 students in the Specialist, 106 in the Specialist (Co-op) and 451 in the Major, for a total of 622 students. Overall enrolments in the programs have increased 25% since 2009.

This is a proposal for major modifications to the Specialist and Specialist (Co-op) programs in Neuroscience. These changes are designed to achieve two important goals:

- First: to address a number of curricular and pedagogical challenges, including an overly rigid curricular structure, the need for an earlier introduction to neurophysiology and research methodology, and the need to ensure students have access to, and are better prepared for, courses at the upper-levels. To service this goal, the following changes will be implemented:
  - Adding a new course focused on neurophysiology (NROB61H3 Neurophysiology) as a requirement;
  - Adding an existing research methodology course as a requirement (PSYB70H3 Methods in Psychological Science);
  - Increasing program flexibility by reducing the number of specified required courses;
  - Strengthening pre-requisites of C-level courses to promote better preparation for courses at the upper-levels.

- Second: to leverage existing teaching and research strength in the Department of Psychology in the areas of cognitive science and neuroscience, by establishing cognitive neuroscience as a distinct stream in the program, while at the same time maintaining the programs' existing areas of focus. To service this goal, the Specialist and Specialist Co-op programs in Neuroscience will be restructured to have a common core and three streams: (A) Systems/Behavioural; (B) Cellular/Molecular; and (C) Cognitive:
  - The common core will consist of 6.5 credits;
  - The Systems/Behavioural stream will require an additional 6.5 credits, for a total of 13.0 credits. This stream examines the neural mechanisms underlying behaviour and how brain circuits work together to analyze external stimuli, internal biological states and past experiences in order to coordinate appropriate responses, predominantly through the use of *in vivo* approaches in behaving subjects (e.g., optogenetics, chemogenetics).
  - The Cellular/Molecular stream will require an additional 6.5 credits, for a total of 13.0 credits. This stream explores the nervous system at its most fundamental level, investigating the influence of genes, signalling molecules, and cellular morphology on the development and maintenance of brain function, predominantly through the use of *in vitro* techniques (e.g., immunohistochemistry, patch clamp).
  - The Cognitive stream will require an additional 7.0 credits, for a total of 13.5 credits. This stream focuses on understanding the neural basis of human cognition (e.g., language, memory, attention, decision-making) predominantly through the use of patient neuropsychology and neuroimaging techniques (e.g., magnetic resonance imaging (MRI), electroencephalography (EEG)).

Together, these changes will address the academic priorities of both departments.

2 Academic Rationale

This is a proposal for major modifications to the Specialist and Specialist (Co-op) programs in Neuroscience. These changes are designed to achieve two important goals: (1) in line with the academic priorities of both the Department of Biological Sciences and the Department of Psychology, to resolve a number of ongoing curricular challenges; and (2) in line with the academic priorities of the Department of Psychology, to address a growing student interest in cognitive neuroscience.

1. Resolving curricular challenges:

Following a review of the programs, a number of curricular and pedagogical challenges were identified: (a) the programs have a too-rigid structure leading to higher rates of attrition; (b) students need an earlier introduction to neurophysiology and methodology; and (c) students need better access to, and better preparation for, courses at the upper-levels.

The existing Specialist and Specialist (Co-op) programs are highly prescriptive, which creates challenges in the form of increased resource demands given the large number of required courses, an increased likelihood of attrition since students may not be able to complete necessary course prerequisites, and limited opportunities for students to explore their particular areas of interest within neuroscience. To resolve this issue, the number of courses that are specified as requirements have been reduced.

Two gaps have been identified in the existing program: first, more fulsome foundations in neurophysiology are needed earlier in the curriculum in order to prepare students for upper-level courses. Similarly, an earlier exposure to methodological tools will ensure that students gain a solid foundation in research design, the ability to craft logical, coherent and compelling arguments, and the ability to consume scientific articles effectively. To satisfy these needs NROB61H3 and PSYB70H3 are being added to the programs as requirements:

- NROB61H3 Neurophysiology (new course):

This course provides foundational knowledge for understanding how the nervous system functions, with an emphasis on the generation and propagation of electrical signals that underlie neuronal communication. Neurophysiology is an essential part of a neuroscience education and this new course will ensure that students are introduced to the field in a more cohesive and fulsome manner than is currently the case. The skill development integrated into this course (e.g., scientific literacy, critical thinking, written communication, and practical laboratory skills) has been designed to complement the skill development opportunities found in NROB60H3 and PSYB55H3, which also function as program requirements. Collectively, this trio of courses will fortify student knowledge and skills prior to them engaging in upper-level courses, and will also help orient students to major subdisciplines in neuroscience, which is particularly important for preparing students to select a stream of focus.

- PSYB70H3 Methods in Psychological Science (existing course)

This course focuses on scientific literacy skills central to effectively consuming and critiquing research in psychological science. Students will learn about commonly used research designs, how to assess whether a design has been applied correctly, and whether the conclusions drawn from the data are warranted. Students will also develop skills to effectively find and consume primary research in psychology. The substantial overlap in utility of this course for Psychology,

Mental Health Studies, and Neuroscience allows the Department to lean on this one course for all programs rather than developing area-specific research methods courses.

Students have frequently voiced concerns about the increased expectations in upper-level courses prompting the re-examination of the way in which skills-development is scaffolded in the programs – particularly in NRO required courses prior to the C-level. To resolve this issue, the C-level course prerequisites have been updated to ensure students are able to develop the skills they need to be successful in upper-level courses, and efforts have been made to ensure that Neuroscience students also have fair and reasonable access to upper-level required courses in the Biological Sciences. Since strengthening prerequisites for NRO C-level courses will create some challenges with respect to course access during the first year following the implementation of the proposed changes, the Department will honour current calendar requirements for all NRO C-level courses for one academic year after implementation. To help students with their academic planning around this issue, the Department will provide clear communication once the proposal has been approved, and will provide monthly email reminders to students for one calendar year. Once the year has passed, accommodations will be made on a case-by-case basis.

2. Addressing the growing interest in cognitive neuroscience:

The existing Specialist and Specialist (Co-op) programs in Neuroscience are comprehensive programs that explore the nervous system from many different levels of organization. They are highly prescriptive programs focused on two broad domains of neuroscience research: Systems/Behavioural and Cellular/Molecular. These domains fall naturally into distinct formal streams, and re-structuring the programs to support this will provide an opportunity for students to obtain in-depth content knowledge and skills in the subdiscipline that interests them most, while at the same time improving curricular flexibility.

Beyond the pedagogical advantages to be gained from restructuring the Specialist and Specialist (Co-op) programs in Neuroscience to include formal Systems/Behavioural and Cellular/Molecular streams, there is an additional opportunity to move these programs forward in a new direction by adding a third stream in Cognitive Neuroscience.

A stream in Cognitive Neuroscience will leverage existing teaching and research expertise in cognitive science and neuroscience found in the Department of Psychology. Faculty in the Department of Psychology are divided into core area groupings (CAGs) based on area of expertise, and one of these areas is in Cognitive Science/Neuroscience. This includes faculty with expertise in the areas of visual processing (Jonathan Cant, Adrian Nestor), attention (Matthias Niemeier), memory (George Cree, Andy Lee), language (Blair Armstrong), decision-making (Cendri Hutcherson), and executive functioning (Michael Inzlicht, Michael Souza). Additionally, colleagues in the UTSC graduate field in Clinical Psychology have expertise in clinical cognitive neuroscience (Vina Goghari, Anthony Ruocco). These faculty teach a range of courses appropriate for a cognitive neuroscience undergraduate program and indeed, there is tremendous growth potential to further build upon the present course offerings (e.g., Computational Cognitive Neuroscience, Cognitive Neuroscience of Memory, Clinical Cognitive Neuroscience, to name a few recently discussed options).

This new stream in Cognitive Neuroscience will also address a growing interest among students in cognitive neuroscience. Currently, UTSC students who are interested in concentrating on cognitive

neuroscience must choose a program in Psychology and take as many cognitive neuroscience-themed courses as the program will permit. This solution is not ideal for two key reasons:

- First, it is important for cognitive neuroscience students to have a solid biology, chemistry, math, and computer programming foundation, all of which would be optional through the current requirements in the Psychology programs.
- Second, although UTSC Psychology maintains rigorous experimental and clinical programs that are consistently funded at the highest levels by granting agencies and which produce graduates well prepared for many public and private sector careers, a belief continues to exist among some stakeholders (crucially, parents and prospective students) that a degree in Neuroscience is better suited to a student who wishes to pursue a career in, for example, medicine or clinical research. Given this reality, it makes more sense to place cognitive neuroscience under Neuroscience, rather than Psychology.

Thus, with the approval of this proposal, the Specialist and Specialist Co-op programs in Neuroscience will be restructured so as to have a common core and three streams: (A) Systems/Behavioural; (B) Cellular/Molecular; and (C) Cognitive:

- The common core will consist of 6.5 credits to ensure that all three streams have the same background coursework in biology, chemistry, mathematics, neuroscience, and psychology.
- The Systems/Behavioural stream will require an additional 6.5 credits, for a total of 13.0 credits. Systems/Behavioral Neuroscience examines the neural mechanisms underlying behaviour and how brain circuits work together to analyze external stimuli, internal biological states and past experiences in order to coordinate appropriate responses, predominantly through the use of *in vivo* approaches in behaving subjects (e.g., optogenetics, chemogenetics). This stream is aligned with the current undifferentiated program in that it provides robust learning opportunities in this area of neuroscience; however, the shift to the stream model allows students to develop a deeper, more intensive focus on the Systems/Behavioral area than is currently the case.
- The Cellular/Molecular stream will require an additional 6.5 credits, for a total of 13.0 credits. Cellular/Molecular Neuroscience explores the nervous system at its most fundamental level, investigating the influence of genes, signalling molecules, and cellular morphology on the development and maintenance of brain function, predominantly through the use of *in vitro* techniques (e.g., immunohistochemistry, patch clamp).This stream is aligned with the current undifferentiated program in that it provides robust learning opportunities in this area of neuroscience; however, the shift to the stream model allows students to develop a deeper, more intensive focus on the Cellular/Molecular area than is currently the case.
- The Cognitive stream will require an additional 7.0 credits, for a total of 13.5 credits. This stream builds on the current undifferentiated program, where cognitive neuroscience is currently just a focus in one course at the B-level (PSYB55H3 Introduction to Cognitive Neuroscience). This stream focuses on understanding the neural basis of human cognition (e.g., language, memory, attention, decision-making) predominantly through the use of patient neuropsychology and neuroimaging techniques (e.g., magnetic resonance imaging (MRI), electroencephalography (EEG)).

A stream approach distinguishes our campus from UTSG (a comprehensive program offered through Human Biology) and UTM (a comprehensive program offered through Psychology) in a useful way. It also provides a framework that is easily amenable to the addition of new stream-relevant courses,

not to mention the addition of future streams if appropriate (e.g. Theoretical Neuroscience, Clinical Neuroscience). The creation of three streams of focus provides our students with a potent opportunity to develop depth in the subdisciplines of neuroscience that interest them most, and the creation of a Cognitive Neuroscience stream, which does not exist in any form currently, offers a powerful new learning opportunity and focus for our students.

3 Description of the Proposed Major Modification(s)

Changes to Enrolment Requirements – Specialist and Specialist (Co-op) programs:

1. The CPGA requirement is being changed from 2.80 to 2.75. This change will align the enrolment requirements for both the Specialist and Specialist Co-op offerings.
2. [MATA29H3 or MATA30H3] has been added to the list of courses that students must complete to apply to the program. Students will often delay completing this requirement until later in the program; since this material is foundational to the program, it is important that students complete it early on.
3. There will be a two-stage admission to the program. The establishment of a two-stage admission process will ensure that: students have the foundation they need to be successful at each stage; and students are introduced to the three streams and can make appropriate decisions regarding the stream that best meets their needs and interests.
    - Stage 1: provides entry to the Specialist and Specialist (Co-op) programs, but not to any of the three streams; normally, students will be able to apply to Stage 1 after completing Year 1 of their studies. Students may apply to Stage 1:
        - after successfully completing a minimum of 4.0 credits, including BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, [MATA29H3 or MATA30H3], PSYA01H3, and PSYA02H3
    - Stage 2: provides entry to one of the three streams; normally, students will be able to apply to Stage 2 after completing Year 2 of their studies. To apply to Stage 2 students must:
        - Complete a minimum of 10.0 credits including all Stage 1 course requirements, as well as BIOB10H3, NROB60H3, NROB61H3, [PSYB07H3 or STAB22H3), PSYB55H3, PSYB70H3;
        - Complete 1.0 credit in stream-specific courses from the following list:
            - BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
            - CSCA20H3 Introduction to Programming
            - CHMB41H3 Organic Chemistry I
            - CHMB42H3 Organic Chemistry II
            - MATA23H3 Linear Algebra
            - [PHYA11H3 Physics I for the Life Sciences *or* PHYA10H3 Physics I for the Physical Sciences]
            - PSYB51H3 Introduction to Perception
            - PSYC08H3 Advanced Data Analysis in Psychology
            - PSYC09H3 Applied Multiple Regression in Psychology
        - Have achieved a CGPA of 2.5 or higher. This CGPA requirement is necessary to ensure that students are successful in the upper level courses in the program.
    - Students who do not meet the Stage 1 enrolment requirements can still apply to the Specialist program at Stage 2. This pathway requires students to complete a minimum of 10.0 credits, including all of the core courses of the program (Scientific Foundations,

Neuroscience Foundations, and Stream Foundations). In addition to completing the course requirements, students must also have achieved a CGPA of 2.5 or higher across all courses, and a CGPA of 2.75 or higher across the Neuroscience Foundations and Stream Foundations courses.
    - Students who do not successfully meet the requirements to move to Stage 2 will be able to transfer to the Major program in Neuroscience. There is strong alignment between the Stage 1 and 2 requirements of the Specialist program and the Major program in Neuroscience to make it easier for students to transfer between them. In this way, students who move to the Major from the Specialist will not encounter any barriers, and will not increase their time to graduation.

See Appendix B for all changes.

Changes to Program Requirements – Specialist and Specialist (Co-op) programs:

The existing undifferentiated Specialist and Specialist (Co-op) programs in Neuroscience are being restructured as programs with a common core and three streams. For a Calendar description of the existing programs, please see Appendix A. For a Calendar description of the revised programs, please see Appendix B.

1. From the course requirements of the existing programs a common core consisting of 6.5 credits is being created:
    - These credits are drawn primarily from components 1 and 2 of the original undifferentiated program.
    - Component 1 of the revised program will focus on scientific foundations, including courses in biological sciences (BIOA01H3 and BIOA02H3), chemistry (CHMA10H3 and CHMA11H3), calculus (MAT29H3/MATA30H3 and psychology (PSYA01H3 and PSYA02H3).
    - Component 2 of the revised program will focus on neuroscience foundations, including cell biology (BIOB10H3), neuroanatomy (NROB60H3), a new course in neurophysiology (NROB61H3), cognitive neuroscience (PSYB55H3), data analysis (PSYB07H3/STAB22H3), and a new course in methods in psychology (PSYB70H3):
        - NROB61H3 addresses the need for a more fulsome treatment of neurophysiology, early in the program;
        - PSYB70H3 addresses the need for stronger and more coherent research methodology training.
    - Courses in physics (PHYA10H3/PHYA11H3), biological sciences (BIOB11H3), and chemistry (CHMB41H3, CHMB42H3) are being moved into the three streams as either requirements or options.
    - Minor modifications will be implemented in the Major in Neuroscience so that the requirements of the core and the Major are aligned; this change will allow students who do not meet the requirements to move to Stage 2 of the Specialist programs to transition to the Major.
2. Create three new streams:
    - Systems/Behavioural Stream (A) – students must complete an additional 6.5 credits as follows:
        - 1.0 credit in quantitative logic and reasoning
        - 2.0 credits in advanced foundations

        - 1.0 credit in stream-specific electives
        - 1.0 credit in breadth in neuroscience
        - 0.5 credit in laboratory courses
        - 1.0 credit in capstone courses
    - Cellular/Molecular Stream (B) – students must complete an additional 6.5 credits as follows:
        - 1.0 credit in quantitative logic and reasoning
        - 2.0 credits in advanced foundations
        - 1.0 credit in stream-specific electives
        - 1.0 credit in breadth in neuroscience
        - 0.5 credit in laboratory courses
        - 1.0 credit in capstone courses
    - Cognitive Stream (C) – students must complete an additional 7.0 credits as follows:
        - 1.5 credits in quantitative and methodological skills
        - 1.5 credits in advanced programming
        - 1.5 credits in advanced foundations
        - 1.0 credit in breadth in neuroscience
        - 0.5 credit in laboratory courses
        - 1.0 credit in capstone courses
3. Most courses from components 3 and 4 of the existing programs will be present in the revised programs, but are being shifted around as follows:
    - BIOC12H3, BIOC13H3, NROC60H3 are options in stream B;
    - NROC36H3 and NROC69H3 are an option in streams A and C, and a requirement in stream B;
    - NROC34H3, NROC61H3, NROC64H3, NROD98Y3 and PSYD66H3 are an option in all three streams;
    - PSYC08H3 is a requirement in streams A and B, and an option in stream C;
    - BIOC14H3, PSYC62H3, BIOD19H3, BIOD65H3, NROD08H3/BIOD08H3, NROD60H3, NROD61H3, NROD66H3, NROD67H3 are an option in streams A and B;
    - BIOD45H3 and NROC63H3 are options in stream A;
    - PSYD17H3 is now an option in stream C;
4. Courses being removed altogether from the program are: BIOC32H3, BIOC34H3, BIOD27H3, PSYD33H3.

See Appendix B for all changes.

Changes to Program Requirements – Specialist (Co-op) program only:

1. Only students in streams A and B must also complete BIOB12H3*;
   *students in stream B are cautioned that they cannot apply BIOB12H3 towards the completion of component 7 of the stream requirements.
2. Students are no longer required to complete BIOC23H3.

Changes to Co-op Work Term Requirements – Specialist (Co-op) program only:

1. Students are apprised that they will complete a total of 8 months in Co-op work terms, which may occur as a single eight-month placement, or 2 four-month placements;

2. The courses that students must complete to be eligible for their first work term have been updated to be aligned with the revised enrolment requirements;
3. Students are apprised that they must achieve a CGPA of 2.5 or higher to be eligible for their first work term.

See Appendix B for all changes.

Impact on Program Learning Outcomes:

While the development of the Neuroscience curricula many years ago were guided by content and skill-development ideals for students, these ideals were never formalized in an official document. As a result, the Department is taking the opportunity provided by this major modification proposal to formalize – and further refine – these ideals (program goals). This proposal details the learning outcomes that delineate content and skill development distinctions across the newly developed streams in the Specialist.

For more information, see Appendix C.

Alignment of the changes with Universal Design Principles:

The proposed changes will create a more inclusive and accessible learning experience for students. In an effort to reduce barriers to learning and increase student engagement, the proposed changes aim to dramatically improve the curricular flexibility of the programs and give students more choice in the courses they select. Furthermore, through the addition of new specific course requirements (e.g. NROB61H3, PSYB70H3) and strengthened prerequisites, students will be better prepared to engage with upper-level course material, resulting in better student outcomes and increased motivation to engage. Both NROB61H3 and PSYB70H3 are designed with the three principles of universal design for learning in mind. They present information in multiple formats, allow students to express what they know in different ways, and aim to stimulate interest and motivation through the use of challenging and exciting learning activities.

4 Impact of the Change(s) on Students

Students who are already enrolled in the programs will be grandfathered, and will be able to continue with the program if they choose. However, students will be allowed to switch to the new pathway, if appropriate, and departmental advising resources will be allocated to work with individual students to evaluate the appropriateness of such a move given where they are at in their studies.

The strengthening of prerequisites for a number of NRO C-level courses (e.g., NROC61) requires that students complete all second-year requirements, which is not currently the case. With successful passage of this proposal, we will waive these prerequisite changes for one (1) academic year. Coupled with effective and frequent communication to our students, we believe this will allow students to plan their courses in such a way that they are not held up by this change.

Upon passage of this proposal, students interested in Neuroscience will now see a clearer demarcation between the Major and Specialist programs: whereas the Major program will continue to be a “generalist” neuroscience degree, the Specialist will allow students the opportunity to delve

deeper into one of three areas of neuroscience, each with their own path of courses. We anticipate that this will be enormously attractive and appealing to current and future students.

New students will be required to follow the new two-stage enrolment pathway. The Department recognizes that students may require some additional advising, and they are prepared to meet that need. The Department also understands that not all students will meet the Stage 2 requirements of the program; these students will be guided towards to the Major program in Neuroscience; there is strong alignment between the Stage 1 and 2 requirements of the Specialist program and the Major program in Neuroscience to make it easier for students to transfer between them. In this way, students who move to the Major from the Specialist will not encounter any barriers, and will not increase their time to graduation.

5 Consultation

This proposal was approved by the Psychology Curriculum Committee on **12/Jun/2019**, and in a full faculty meeting on **27/Jun/2019**.

We met and consulted with the Department of Biological Sciences on **06/Jun/2019**, **14/Jun/2019**, and **20/Jun/2019**. This proposal, as well as changes to all associated NRO courses, was approved by the Department of Biological Sciences on **03/Jul/2019**. See attached email for correspondence.

We obtained final approval to use CSCA08, CSCA20, CSCA48, and MATA23 from the Department of Mathematical and Computer Sciences on **17/Jun/2019**. See attached email for correspondence.

We consulted with the Co-op Office regarding this proposal on **24/May/2019** and **30/May/2019**. This work helped us ensure that our proposed changes work well with preparing students for work term from both pedagogical and logistical perspectives.

We consulted with the Office of the Registrar regarding this proposal on **07/May/2019** and **04/Jun/2019.** These consultations, along with Annette Knott, helped us develop the Stage framework for admissions to work with the stream-based model.

There has been ongoing consultation with students in the Department, especially in upper level courses; they are very supportive of the changes, and have expressed interest in the new streams.

6 Resources

There are resource implications associated with the launching of NROB61H3, including funds to support a CLTA, TA support, space renovations and supplies. The Department will cover the costs of supplies from their existing budgets. The Dean's Office has approved additional funding for the teaching and space needs.

The Department is prepared to absorb the added resource demands for including PSYB70 as a new program requirement. Prof. Kosha Bramesfeld, the instructor for PSYB70, has developed a high-quality, robust teaching model that includes a WebOption to meet this need.

We do not anticipate any further specific resource demands other than the neuroscience programs becoming more popular and thus having a higher enrolment over time. We will manage this opportunity through careful observation of program and course enrolment number, and will take the appropriate steps to ensure the sustainability of the program as these needs evolve.

7 UTSC Administrative Steps

Administrative Steps Required	**Date**
Departmental Curriculum Committee	June 12. 2019
Dean's Office Green Light	N/A
Campus Curriculum Committee	December 4, 2019

8 UTQAP/Formal Governance Process

Levels of Approval Required	**Date**
• **Decanal Sign-Off** • **Provost Office Sign-Off**	December 2, 2019 November 29, 2019
UTSC Academic Affairs Committee	January 15, 2020
Submission to Provost's Office	
AP&P – reported annually	
Ontario Quality Council – reported annually	

Appendix A: Current *Calendar* Copy

SPECIALIST PROGRAM IN NEUROSCIENCE (SCIENCE)

Enrolment Requirements

Enrolment in the Program is limited. Students may apply after completing a minimum of 4.0 credits including 1.0 credit in each of biology, chemistry and psychology. Admission will be based on the cumulative GPA, with 2.8 or higher guaranteeing admission to the Specialist Program. Students with lower CGPAs will be considered to the extent that laboratory spaces are available. The minimum CGPA used to admit these students will be determined in May (after the Winter session) and August (after the Summer session). Application for admission will be made to the Office of the Registrar through ACORN, in April/May and July/August.

Program Requirements

This program requires completion of 14.0 credits:

1. 4.0 credits as follows:
BIOA01H3 Life on Earth: Unifying Principles
BIOA02H3 Life on Earth: Form, Function and Interactions
CHMA10H3 Introductory Chemistry I: Structure and Bonding
CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms
[MATA30H3 Calculus I for Physical Sciences *or* MATA29H3 Calculus I for the Life Sciences]
[PHYA10H3 Physics I for the Physical Sciences *or* PHYA11H3 Physics I for the Life Sciences]
PSYA01H3 Introduction to Biological and Cognitive Psychology
PSYA02H3 Introduction to Clinical, Developmental, Personality and Social Psychology

2. 3.5 credits as follows:
BIOB10H3 Cell Biology
BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
CHMB41H3 Organic Chemistry I
CHMB42H3 Organic Chemistry II
NROB60H3 Neuroanatomy Laboratory
[PSYB55H3 Introduction to Cognitive Neuroscience or (PSYB65H3) Human Brain and Behaviour]
[STAB22H3 Statistics I or PSYB07H3 Data Analysis in Psychology]

3. 5.5 credits as follows:
BIOC12H3 Biochemistry I: Proteins & Enzymes
BIOC13H3 Biochemistry II: Bioenergetics & Metabolism
[(BIOC33H3) Human Physiology II: Lecture & Laboratory *or* BIOC34H3 Human Physiology II: Lecture]
NROC34H3 Neuroethology (Invertebrate Neurobiology)
NROC36H3 Molecular Neuroscience
NROC61H3 Learning and Motivation
[NROC60H3 Cellular Neuroscience Laboratory or NROC63H3 Neuroscience Laboratory]

NROC64H3 Sensorimotor Systems
NROC69H3 Synaptic Organization & Physiology of the Brain
PSYC08H3 Advanced Data Analysis in Psychology
PSYC62H3 Drugs & the Brain

4. 1.0 credit from the following:
BIOC14H3 Genes, Environment and Behaviour
BIOC32H3 Human Physiology I
BIOD19H3 Epigenetics in Health and Disease
BIOD27H3 Vertebrate Endocrinology
BIOD45H3 Animal Communication
BIOD65H3 Pathologies of the Nervous System
NROD08H3/BIOD08H3 Theoretical Neuroscience
NROD60H3 Current Topics in Neuroscience
NROD61H3 Emotional Learning Circuits
(NROD63H3) Advanced Neuroscience Laboratory
NROD66H3 Drug Addiction
NROD67H3 Psychobiology of Aging
PSYD17H3 Social Neuroscience
PSYD33H3 Current Topics in Clinical Psychology
PSYD66H3 Current Topics in Human Brain & Behaviour
Note: 0.5 credit of NROD98Y3, Thesis in Neuroscience, may also be counted towards the completion of component 4.

SPECIALIST (CO-OPERATIVE) PROGRAM IN NEUROSCIENCE (SCIENCE)

Co-op Contact: askcoop@utsc.utoronto.ca

The Specialist (Co-op) Program in Neuroscience is a Work Integrated Learning (WIL) program that combines academic studies with paid work terms in the public, private, and/or non-profit sectors. The program provides students with the opportunity to develop the academic and professional skills required to pursue employment in these areas, or to continue on to graduate training in an academic field related to Neuroscience upon graduation.
In addition to their academic course requirements, students must successfully complete the additive Arts & Science Co-op Work Term Preparation courses and a minimum of two Co-op work terms.

Enrolment Requirements
Enrolment in the program is limited. The minimum qualifications for entry are 4.0 credits, including BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, PSYA01H3 and PSYA02H3, plus a cumulative GPA of at least 2.75.

Current Co-op Students:
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits and must meet the minimum qualifications for entry as noted above.

Prospective Co-op Students:
In addition to requesting the program on ACORN, prospective Co-op students (i.e., those not yet admitted to a Co-op Degree POSt) must also submit a Co-op Supplementary Application Form, which is available from the Arts & Science Co-op Office website. Submission deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit both the Supplementary Application Form and the program request on ACORN will result in that student's application not being considered.

Completion Requirements
The program requires students to complete a total of 15.0 credits including the 14.0 credits as specified in the Specialist Program in Neuroscience, plus the following:

1. BIOB12H3 Cell and Molecular Biology Laboratory
2. BIOC23H3 Practical Approaches to Biochemistry

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 Neuroscience and have completed at least 10.0 credits including: BIOB10H3, BIOB11H3, BIOB12H3, CHMB41H3, CHMB42H3, NROB60H3, and [NROC61H3 or NROC64H3].
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*.

Appendix B: *Calendar* Copy [showing changes]

SPECIALIST PROGRAM IN NEUROSCIENCE (SCIENCE)

The Specialist program in Neuroscience is a research-intensive program designed to provide students with strong breadth in the major domains of neuroscience, as well as an opportunity to intensively focus on one of three major domains, hereafter referred to as "streams."

Students will choose one of the following three streams:

A. Systems/Behavioural: This stream examines the neural mechanisms underlying behaviour and how brain circuits work together to analyze external stimuli, internal biological states and past experiences in order to coordinate appropriate responses, predominantly through the use of *in vivo* approaches in behaving subjects (e.g., optogenetics, chemogenetics).
B. Cellular/Molecular: This stream explores the nervous system at its most fundamental level, investigating the influence of genes, signalling molecules, and cellular morphology on the development and maintenance of brain function, predominantly through the use of *in vitro* techniques (e.g., immunohistochemistry, patch clamp).
C. Cognitive: This stream focuses on understanding the neural basis of human cognition (e.g., language, memory, attention, decision-making) predominantly through the use of patient neuropsychology and neuroimaging techniques (e.g., magnetic resonance imaging (MRI), electroencephalography (EEG)).

Enrolment Requirements

Enrolment in the Program is limited, and takes place in two stages.

Stage 1:

Students may apply to stage 1 of the program after successfully completing a minimum of 4.0 credits, including the Scientific Foundations courses: BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, [MATA29H3 or MATA30H3], PSYA01H3, and PSYA02H3 ~~1.0 credit in each of biology, chemistry and psychology~~. Students must have a CGPA of 2.75 or higher to be admitted to the program. ~~Admission will be based on the cumulative GPA, with 2.8 or higher guaranteeing admission to the Specialist Program. Students with lower CGPAs will be considered to the extent that laboratory spaces are available. The minimum CGPA used to admit these students will be determined in May (after the Winter session) and August (after the Summer session).~~
Application for admission will be made to the Office of the Registrar through ACORN, in March/April ~~April/May~~ and June/July ~~July/August~~. For more information on applying to limited enrolment programs, please visit the Office of the Registrar website.

Stage 2:

To complete the program, students must choose one of the three available streams. Students who have successfully met the enrolment requirements of their chosen stream will be admitted to the

Specialist Neuroscience Stage 2 category. Applications for admission into a Stage 2 stream will be made to the Office of the Registrar through ACORN in March/April and June/July.

Before applying to their chosen stream, students must:

1. Complete a minimum of 10.0 credits including all Stage 1 Scientific Foundations course requirements as well as the Neuroscience Foundations courses which include BIOB10H3, NROB60H3, NROB61H3, [PSYB07H3 or STAB22H3], PSYB55H3, PSYB70H3;

2. Complete 1.0 credit in Stream Foundations courses from the following list:
   - BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
   - CSCA20H3 Introduction to Programming
   - CHMB41H3 Organic Chemistry I
   - CHMB42H3 Organic Chemistry II
   - MATA23H3 Linear Algebra
   - [PHYA11H3 Physics I for the Life Sciences *or* PHYA10H3 Physics I for the Physical Sciences]
   - PSYB51H3 Introduction to Perception
   - PSYC08H3 Advanced Data Analysis in Psychology
   - PSYC09H3 Applied Multiple Regression in Psychology

   Note: students are advised to exercise caution when selecting these courses since some can be applied to all streams (BIOB11H3, CHMB41H3, PSYB51H3, PSYC09H3), but others can be applied to only one or two streams);

3. Have achieved a CGPA of 2.5 or higher.

Students who do not meet the Stage 1 enrolment requirements can still apply to the Specialist program at Stage 2. This pathway requires students to complete a minimum of 10.0 credits, including all of the core courses of the program (Scientific Foundations, Neuroscience Foundations, and Stream Foundations). In addition to completing the course requirements, students must also have achieved a CGPA of 2.5 or higher across all courses, and a CGPA of 2.75 or higher across the Neuroscience Foundations and Stream Foundations courses. Application for admission into a Stage 2 stream will be made to the Office of the Registrar through ACORN in March/April and June/July. Admission through this route is dependent upon the availability of space in the program.

Program Requirements

This program requires students to complete 6.5 credits in core courses that are common to all streams. Students completing the Systems/Behavioural and Cellular/Molecular streams will complete a further 6.5 credits for a total of 13.0 credits; students completing the Cognitive stream will complete a further 7.0 credits for a total of 13.5 credits. ~~completion of 14.0 credits~~:

CORE (6.5 credits)

1. Scientific Foundations (~~4.0~~ 3.5 credits) ~~as follows~~:

BIOA01H3 Life on Earth: Unifying Principles
BIOA02H3 Life on Earth: Form, Function and Interactions
CHMA10H3 Introductory Chemistry I: Structure and Bonding
CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms
[MATA29H3 Calculus I for the Life Sciences *or* MATA30H3 Calculus I for Physical Sciences]
~~[PHYA10H3 Physics I for the Physical Sciences *or* PHYA11H3 Physics I for the Life Sciences]~~
PSYA01H3 Introduction to Biological and Cognitive Psychology
PSYA02H3 Introduction to Clinical, Developmental, Personality and Social Psychology

2. Neuroscience Foundations (~~3.5~~ 3.0 credits) ~~as follows~~:
BIOB10H3 Cell Biology
~~BIOB11H3 Molecular Aspects of Cellular and Genetic Processes~~
~~CHMB41H3 Organic Chemistry I~~
~~CHMB42H3 Organic Chemistry II~~
NROB60H3 Neuroanatomy Laboratory
NROB61H3 Neurophysiology
~~[~~PSYB55H3 Introduction to Cognitive Neuroscience ~~or (PSYB65H3) Human Brain and Behaviour]~~
[PSYB07H3 Data Analysis in Psychology *or* STAB22H3 Statistics I]
PSYB70H3 Methods in Psychological Science

A. Systems/Behavioural Stream (6.5 credits)

3. Quantitative Logic and Reasoning (1.0 credit)
PSYC08H3 Advanced Data Analysis in Psychology
and one of the following:
- CSCA20H3 Introduction to Programming
- [PHYA10H3 Physics I for the Physical Sciences *or* PHYA11H3 Physics I for the Life Sciences]

4. Advanced Foundations (2.0 credits)
BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
and three of the following:
- NROC36H3 Molecular Neuroscience
- NROC61H3 Learning and Motivation
- NROC64H3 Sensorimotor Systems
- NROC69H3 Synaptic Organization & Physiology of the Brain

5. Stream-specific electives (1.0 credit)
two of the following:
- BIOC14H3 Genes, Environment and Behaviour
- CHMB41H3 Organic Chemistry I
- CHMB42H3 Organic Chemistry II
- *NROC36H3 Molecular Neuroscience
- PSYC62H3 Drugs and the Brain

**only if not used to complete component A4*

6. Breadth in Neuroscience (1.0 credit)
two of the following:
- *CHMB41H3 Organic Chemistry I
- *NROC36H3 Molecular Neuroscience
- *NROC69H3 Synaptic Organization & Physiology of the Brain
- PSYB51H3 Introduction to Perception
- PSYC51H3 Cognitive Neuroscience of Vision
- PSYC52H3 Cognitive Neuroscience of Attention
- PSYC57H3 Cognitive Neuroscience of Decision Making
- PSYC59H3 Cognitive Neuroscience of Language
**only if not used to complete components A4 or A5*

7. Laboratory Course (0.5 credit)
one of the following:
- NROC63H3 Behavioural Neuroscience Laboratory
- NROC90H3 Supervised Study in Neuroscience
- NROC93H3 Supervised Study in Neuroscience
- PSYC74H3 Human Movement Laboratory

8. Capstone Courses (1.0 credit)
two of the following:
- BIOD07H3 Advanced Topics and Methods in Neural Circuit Analysis
- BIOD19H3 Epigenetics in Health and Disease
- BIOD45H3 Animal Communication
- BIOD65H3 Pathologies of the Nervous System
- NROD08H3/BIOD08H3 Theoretical Neuroscience
- NROD60H3 Current Topics in Neuroscience
- NROD61H3 Emotional Learning Circuits
- NROD66H3 Drug Addiction
- NROD67H3 Neuroscience of Aging
- NROD98Y3 Thesis in Neuroscience
- PSYD66H3 Current Topics in Human Brain & Behaviour

B. Cellular/Molecular Stream (6.5 credits)

3. Quantitative Logic and Reasoning (1.0 credit)
PSYC08H3 Advanced Data Analysis in Psychology
and one of the following:
- CSCA20H3 Introduction to Programming
- [PHYA10H3 Physics I for the Physical Sciences *or* PHYA11H3 Physics I for the Life Sciences]

4. Advanced Foundations (2.0 credits)
BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
CHMB41H3 Organic Chemistry I

NROC36H3 Molecular Neuroscience
NROC69H3 Synaptic Organization & Physiology of the Brain

5. Stream-specific Electives (1.0 credit)
two of the following:
- BIOC12H3 Biochemistry I: Proteins & Enzymes
- BIOC13H3 Biochemistry II: Bioenergetics & Metabolism
- BIOC14H3 Genes, Environment and Behaviour
- CHMB42H3 Organic Chemistry II
- NROC34H3 Neuroethology
- NROC61H3 Learning and Motivation
- NROC64H3 Sensorimotor Systems
- PSYC62H3 Drugs and the Brain

6. Breadth in Neuroscience (1.0 credit)
two of the following:
- NROC34H3 Neuroethology*
- NROC61H3 Learning and Motivation*
- NROC64H3 Sensorimotor Systems*
- PSYB51H3 Introduction to Perception
- PSYC51H3 Cognitive Neuroscience of Vision
- PSYC52H3 Cognitive Neuroscience of Attention
- PSYC57H3 Cognitive Neuroscience of Decision Making
- PSYC59H3 Cognitive Neuroscience of Language
**only if not used to complete component B5 of the requirements*

7. Laboratory Course (0.5 credit)
one of the following:
- BIOB12H3 Cell and Molecular Biology Laboratory
- NROC60H3 Cellular Neuroscience Laboratory
- NROC90H3 Supervised Study in Neuroscience
- NROC93H3 Supervised Study in Neuroscience

8. Capstone Courses (1.0 credit)
two of the following:
- BIOD07H3 Advanced Topics and Methods in Neural Circuit Analysis
- BIOD19H3 Epigenetics in Health and Disease
- BIOD65H3 Pathologies of the Nervous System
- NROD08H3/BIOD08H3 Theoretical Neuroscience
- NROD60H3 Current Topics in Neuroscience
- NROD61H3 Emotional Learning Circuits
- NROD66H3 Drug Addiction
- NROD67H3 Neuroscience of Aging
- NROD98Y3 Thesis in Neuroscience
- PSYD66H3 Current Topics in Human Brain & Behaviour

C. Cognitive Stream (7.0 credits)

3. Quantitative and Methodological Skills (1.5 credits)
PSYC02H3 Scientific Communication in Psychology
PSYC70H3 Advanced Research Methods Laboratory
[PSYC08H3 Advanced Data Analysis in Psychology or PSYC09H3 Applied Multiple Regression in Psychology]

4. Advanced Programming (1.5 credits)
MATA23H3 Linear Algebra
*[[CSCA08H3 Introduction to Computer Science I and CSCA48H3 Introduction to Computer Science II] *or* [PSYB03H3 Introduction to Computers in Psychological Research and PSYC03H3 Introduction to Computers in Psychological Research: Advanced Topics]]
*Note: students are strongly advised to choose the [PSYB03H3 and PSYC03H3] pairing.

5. Advanced Foundations (1.5 credits)
PSYB51H3 Introduction to Perception
and two of the following:
- PSYC51H3 Cognitive Neuroscience of Vision
- PSYC52H3 Cognitive Neuroscience of Attention
- PSYC57H3 Cognitive Neuroscience of Decision Making
- PSYC59H3 Cognitive Neuroscience of Language

6. Breadth in Neuroscience (1.0 credit)
two of the following (at least 0.5 credit must be a C-level NRO course):
- BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
- CHMB41H3 Organic Chemistry I
- NROC34H3 Neuroethology
- NROC36H3 Molecular Neuroscience
- NROC61H3 Learning and Motivation
- NROC64H3 Sensorimotor Systems
- NROC69H3 Synaptic Organization & Physiology of the Brain

7. Laboratory Course (0.5 credit)
one of the following:
- PSYC75H3 Cognitive Psychology Laboratory
- PSYC76H3 Brain Imaging Laboratory
- NROC90H3 Supervised Study in Neuroscience
- NROC93H3 Supervised Study in Neuroscience

8. Capstone Courses (1.0 credit)
two of the following:
- PSYD17H3 Social Neuroscience
- PSYD50H3 Current Topics in Memory and Cognition
- PSYD51H3 Current Topics in Perception
- PSYD54H3 Current Topics in Visual Recognition

- PSYD55H3 Functional Magnetic Resonance Imaging Laboratory
- PSYD66H3 Current Topics in Human Brain & Behaviour
- NROD98Y3 Thesis in Neuroscience

~~**3. 5.5 credits as follows:**~~
~~BIOC12H3 Biochemistry I: Proteins & Enzymes~~
~~BIOC13H3 Biochemistry II: Bioenergetics & Metabolism~~
~~[(BIOC33H3) Human Physiology II: Lecture & Laboratory *or* BIOC34H3 Human Physiology II: Lecture]~~
~~NROC34H3 Neuroethology (Invertebrate Neurobiology)~~
~~NROC36H3 Molecular Neuroscience~~
~~NROC61H3 Learning and Motivation~~
~~[NROC60H3 Cellular Neuroscience Laboratory or NROC63H3 Neuroscience Laboratory]~~
~~NROC64H3 Sensorimotor Systems~~
~~NROC69H3 Synaptic Organization & Physiology of the Brain~~
~~PSYC08H3 Advanced Data Analysis in Psychology~~
~~PSYC62H3 Drugs & the Brain~~

~~**4. 1.0 credit from the following:**~~
~~BIOC14H3 Genes, Environment and Behaviour~~
~~BIOC32H3 Human Physiology I~~
~~BIOD19H3 Epigenetics in Health and Disease~~
~~BIOD27H3 Vertebrate Endocrinology~~
~~BIOD45H3 Animal Communication~~
~~BIOD65H3 Pathologies of the Nervous System~~
~~NROD08H3/BIOD08H3 Theoretical Neuroscience~~
~~NROD60H3 Current Topics in Neuroscience~~
~~NROD61H3 Emotional Learning Circuits~~
~~(NROD63H3) Advanced Neuroscience Laboratory~~
~~NROD66H3 Drug Addiction~~
~~NROD67H3 Psychobiology of Aging~~
~~PSYD17H3 Social Neuroscience~~
~~PSYD33H3 Current Topics in Clinical Psychology~~
~~PSYD66H3 Current Topics in Human Brain & Behaviour~~

~~**Note:** 0.5 credit of NROD98Y3, Thesis in Neuroscience, may also be counted towards the completion of component 4.~~

SPECIALIST (CO-OPERATIVE) PROGRAM IN NEUROSCIENCE (SCIENCE)
Co-op Contact: askcoop@utsc.utoronto.ca

The Specialist (Co-Op) program in Neuroscience is a research-intensive program designed to provide students with strong breadth in the major domains of neuroscience, as well as an opportunity to intensively focus on one of three major domains, hereafter referred to as "streams."

This is a Work Integrated Learning (WIL) program that combines academic studies with paid work terms in the public, private, and/or non-profit sectors. The program provides students with the opportunity to develop the academic and professional skills required to pursue employment in these areas, or to continue on to graduate training in an academic field related to Neuroscience upon graduation.

In addition to their academic course requirements, students must successfully complete the additive Arts & Science Co-op Work Term Preparation courses and two 4 month Co-op work terms (or one 8 month work term).

Students will choose one of the following three streams:

A. Systems/Behavioural: This stream examines the neural mechanisms underlying behaviour and how brain circuits work together to analyze external stimuli, internal biological states and past experiences in order to coordinate appropriate responses, predominantly through the use of *in vivo* approaches in behaving subjects (e.g., optogenetics, chemogenetics).
B. Cellular/Molecular: This stream explores the nervous system at its most fundamental level, investigating the influence of genes, signalling molecules, and cellular morphology on the development and maintenance of brain function, predominantly through the use of *in vitro* techniques (e.g., immunohistochemistry, patch clamp).
C. Cognitive: This stream focuses on understanding the neural basis of human cognition (e.g., language, memory, attention, decision-making) predominantly through the use of patient neuropsychology and neuroimaging techniques (e.g., magnetic resonance imaging (MRI), electroencephalography (EEG)).

Enrolment Requirements

Current Co-op Students:
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits and must meet the minimum qualifications for entry as noted above.

Prospective Co-op Students:
In addition to requesting the program on ACORN, prospective Co-op students (i.e., those not yet admitted to a Co-op Degree POSt) must also submit a Co-op Supplementary Application Form, which is available from the Arts & Science Co-op Office website. Submission deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each

year. Failure to submit both the Supplementary Application Form and the program request on ACORN will result in that student's application not being considered.
Enrolment in the Program is limited, and takes place in two stages.

Stage 1:

Students may apply to stage 1 of the program after successfully completing a minimum of 4.0 credits, ~~The minimum qualifications for entry are 4.0 credits~~, including the Scientific Foundations courses: BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, [MATA29H3 or MATA30H3], PSYA01H3 and PSYA02H3. Students must have a CGPA of 2.75 or higher to be admitted to the program~~. , plus a cumulative GPA of at least 2.75.~~ Application for admission will be made to the Office of the Registrar through ACORN, in March/April and June/July. For more information on applying to limited enrolment programs, please visit the Office of the Registrar website.

Stage 2:

To complete the program, students must choose one of the three available streams. Students who have successfully met the enrolment requirements of their chosen stream will be admitted to the Specialist Neuroscience Stage 2 category. Applications for admission into a Stage 2 stream will be made to the Office of the Registrar through ACORN in March/April and June/July. Before applying to their chosen stream, students must:

4. Complete a minimum of 10.0 credits including all Stage 1 Scientific Foundations course requirements as well as the Neuroscience Foundations courses which include BIOB10H3, NROB60H3, NROB61H3, [PSYB07H3 or STAB22H3), PSYB55H3, PSYB70H3;
5. Complete 1.0 credit in Stream Foundations courses from the following list:
   - BIOB11H3 Molecular Aspects of Cellular and Genetic Processes
   - CSCA20H3 Introduction to Programming
   - CHMB41H3 Organic Chemistry I
   - CHMB42H3 Organic Chemistry II
   - MATA23H3 Linear Algebra
   - [PHYA11H3 Physics I for the Life Sciences *or* PHYA10H3 Physics I for the Physical Sciences]
   - PSYB51H3 Introduction to Perception
   - PSYC08H3 Advanced Data Analysis in Psychology
   - PSYC09H3 Applied Multiple Regression in Psychology

   Note: students are advised to exercise caution when selecting these courses since some can be applied to all streams (BIOB11H3, CHMB41H3, PSYB51H3, PSYC09H3), but others can be applied to only one of two streams;
6. Have achieved a CGPA of 2.5 or higher.

~~*Current Co-op Students:*~~
~~Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits and must meet the minimum qualifications for entry as noted above.~~

~~*Prospective Co-op Students:*~~

~~In addition to requesting the program on ACORN, prospective Co-op students (i.e., those not yet admitted to a Co-op Degree POSt) must also submit a Co-op Supplementary Application Form, which is available from the Arts & Science Co-op Office website. Submission deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit both the Supplementary Application Form and the program request on ACORN will result in that student's application not being considered.~~

Completion Requirements

The program requires students to complete all of the course requirements of ~~a total of 15.0 credits including the 14.0 credits as specified in~~ the Specialist Program in Neuroscience, including the requirements of one of three streams. In addition:

- Co-op students in the Systems/Behavioural and Cellular/Molecular streams must also complete BIOB12H3 Cell and Molecular Biology Laboratory.
- Co-op students in the Cellular/Molecular stream cannot use BIOB12H3 to satisfy the 0.5 credit in Laboratory Courses (see component 7); instead, students must complete one of NROC60H3, NROC90H3 or NROC93H3.

~~plus the following:~~
~~1. BIOB12H3 Cell and Molecular Biology Laboratory~~
~~2. BIOC23H3 Practical Approaches to Biochemistry~~

Co-op Work Term Requirements

Students must satisfactorily complete a total of eight months in Co-op work terms, which may occur as a single eight-month placement, or 2 four-month placements. ~~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 Neuroscience;
- ~~and~~ have successfully completed ~~at least~~ 10.0 credits, including: BIOB10H3, ~~BIOB11H3,~~ ~~BIOB12H3, CHMB41H3, CHMB42H3,~~ NROB60H3, NROB61H3, [PSYB07H3 or STAB22H3], PSYB55H3, PSYB70H3, and the following additional courses:
  - in the Systems/Behavioural and Cellular/Molecular streams: BIOB11H3, BIOB12H3, CHMB41H3 (NOTE: CHMB42H3 is recommended but not required)
  - in the Cognitive stream: PSYC02H3, PSYC70H3, and [PSYC08H3 or PSYC09H3];
- ~~and [NROC61H3 or NROC64H3].~~
- have achieved a CGPA of 2.5 or higher.

Students are cautioned that thoughtful course planning is a must to ensure they remain on track to go out on work-term in a timely fashion; students are encouraged to use the course planning resources available through the Arts & Science Co-op Office.

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*.

Appendix C: New Learning Outcomes, and Degree Level Expectations

PROGRAM LEARNING OUTCOME (PLOS)
Upon successful completion of the program, students will demonstrate proficiency in the following domains:

S/B	C/M	COG	Co-op		Learning Outcomes
				1	**Fundamental knowledge from the core domains of math and the sciences that provide a critical foundation for the heavily interdisciplinary field of Neuroscience.**
√	√	√	√	1.1	Develop an understanding of the core principles of cellular organization, metabolic processes, and the relationship between form and function in plants and animals.
√	√	√	√	1.2	Explore chemical transformations, reactions and equilibria that take place in chemical systems, with an emphasis on the molecular structure and forces at play.
√	√	√	√	1.3	Examine the link between fundamental cognitive processes and behaviour, and how this link is affected by development, sociocultural influences, and psychological well-being
√	√	√	√	1.4	Develop insight into the concepts of differentiation and integration, and how these concepts can be applied to problem-solving and real-world applications.
				2	**Knowledge within the major subdisciplines of Neuroscience and an ability to appreciate the complementary nature of these approaches**
√	√	√	√	2.1	Identify foundational inquiries in Neuroscience motivated by both scientific curiosity and real-world challenges (i.e., neurological dysfunction)
√	√	√	√	2.2	Understand that the brain can be studied at different levels of organization (e.g., behavioural, cellular, cognitive, molecular, systems) and be able to articulate the theoretical approach of each of these subdisciplines
√√	√√	√√	√√	2.3	Understand both classic and cutting-edge theory and research in Neuroscience, and evaluate these ideas from the perspective of multiple subdisciplines
√√	√√	√√	√√	2.4	Analyze the complementary contributions from the subdisciplines in Neuroscience to synthesize a more comprehensive understanding of neurological functioning
				3	**Understanding, recognizing, and implementing a variety of methodological approaches in neuroscience research**
√	√	√	√	3.1	Understand the application of the scientific method to research questions in Neuroscience, and the fact that neuroscience knowledge is constantly evolving
√√	√√	√√	√√	3.2	Understand a range of research designs (e.g., experimental) that are appropriate for different research questions of interest
√√	√√	√√	√√	3.3	Understand a range of neuroscientific research tools and techniques, along with their strengths, limitations and ethical considerations

S/B	C/M	COG	Co-op		Learning Outcomes
√√	√√	√√	√√	3.4	Recognize when a particular research design, tool, and/or technique is being used and evaluate its appropriateness given the research question
√√	√√	√√	√√	3.5	Apply methodological knowledge to create thoughtful, rigorous, and ethical ways to test novel hypotheses
				4	**Understanding and applying statistical knowledge to evaluate data, generate plausible interpretations, and plan future analyses**
√√	√√	√√	√√	4.1	Articulate why statistical competency is necessary for analyzing and interpreting neuroscientific data
√√	√√	√√	√√	4.2	Understand data presented in various formats and identify statistically significant patterns
√√	√√	√√	√√	4.3	Analyze and interpret data patterns in the context of research questions
√√	√√	√√	√√	4.4	Translate analyzed data into an appropriate medium for consumption (e.g., graphical, tabular)
√√	√√	√√	√√	4.5	Recognize when a particular statistical approach is being used and evaluate its appropriateness given the research question
√	√	√	√	4.6	Apply statistical knowledge *a priori* to create thoughtful and rigorous ways to test novel hypotheses
				5	**Fundamental skills with computer programming to strengthen logical thinking and problem-solving, and the ability to create experimental paradigms and to process data**
(opt)	(opt)	√√	√	5.1	Develop the ability to conceptualize problems and concretize the steps necessary to solve them (i.e., procedural abstraction) in a programming context
(opt)	(opt)	√√	√	5.2	Strengthen problem-solving and trouble-shooting skills in a programming context
		√√		5.3	Understand how to conceptualize, handle, and manipulate data structures
		√√		5.4	Apply programming skills to prepare stimuli, implement experimental protocols, and/or process and analyze data
				6	**Navigating, consuming, and [when appropriate] producing primary literature in neuroscience**
√	√	√	√	6.1	Develop effective strategies for consuming primary literature in neuroscience
√	√	√	√	6.2	Understand how to locate primary resources, to critically evaluate its pertinence to your information goals, and to properly reference resources
√√	√√	√√	√√	6.3	Produce informed critiques of primary research and offer thoughtful ways to address key limitations
√√	√√	√√	√√	6.4	Synthesize a body of literature to better assess the current understanding and limitations of knowledge related to neuroscience
(opt)	(opt)	(opt)	(opt)	6.5	Under the supervision of a faculty member, carry out a laboratory-based research project requiring data analysis and produce a written report of the project and findings
(opt)	(opt)	(opt)	(opt)	6.6	Under the supervision of a faculty member, create and carry out all aspects of an intensive independent laboratory-based research

S/B	C/M	COG	Co-op		Learning Outcomes
					project that culminates in the production of a written thesis and oral presentation
				7	**Understanding and applying a robust set of strategies for effective communication in a variety of contexts**
√√	√√	√√	√√	7.1	Develop effective strategies for working with colleagues in various settings (e.g., peer feedback, group work, debate)
√√	√√	√√	√√	7.2	Recognize the importance of effectively translating scientific discourse, and strengthen the ability to flexibly adapt your approach depending on audience and platform
√√	√√	√√	√√	7.3	Create and effectively support logical, evidence-based arguments
√√	√√	√√	√√	7.4	Develop and implement effective strategies for written work (e.g., scope, planning, style)
√√	√√	√√	√√	7.5	Develop and implement effective strategies for oral presentations (e.g., scope, planning, style)
				8	**Translating their knowledge and skills to successfully transition to post-undergraduate pursuits**
√√	√√	√√	√√	8.1	Critically evaluate scientific and non-scientific information as to be a better consumer of information presented in a variety of outlets (e.g., media)
√	√	√	√	8.2	Identify how your program of study has affected your personal strengths and weaknesses to set the stage for continued growth as a lifelong learner
√	√	√	√√	8.3	Foster the development of autonomy to support students as they identify, evaluate, pursue, and making the most of outside the classroom experiences (e.g., research position, work placement) to bolster their knowledge and skillset

Please note:
"√" indicates that the program learning outcome is addressed in this particular program of study
"√√" indicates that the program learning outcome is addressed *more substantially* in this program of study
"opt" indicates that this sub-goal is optional, as it depends on a student's choice of courses

Degree Level Expectations	Clearly describe the new Program Learning Outcomes. • Program Learning Outcomes describe what students will know or be able to do at the completion of the program. • Program Learning Outcomes should support the Degree Level Expectations.	Clearly describe how the revised program design/structure will support the program learning outcomes.
1. Depth and Breadth of Knowledge Depth of Knowledge: is attained through a progression of introductory, core and specialized courses. Specialized courses will normally be at the C and D levels. Breadth of Knowledge: students will gain an appreciation of the variety of modes of thinking, methods of inquiry and analysis, and ways of understanding the world that underpin different intellectual fields.	Depth and breadth of knowledge is understood in the Specialist/Specialist (Co-op) in Neuroscience as: Fundamental knowledge from the core domains of math and the sciences that provide a critical foundation for the heavily interdisciplinary field of Neuroscience. **(LO #01)** Knowledge within the major subdisciplines of Neuroscience and an ability to appreciate the complementary nature of these approaches **(LO #02)**	The development of a common core across the three new streams addresses both LOs 1-2: Students are required to take all of the following courses to satisfy their "Scientific Foundations:" BIOA01, BIOA02, CHMA10, CHMA11, PSYA01, PSYA02, and [MATA30 or MATA29] **(LO #01)**, and all of the following courses to satisfy their "Neuroscience Foundations:" BIOB10, NROB60, NROB61, PSYB55, [PSYB07 or STAB22], and PSYB70 These course selections ensure proper core foundations in biology, chemistry, mathematics, neuroscience, and psychology. **(loads onto LO #01)** Further courses exist in each respective stream that build on these important foundations. Students will gain specialized, stream-focused knowledge in their "Advanced Foundations," "Stream-Specific Electives," "Laboratory," and "Capstone" courses, and will strengthen their breadth in neuroscience with their "Breadth in Neuroscience" courses. The courses loading on these categories vary as a function of stream. **(loads onto LO #02)**
2. Knowledge of Methodologies Students have a working knowledge of different methodologies and approaches relevant to their area of study. They are able to evaluate the efficacy of different methodologies in addressing questions that arise in their area of study.	Understanding, recognizing, and implementing a variety of methodological approaches in neuroscience research **(LO #03)**	The package of courses targeted for the second year of study ("Neuroscience Foundations") introduce core methodologies pertinent for neuroscience (e.g., NROB60, NROB61, PSYB55, PSYB70). These courses are built on substantially in each respective stream through the "Advanced Foundations," "Stream-Specific Electives," "Laboratory," "Breadth in Neuroscience," and "Capstone" courses. **(loads onto LO #03)**
3. Application of Knowledge Students are able to frame relevant questions for further inquiry. They are familiar with, or will be able to seek the tools with	Navigating, consuming, and [when appropriate] producing primary literature in neuroscience **(LO #06)** Fundamental skills with computer programming to	**LO #06** scaffolds the ability to locate, consume, and produce research in neuroscience. Through a strengthened knowledge of methodologies in the abovementioned courses **(see DLE #2 and LO #03)**, students will receive training to prepare them to propose their own research

which, they can address such questions effectively.	strengthen logical thinking and problem-solving, and the ability to create experimental paradigms and to process data **(LO #05)**	questions, which may culminate in a Directed Research project or Thesis. Unique to the Cognitive Stream, students will take linear algebra (MATA23) and two programming courses ([PSYB03 and PSYC03] or [CSCA08 and CSCA48]) to develop foundational computer programming skills which will empower them to learn how to program cognitive experiments, as well as to structure, manipulate and analyze neurocognitive data. **(loads onto LO #05)**
4. Awareness of Limits of Knowledge Students gain an understanding of the limits of their own knowledge and an appreciation of the uncertainty, ambiguity, and limits to our collective knowledge and how these might influence analyses and interpretations.	Understanding and applying statistical knowledge to evaluate data, generate plausible interpretations, and plan future analyses **(LO #04)**	**LO #04** is anchored in helping our students to develop strong quantitative literacy (i.e., understanding data patterns, generating appropriate conclusions from such data informed by appropriate statistical analyses). Both introductory (PSYB07 or STAB22) and advanced statistics (i.e., PSYC08 across the three streams and PSYC09 unique to the Cognitive stream) provide this critical statistical foundation which is intended to empower more critical consumption of neuroscience research at the B-, C-, and D-levels of study.
5. Communication Skills Students are able to communicate information, arguments, and analyses accurately and reliably, both orally and in writing. They learn to read and to listen critically.	Navigating, consuming, and [when appropriate] producing primary literature in neuroscience **(LO #06)** Understanding and applying a robust set of strategies for effective communication in a variety of contexts **(LO #07)**	**LO #06** is intended to position students to successfully consume primary literature in neuroscience, and is built in the manner detailed above in **DLE #3**. **LO #07** is concerned with students developing useful strategies for both written and oral communication. The foundations of this work start in earnest at the B-level with the "Neuroscience Foundations" courses (e.g., PSYB55), which are designed to load significantly on the ability to recognize, critique, and then produce thoughtful, evidence-based arguments. This work is an intense focus of many of the C-level courses (especially NRO C-level courses), where writing and verbal communication demands increase, and this focus continues further in "Capstone Courses."
6. Autonomy and Professional Capacity The education students receive achieves the following broad goals: • It gives students the skills and knowledge they need to become informed, independent and creative thinkers • It instils the awareness that	Translating their knowledge and skills to successfully transition to post-undergraduate pursuits **(LO #08)**	**LO #8** is focused on (1) students becoming more thoughtful, critical (not cynical) consumers of information in their world (e.g., news outlets), (2) metacognitive reflection of one's own abilities, and (3) and encouraging students to develop autonomy in searching, identifying, and pursuing curricular and extracurricular activities pertinent to their future objectives. With respect to (1), DLEs 2-5 play a fundamental role in helping students strengthen their ability to analyze and evaluate information and are developed throughout the program.

knowledge and its applications are influenced by, and contribute to, society • It lays the foundation for learning as a life-long endeavour		With respect to (2), providing students with regular, robust feedback on the quality of their work, as well as clear guidance on how to continue improving their work, is a focus of all courses involved in this program. As the nature of assessment evolves as one advances through the curriculum (i.e., relative more reliance on something like multiple choice in Year 1, and more reliance on writing assignments and presentations in Years 3+), the nature of this feedback matures as they advance through courses. With respect to (3), we aim to systematically incorporate more about pertinent volunteer and future career opportunities in our courses beyond the "obvious" options (i.e., someone who likes cognitive neuroscience could become a cognitive neuroscientist). In an effort to broaden student perceptions of job prospects, we intend to start this in earnest in Year 2 with our "trio" of neuroscience courses (NROB60, NROB61, PSYB55) and will further build upon this in more advanced courses wherever possible.