Interdisciplinary Neuroscience New Program Proposal
BSc Specialized Honours Degree in Neuroscience
Faculty of Science & Health
York University

April 2019

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New Undergraduate and Graduate Degree Program
New Program Brief Template

The development of new undergraduate and graduate degree programs follows the protocol for new degree approvals as outlined in the York University Quality Assurance Process and also complies with the Quality Council's Quality Assurance Framework.

The Program Brief for new degree programs that require full approval includes two components for undergraduate programs and three components for graduate programs, as follows:

- program proposal, including letters of consultation/support and other relevant appendices
- curricula vitae of the faculty, including program-specific appointment criteria (for new graduate programs only)
- external reviewer nominations

To ensure that all of the evaluation criteria are addressed in the proposal under development, program proponents are required to submit the New Program Brief in the following format.

York University

New Program Brief

of the
BSc Specialized Honours degree
in

Neuroscience

Updated March 2019

1. Introduction

This document proposes the establishment of a BSc Specialized Honours program in Neuroscience. Neuroscience is a well-established field at the intersection of Biology, Psychology, and Health Science. Because of its interdisciplinary nature, a specialized honours program is appropriate and consistent with other interdisciplinary programs such as Biochemistry, Biophysics, and Global Health at York University.

2. Governance

Many details of the administration of the program are beyond the scope of this proposal, hence what we provide in Appendix A is a broad overview of a proposed governance model and some guiding principles for implementing the proposed neuroscience program. This model has been developed from best practices based on feedback from Vice-Provost Academic, and the shared council model such as used with the Digital Media program, and the Global Health program. Please refer to Appendix A for details.

3. General Objectives of the Program

Neuroscience involves the study of the nervous system, including: how it develops; how it is structured; how it works; how it malfunctions; and how it can be changed. More precisely, neuroscience is the interdisciplinary study of the nervous system, integrating and synthesising research on molecular and cellular mechanisms in nerve cells and on the relationship among the elements of neural systems, to the study of the behaviour of the whole organism. For example, central nervous system diseases related to aging and the incidence of mental health issues are two key contemporary concerns with significant global socioeconomic impact. The growing importance of better understanding the brain and its impact on behaviour and health is recognized by large amounts of research funding devoted to neuroscience in Europe, the USA, Canada, and many other countries.

The aim of the program is to not only provide students with a sound understanding of neuroscience, but also as an undergraduate path into graduate studies or to neuroscience related careers in academia, hospitals, or industry. As such, and as outlined in this proposal, this program is aimed at high-achieving students. Students will graduate with a broad and advanced understanding of cellular and molecular, cognitive and behavioural, and systems neuroscience. Given their breadth and depth of knowledge and skills, graduates will be prepared for employment opportunities in life sciences professions and industry that are afforded by the rapid expansion of clinical, technological, and entrepreneurial endeavours in neuroscience.

Growing the University's profile in the broad fields of science and health have been key elements of York's Academic Plan. Providing quality programs is also a key objective. Further, this new program aims to increase enrollments in the Faculties of Science and Health. Neuroscience is envisaged to be a competitive program of interest for top students, creating a reputational spin-off that will help the Faculties meet White Paper objectives of increasing undergraduate student quality. Such a program will encourage more high-achieving students to consider York as their institution of choice. Such top students are also more likely to consider graduate studies and hence we expect the program to contribute to research intensification at York, another key objective of University and Faculty missions.

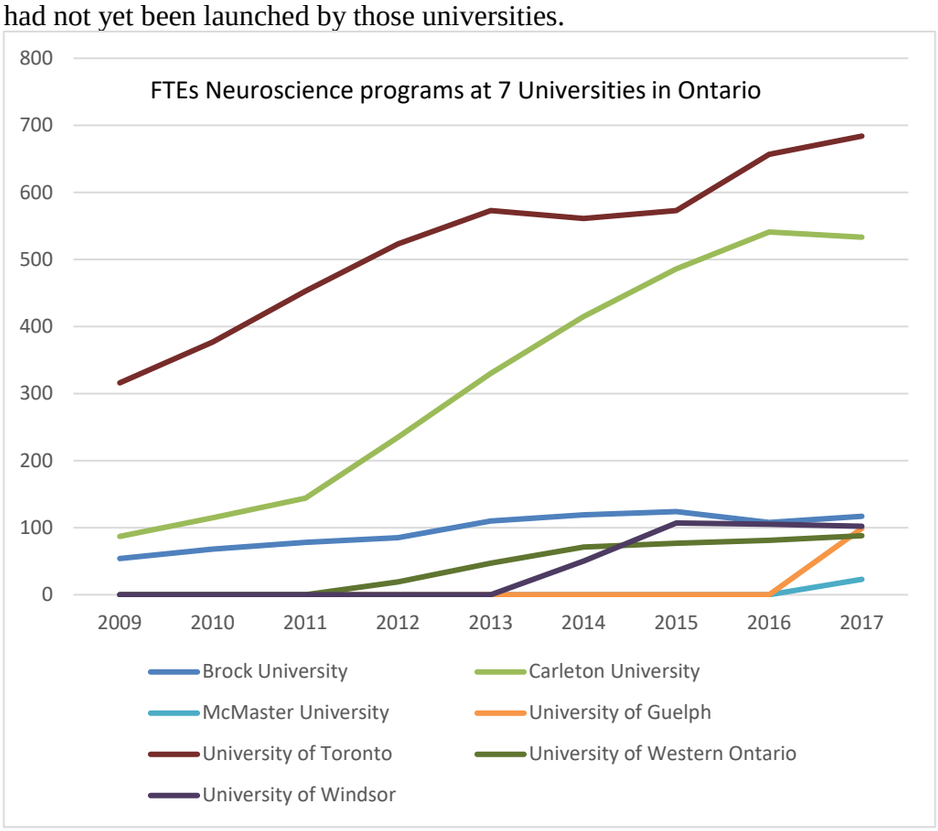
4. Need and Demand

We need a BSc. Specialized Honours program in Neuroscience at York University on the Keele campus as there are no other science-focused neuroscience programs. There is a Cognitive Neuropsychology stream offered by Glendon College by their Psychology program (see http://www.glendon.yorku.ca/psychology/cognitive-neuropsychology/). This stream requires the equivalent of 2.5 full courses, involves an applied research practicum, is bilingual, and is clinically focused on cognitive aging complementing their BSc/BA degrees. The proposed Neuroscience BSc program is different from the Cognitive Neuropsychology program offered by Glendon in that the proposed Neuroscience BSc will expose students to a depth and breadth of topics from molecular to whole systems. We also note that there is a Cognitive Science BA program offered by the Faculty of Liberal Arts and Professional Studies, primarily through the Department of Philosophy, with participation of the Faculty of Health. This cross disciplinary program studies the mind and the nature of its processes such as thinking, reasoning, language/linguistics, and memory. Although there are some topics in common (such as memory), there are many different topics (e.g., philosophy). The proposed Neuroscience BSc program is different from the Cognitive Science BA program because it is more focused on educating students about the scientific study of the structure and function of the nervous system and the brain.

The proposed Neuroscience program is unique in that it: (1) is interdisciplinary between Science and Health, providing students with a training environment that teaches them to integrate multiple disciplines through the different courses that make up the streams, and (2) incorporates a strong applied research component with laboratory experience and with an individualized or team-based capstone experience that engages students in research in a traditional lab, industry, or clinical settings. The proposed Neuroscience program will position York University as a provider of a distinctive research-intensive program.

Considering the Greater Toronto Area (GTA), there is no comparable program at Ryerson or UOIT. Neuroscience programs are offered at all three University of Toronto campuses. At St. George, the program is a collaboration between the Faculty of Medicine and the Faculty of Arts and Science. The St. George program is heavily based in molecular and cellular biology. One strength of the program we propose is that it is explicitly interdisciplinary, covering molecular and cellular physiology, behaviour and cognition, and systems neuroscience. This distinguishes it significantly from the St. George program. Additionally, the proposed Neuroscience program is to be offered at Keele Campus located in north Toronto adjacent to a major growth area in York Region. Keele Campus is not in close geographic proximity to any currently offered science programs in Neuroscience.

Across Ontario, there is also a demand for neuroscience education. Neuroscience has entered the imagination of aspiring young scientists at least as it pertains to the challenge of understanding the brain and manifold brain-related disorders and dysfunctions. A sign of demand is represented by the following figure showing an increase in enrollments over an interval of time between 2009 and 2017 (as reflected by Full-Time equivalents (FTEs)) across 7 universities that offer neuroscience programs in Ontario (data provided by York University's Office of Institutional Planning and Analysis, Dec 2018). Note an FTE of zero means that we have no data for those earlier years and assume the program had not yet been launched by those universities.



Many opportunities for funding that targets neuroscience indicate the level of societal need, and potential opportunities for meaningful careers. Societal need for the neuroscience program is a critical factor for our proposed Neuroscience program. According to the Canadian Brain Research Strategy, understanding the brain is one of the greatest and most urgent scientific challenges we are facing. One in three Canadians will be affected by a brain or nervous system disorder. Currently, $61 billion is spent annually on neurological and mental health disorders in Canada (Canadian Brain Research Strategy). In turn, the Government of Canada sees Neuroscience as a transformative area and has made an investment of $100 million in federal funding to match private donations to support Canadian brain research. In the same way, Canada is among the countries with the greatest impact in neuroscience research (Canadian Brain Research Strategy: https://www.canadianbrain.ca/).

An indicator of both need and demand is that there are a variety of careers available for graduates of neuroscience programs. Many of the students enrolled in an undergraduate program in neuroscience will continue on to postgraduate education (especially medical school and graduate school). For students who do not wish to continue on to advanced degrees, they will be advised to seek additional opportunities (e.g., volunteer, research, internships, part-time jobs) and to build their network to

strategically position themselves for the marketplace. Careers listed in the table are associated with an undergraduate degree in neuroscience.

Highlights of Neuroscience Careers with a Bachelor Level Degree in Neuroscience

Position	**Level**
Clinical Data Collector	Entry-Level
Clinical Research Assistant	Entry-Level
Clinical Research Associate	Mid-Level
Community Program Coordinator	Mid-Level
Disability Case Manager	Mid-Level
Healthcare Manager	Mid-Level
Laboratory Assistant	Entry-Level
Laboratory Technician	Entry-Level
Medical Device Sales	Entry-Level
Natural Science Manager	Mid-Level
Patient Care Assistant	Entry-Level
Pharmaceutical Sales	Entry-Level
Regulatory Affairs specialist	Mid-Level
Rehabilitation Counsellor	Entry-Level
Research Assistant	Entry-Level
Research Associate	Mid-Level
Sales Assistant	Entry-Level
Science Advocacy	Entry-Level
Science Editor	Entry-Level
Science Technician	Mid-Level
Science Writer	Entry-Level
Teaching Assistant	Entry-Level

Source: Canadian Association for Neuroscience https://can-acn.org/neuroscience-research-staff; Society for Neuroscience https://www.sfn.org/Search?q=career%20report; and Neuronline https://neuronline.sfn.org/Career-Specific-Topics/Career-Paths

A final indicator of need and demand for a neuroscience program at York is based on the results of a survey administered to students at York. In 2014, we surveyed prospective new students, i.e. those who had been offered admission to York University in F14, asking some 2900 students the following questions:

1. How interested are you in an undergraduate program in Neuroscience? (scale 1 to 5)
2. To what extent are you *more* interested in Neuroscience than the program to which you have currently applied? (scale 1 to 5)
3. To what extent are you interested in a minor in Neuroscience, i.e. a smaller set of courses that would complement your undergraduate program? (scale 1 to 5)
4. Are you *more* likely to accept admission to a Neuroscience program than to the program you've applied to at York? (scale 1 to 5)
5. If you were to study at the graduate (MSc) level at York to what extent are you interested in a graduate diploma in Neuroscience? (scale 1 to 5)

A detailed analysis of the survey results can be found in Appendix B. We note that approximately 60% of 1167 respondents were somewhat or very interested in an undergraduate Neuroscience program (Q.1). Briefly, the survey indicates that academically strong students (as determined by high school average) are interested in neuroscience (65% of those in the >90% range) and that 30% of such students are more likely to accept an offer of admission to a Neuroscience program than to the program they applied to. Also 30% of students who applied to a program as their second or higher choice are more likely to accept an offer of admission to Neuroscience. The survey clearly indicates strong interest in Neuroscience amongst students, and that a Neuroscience program would attract top new students, i.e. potentially ones who would not otherwise come to York.

5. Admission requirements

Students will be able to apply to the Neuroscience program for September 2020 to either the Faculty of Health or the Faculty of Science. Grade 12 performance (e.g., minimum 80%) will be used to ensure that over-enrollment in the program does not occur. Students applying to the Neuroscience major will be required to enroll in a newly created one-credit Neuroscience course (NRSC 1001 1.00) called *The Frontiers of Neuroscience*. Through this novel one-credit course they will be introduced to their cohort and the interdisciplinary collaborative nature of neuroscience, engaging in invited lectures and

extracurricular events spread out over two terms. This course will introduce students to research activity in the field of neuroscience at York and in the GTA, and to the faculty members at York conducting research in neuroscience.

Transfer and mature students (i.e., students not directly entering from high school) will be able to apply for entry into the neuroscience major in 2023 once all the newly designed neuroscience courses are rolled out and available.

6. A **"Three pathways" program model**

An environmental scan of 13 Ontario universities offering 20 different programs having a neuroscience focus revealed that all but five programs offer direct first year entry. McMaster, Queens, University of Toronto Mississauga, and Western offer second year entry with the requirement of retaining a particular GPA in first year core courses.

A key advantage of direct entry is that students enter in the unit in which they will likely remain, becoming their home base. Our proposal employs a hybrid model that combines the best of both direct entry and second year entry models, making it particularly attractive. For students who satisfy the proposed admission requirements for the Neuroscience program, a secure spot in the Neuroscience program beginning in their 2nd year is guaranteed, assuming they complete the required number of first year credits and maintain a specified overall GPA in their first year. We expect that students with diverse interests in neuroscience will apply to one of three academic units (Kinesiology & Health Science, Psychology, Biology), presumably the one that most suits their interests. These are the three alternative pathways. Although there will be exceptions and it will not be restrictive, those interested in working with people and in the life-sciences field may very well choose Kinesiology & Health Sciences or Psychology, while those interested in the cellular/molecular stream of neuroscience are more likely to choose Biology. Entering one of these three school/departments at the outset will provide students with a home base and a suitable first-year foundation for Neuroscience and will also allow them the confidence they can continue with the Neuroscience curriculum in second year.

We recommend that Senate approve the establishment of an Honours BSc degree program in Neuroscience jointly housed in the Departments of Psychology and Kinesiology & Health Science in the Faculty of Health, and the Department of Biology in the Faculty of Science, structured as follows:

Neuroscience – Psychology
Neuroscience – Kinesiology & Health Science
Neuroscience – Biology

The details are as follows:

A. Students may apply for admission to the Faculty of Science (Neuroscience - Department of Biology) or Faculty of Health (Neuroscience - School of Kinesiology & Health Science or Neuroscience - Department of Psychology). All three academic units provide pathways to begin the Neuroscience specialization in second year. The nomenclature for capturing this novel interdisciplinary degree between two Faculties and three programs is proposed as follows:
   - Faculty of Health, B.Sc., Spec. Hons. Neuroscience – Psychology
   - Faculty of Health, B.Sc., Spec. Hons. Neuroscience – Kinesiology & Health Science
   - Faculty of Science, B.Sc., Spec. Hons. Neuroscience – Biology

B. An overall fall intake cap for the three programs will be set initially in the neighbourhood of 70 students. This will be established by employing a model that considers (a) financial sustainability, (b) a desire to have the program remain relatively small, and (c) bottlenecks associated with the proposed second-year neuroscience techniques course and the fourth-year capstone course options. Proportions of that capped enrollment will be allotted among Psychology, Kinesiology & Health Science, and Biology. Allotments may be adjusted from year to year in accordance with the numbers and academic profiles of students applying to the three pathway degree programs.

C. A high school cut-off grade in the neighbourhood of 80% will be set, based on the following four compulsory courses: 12U Advanced Functions, Biology, Chemistry, and English. If accepted into one of the three pathway degree programs, students will arrive with a secure spot in Neuroscience, provided they maintain a 7.5 GPA (or as may otherwise be determined) and earn at least 27 credits in their first year (September to April).

D. Students will join the cohort of the degree program into which they enrolled (i.e. Psychology, Kinesiology & Health Science, or Biology), and they will then follow the first-year requirements of their respective programs. Students will, however, receive mandatory advising that will require them to register for the NRSC 1001 1.00 course and that will enable them to move into the Neuroscience curriculum in their second year. This enrollment advising will vary among Psychology, Kinesiology & Health Science, and Biology students. (An example of the courses to be taken through each pathway program are provided in Appendix D):

i) Students entering Faculty of Health, B.Sc., Spec. Hons. Neuroscience - Psychology, will take the following 25 credits, plus 6 others for a total of 31 credits:
- BIOL 1000 & 1001 6.00
- MATH 1505 6.00
- PSYC 1010 6.00
- CHEM 1000 & 1001 6.00
- NRSC 1001 1.00

Advising:
- Students will be advised they require EECS 1520/1540/570 3.00 by the end of second year.
- Because they will require 12 credits of General Education courses, they should take six General Education credits in their first year.
- Students will be advised that instead of MATH 1505 6.00, they may take MATH 1013 3.00 and MATH 1014 3.00.

ii) Students entering Faculty of Health, B.Sc., Spec. Hons. Neuroscience - Kinesiology & Health Science, will take the following 31 credits:
- BIOL 1000 & 1001 6.00
- MATH 1505 6.00
- KINE 1000 6.00
- KINE 1020 6.00
- PSYC 1010 6.00
- NRSC 1001 1.00

Advising:
- Students will be advised they require EECS 1520/1540/1570 3.00 and CHEM 1000 & CHEM 1001 3.00 to be completed by the end of second year
- Because they will require 12 credits of General Education courses, they should take at least six General Education credits in their second year.
- Students will be advised that instead of MATH 1505 6.00, they may take MATH 1013 3.00 and MATH 1014 3.00.

iii) Students entering Faculty of Science, B.Sc., Spec. Hons. Neuroscience - Biology –, will take the following 25 credits, plus 6 others for a total of 31 credits:
- BIOL 1000 & 1001 6.00
- MATH 1505 6.00
- CHEM 1000 & 1001 6.00
- PSYC 1010 6.00
- NRSC 1001 1.00

Advising:
- Enrollment in the PSYC 1010 6.00 course will result from mandatory advising.
- Students will be advised they require EECS 1520 3.00 by the end of second year.
- Because they will require 12 credits of non-Science General Education courses, they should consider taking six credits in their first year.
- Students will be advised that instead of MATH 1505 6.00, they may take MATH 1013 3.00 and MATH 1014 3.00.

E. Providing the students in these three pathway programs achieve a GPA of 7.5 in their first year (or as may otherwise be determined) and complete at least 27 credits in their first year, these students will have secured their admission to the Neuroscience program. In second year, they will begin to take the Neuroscience curriculum (12 credits in second year) and they will also take any of the following courses that they did not take in their first year:
- CHEM 1000 & 1001 6.00
- PSYC 1010 6.00

- EECS 15XX 3.00

Second Year Advising:

- Students will be advised that they require 12 non-Science General Education credits by the time they graduate, and that they should try to complete these courses by the time they have completed 60 credits.
- Students interested in delving deeper into a neuroscience technique, after learning about a breadth of them in NRSC 2200 3.00, will be advised to use some of their credits to enroll in an independent study course at the 3000 or 4000 level with a neuroscience faculty member, prior to the term in which they enroll in the Capstone 4000 level course.
- Students will be advised to enroll in required prerequisite courses for the 3000/4000 level courses that are part of the specialization streams.

Third and fourth year advising:

- Students enroll in required neuroscience courses (see Appendix D for an example of pathways for students through the program),
- Students enroll in the courses that are part of their chosen or alternative specialization streams.

F. Students will remain in their home School/Department, home Faculty (Health or Science), and home College for the balance of their degree, unless they apply to change programs in the manner open to all students. Therefore, Neuroscience - Psychology students will remain with Calumet College, Neuroscience - Kinesiology & Health Science students will remain with Stong College, and Neuroscience - Biology students will remain with Bethune College.

G. Assuming there is some attrition by the end of first year through changes of mind or through the failure to maintain the minimum GPA on at least 27 credits, this attrition will have two consequences. First, seats will become available for second year entry for students enrolled in non-Neuroscience B.Sc. degree programs in Psychology, Kinesiology & Health Science, Global Health, Biology, Biophysics, Biochemistry, and Integrated Science (ISCI) who have achieved a 7.5 GPA on at least 27 credits in their first year. Second, with the idea in mind of contributing to retention rates, neuroscience students who have not attained the minimum 7.5 GPA on at least 27 credits in first year will be eligible to remain in their respective entry programs, assuming they have the required GPA for that home program (or as they may arrange through advising in their home Faculty). For example,
   i) Students in Faculty of Health, B.Sc., Spec. Hons. Neuroscience - Psychology will be eligible for Faculty of Health, B.Sc., Spec. Hons. (requires a secondary application) or Hons. Psychology.
   ii) Students in Faculty of Health, B.Sc., Spec. Hons. Neuroscience - Kinesiology & Health Science will be eligible for Faculty of Health, B.Sc., Spec. Hons. Kinesiology & Health Science.
   iii) Students in Faculty of Science, B.Sc., Spec. Hons. Neuroscience - Biology will be eligible for Faculty of Science, B.Sc., Spec. Hons. or Hons. Biology.

H. Students must maintain a cumulative GPA of 6.00 (B). Those whose cumulative GPA falls below 6.00 will be eligible for any of the programs they qualify for in their home Faculty (or as they may arrange through advising in their home Faculty).

7. Program Content and Curriculum

The curriculum for this new major in Neuroscience is embedded within a specialized honours BSc degree. As part of this proposal we have designed seven new neuroscience courses, two of which are alternative capstone courses that students choose from to complete the program level objectives. We need a course code for the newly designed neuroscience courses so as part of this proposal we are introducing for approval a new course code i.e., “NRSC”. The Neuroscience curriculum comprises 64 credits that includes six core neuroscience courses as well as existing courses clustered in three Neuroscience streams. The three streams are: Molecular and Cellular Neuroscience; Behavioural and Cognitive Neuroscience; and Systems Neuroscience. The Molecular and Cellular stream focuses on the molecular and cellular specialization of neurons and non-neuronal cells and synaptic and non-synaptic transmission. In the Behavioural and Cognitive stream, students delve into the neural basis of behaviour (cognition, sensation and perception, and neuropsychological processes). The Systems stream emphasizes how neural processes are translated to functional outputs of coordinated, distributed neuronal function. These streams build on the research strengths and expertise of 40 faculty members at York in the two Faculties, delivered through 28 currently existing courses. In the future, with the hiring of new faculty complement and additional new courses, Computational Neuroscience may

constitute a fourth specialized stream for this program. The neuroscience curriculum is designed to prepare students for an academic- or industry-based research-oriented career path in the neuroscience field (see Table in section 4 listing potential careers).

*Neuroscience major (*64 credits*)*: The content for the major includes depth (from the new NRSC courses) and breadth (from the three specialization streams), building knowledge that includes molecular and cellular neuroscience, behavioural and cognitive neuroscience, systems neuroscience, research methods and statistics, and functional neuroanatomy. In their final year of study, students integrate and apply their knowledge in a 6-credit Capstone experience (see Capstone experience section).

Keystone course experience (1 credit): In their first year, students will register for a newly created one-credit Neuroscience course (NRSC 1001 1.00) called *The Frontiers of Neuroscience*. This novel, experiential course will lay the foundation for the academic tenure of the neuroscience program. Through this one-credit course, students will come together as a cohort, and they will be introduced to the interdisciplinary, collaborative nature of neuroscience by engaging in invited lectures and extracurricular events spread out over two terms. This course will familiarize students with research ethics and will explore neuroscience related facilities and organizations in the wider community, thereby introducing students to research activity in the field of neuroscience at York and in the GTA, and to York faculty members conducting research in neuroscience.

Capstone Experience (6 credits): The Capstone experience is intentionally flexible in format, allowing students to customize their experiential education and research in their senior year by enrolling in one of two courses (NRSC 4000 6.00 or NRSC 4002 6.00). The individual research thesis (NRSC 4000) engages students in a research-intensive experimental laboratory project or a clinically focused research project, either in a lab at York or with a partner in the community setting (industry or hospital). These research projects will be supervised by a faculty member in either the Faculty of Science or of Health. Supervision for this Capstone experience will be arranged in consultation with faculty members affiliated with the particular neuroscience area, similar to the way honours thesis supervisors are found in other programs.

The team-based group project course (NRSC 4002 6.00) will provide an opportunity for students to develop solutions to applied research problems, typically out in the community working with hospital and/or industry partners. Teams will be coordinated by the course director and projects will focus on research problems proposed by a neuroscience researcher, industry partner(s), or hospital partner(s). A team-based Capstone course like this has been successfully piloted in the Lassonde School of Engineering where projects are proposed by any faculty member or industry partner and students typically work in teams to develop solutions to applied problems. Projects will be supervised by neuroscience faculty members and/or the course director. Community partners in industry and/or hospitals (“advisers”) in collaboration with our neuroscience faculty members can propose research problems, answer questions, and/or provide additional information as needed, and be invited to the oral presentations.

Specialized Neuroscience streams (24 credits in total): As a topic area, neuroscience is interdisciplinary. Therefore, it is important that students completing a neuroscience major get exposure to the breadth of topics in neuroscience. To this end, students in the Neuroscience program will complete 24 credits from the Specialized Neuroscience streams to provide a depth and breadth of understanding in three cutting-edge areas that draw on the research strengths and expertise at York. A minimum of twelve credits are taken in the chosen stream (depth), and a minimum of twelve credits must be taken from the two alternative streams (breadth). When selecting courses from the two alternative streams, not all 12 credits can be taken within one stream. For example, students in the Molecular and Cellular Neuroscience stream could take three credits (one one-term courses) from the Behavioural and Cognitive Neuroscience stream and nine credits (three one-term courses) from the Systems Neuroscience stream to acquire their 12 alternative stream credits.

Prerequisite courses: All upper level courses in Psychology, Kinesiology & Health Science, and Biology require specific first year (and sometimes second and third year) prerequisite courses. For most courses, prerequisites are enforced. Students will be advised accordingly.

If warranted, changes in course credit exclusion status, or establishing the 2000 level NRSC courses as prerequisite courses to other upper level courses in Psychology, Biology, and Kinesiology & Health Science can be established through the normal curricular approval process as, or after, the Neuroscience program is implemented. In particular, the new neuroscience courses (NRSC) provide subject matter specific content that could be deemed suitable prerequisite substitutes by faculty members teaching upper level courses in Biology, Kinesiology & Health Science, and Psychology. For example, KINE 4230 *Neuronal Development for Activity and Health* requires as a prerequisite KINE 3012 *Physiology I*. The

core learning outcomes that are necessary to understand KINE 4230 regarding the neuroscience of the motor system are also covered (in fact, in more detail) in the newly proposed NRSC 2000 *Molecular and Cellular Neuroscience* course. Therefore, students without KINE 3012 could request permission from the instructor to enroll in the KINE 4230 course based on the fact that they have been familiarized with the required prerequisite knowledge from a required course in the neuroscience core. This may also be formalized through amendments to the required prerequisites for particular senior level courses.

Electives: Students will take remaining credits as electives. Credits available for electives can be also used for enrolling in prerequisite courses and for satisfying science requirements. For science credits, students can take any courses from the Lassonde School of Engineering, any courses from the Faculty of Science except Science and Technology Studies (STS) courses, and any courses from the Faculty of Health, with the exception of the following: HH/KINE 2380 3.00; HH/KINE 3240 3.00; HH/KINE 3250 3.00; HH/KINE 3360 3.00; HH/KINE 3420 3.00; HH/KINE 3430 3.00; HH/KINE 3440 3.00; HH/KINE 3490 3.00; HH/KINE 3510 3.00; HH/KINE 3530 3.00; HH/KINE 3580 3.00; HH/KINE 3620 3.00; HH/KINE 4310 3.00; HH/KINE 4315 3.00; HH/KINE 4340 3.00; HH/KINE 4350 3.00; HH/KINE 4360 3.00; HH/KINE 4370 3.00; HH/KINE 4375 3.00; HH/KINE 4420 3.00; HH/KINE 4430 3.00; HH/KINE 4480 3.00; HH/KINE 4485 3.00; HH/KINE 4490 3.00; HH/KINE 4495 3.00; HH/KINE 4530 3.00; HH/KINE 4560 3.00; HH/KINE 4620 3.00; HH/KINE 4630 3.00; HH/KINE 4635 3.00; HH/KINE 4645 3.00; HH/KINE 4646 3.00; HH/PSYC 3350 3.00; HH/PSYC 3430 3.00; HH/PSYC 3600 3.00; HH/PSYC 3620 3.00; HH/PSYC 3630 3.00; HH/PSYC 3670 3.00; HH/PSYC 4891 6.00, or as the list of non-science courses is amended from time to time.

Fulfillment of Degree Requirement (details provided in Appendix F): The proposed Neuroscience major curriculum requires 64 credits. In contrast, students are usually required to attain 54 or 60 credits in the major for the specialized honour BSc degree for Science or Health, respectively. Given the interdisciplinary nature of the Neuroscience major and its greater number of science credits required, this proposal waives the minimum of 9 additional science credits outside of the major normally required for Health and Science students.

Upper level requirements for BSc degrees specify that students must attain a minimum of 42 credits at the 3000 level or above, including 18 credits in the major at the 3000 level, 12 of which must be at the 4000 level. In the proposed Neuroscience major, students will take from 33 to 39 credits at the 3000/4000 level to satisfy their core requirements. (The range exists because there are 6 credits in the behavioural/cognitive stream that are at the 2000 level). Therefore, students will need to be advised to take the remaining three to nine 3000 and 4000 level credits as electives and/or that these credits may be taken within one of the streams.

To be fair and consistent to all students in this interdisciplinary BSc program and given the high number of credits prescribed for the major along with prerequisite courses required, we are recommending that BSc Faculty of Health students be required to complete the same minimum number of 12 (rather than 18) non-science general education credits, as is currently the case with Faculty of Science BSc students.

<u>Summary of Neuroscience Requirements:</u>

Seven new neuroscience (NRSC) course proposals are contained in Appendix C. Note there are two Capstone courses of which students must choose one.

The Neuroscience core comprises six NRSC courses (19 credits), two BIOL courses (6 credits), two PSYC courses (9 credits), one KINE course (3 credits), and one 3 credit statistics course taken from any of the home programs. The remaining 24 credits are acquired through courses from specialization streams: molecular/cellular neuroscience comprising three KINE (9 credits) and two BIOL (6 credits); behavioural/cognitive neuroscience comprising ten PSYC (33 credits) and one KINE (3 credits); and systems neuroscience comprising one BIOL (3 credits), four KINE (12 credits), and two PSYC (6 credits). Students must complete a minimum of 12 credits from one chosen stream and a minimum of 12 credits taken from the two alternative streams. Courses are listed as follows:

Course Code	Title	Credit	Status
BIOL 1000 3.00	Biology I	3	exists
BIOL 1001 3.00	Biology II	3	exists
PSYC 1010 6.00	Introduction to Psychology	6	exists
NRSC 1001 1.00	Frontiers of Neuroscience	1	new
NRSC 2000 3.00	Fundamental Molecular and Cellular Neuroscience	3	new
NRSC 2100 3.00	Systems, Behavioural and Cognitive Neuroscience	3	new
NRSC 2200 3.00	Neuroscience Techniques	3	new

PSYC 2021 3.00, or BIOL 2060 3.00, or KINE 2050 3.00	Statistics*	3	exists
NRSC 3000 3.00	Molecular and Cellular Neurobiology	3	new
PSYC 3250 3.00	Neural Basis of Behaviour	3	exists
KINE 3650 3.00	Functional Neuroanatomy	3	exists
NRSC 4000 6.00 or NRSC 4002 6.00	Neuroscience Capstone	6	new
	Chosen Specialized stream	12	exists
	Alternative Specialized stream	12	exists
	Total Credits:	64	

* In the future, the Neuroscience Committee will need to decide if there is a need to create a separate neuroscience specific statistics course.

Courses within the specialized Neuroscience streams are summarized below. Courses are assigned to streams based on its most representative content covered. No course is in more than one stream.

Molecular and Cellular Neuroscience

Course Code	Title	Credit	Status
KINE 3670 3.00	Molecular and Cellular Neuroscience with Applications to Health	3	exists
BIOL 4310 3.00	Physiology of Circadian Timing	3	exists
BIOL 4370 3.00	Neurobiology	3	exists
KINE 4230 3.00	Neuronal Development for Activity and Health	3	exists
KINE 4505 3.00	Neurophysiology of Movement in Health and Disease	3	exists

Behavioural and Cognitive Neuroscience

Course Code	Title	Credit	Status
PSYC 2220 3.00	Sensation and Perception I	3	exists
PSYC 2260 3.00	Cognition	3	exists
PSYC 3140 3.00	Abnormal Psychology	3	exists
PSYC 3265 3.00	Memory	3	exists
PSYC 3270 3.00	Sensation and Perception II	3	exists
PSYC 3495 3.00	Neuroscience of Aging & Cognitive Health	3	exists
PSYC 4080 6.00	Neuropsychology of Abnormal Behaviour	6	exists
KINE 4210 3.00	Disorders of Visual Cognition	3	exists
PSYC 4260 3.00	Seminar in Sensation and Perception	3	exists
PSYC 4270 3.00	Seminar in Memory and Cognition	3	exists
PSYC 4360 3.00	Visuospatial Memory and Goal-Directed Action	3	exists

Systems Neuroscience

Course Code	Title	Credit	Status
KINE 3020 3.00	Skilled Performance and Motor Learning	3	exists
BIOL 4380 3.00	Systems Neuroscience	3	exists
PSYC 4215 3.00	Neuroimaging of Cognition - fMRI Methods	3	new
KINE 4225 3.00	Principles of Neuro-motor Learning	3	exists
KINE 4240 3.00	Applied Human Factors	3	exists
KINE 4500 3.00	Neural Control of Movement	3	exists
PSYC 4380 3.00	Seminar in Neuroscience: Rhythms of the Brain	3	exists

<u>Summary of Course Requirements:</u>

Students in the Faculty of Health may have a different path to completion of the Neuroscience program requirements from those in the Faculty of Science in terms of courses taken each year. But all will have in common the Neuroscience core courses. NRSC 1001 1.00 is expected to be completed within the first 30 credits of study but if needed students can be given the opportunity to enroll in this course if they have not yet completed 60 credits. See Appendix D outlining what courses should be taken respectively by students coming from the Faculty of Science (i.e. Biology) and the Faculty of Health (i.e., Psychology or Kinesiology & Health Science). Appendix D outlines how a student from each program can complete their degree requirements within four years. As an advising note, students interested in using this degree as a launch to a professional program (e.g. medical school) will need to attend to the requirements specified by the universities to which they want to apply, as that will impact whether they need to take a full course load each year. Similarly, students wishing to apply to a specific type of graduate program

should pay attention to any additional qualifying courses they may need. Appendix E describes details of the courses taken for the Neuroscience degree.

We expect to admit approximately 70 students beginning in 2020. The new 2000-level Neuroscience courses could have enrolments of ~100-150 students. Some of the Neuroscience courses may be capped due to pedagogical constraints. For example, the NRSC 2200 3.00 *Neuroscience Techniques* course will only be open to Neuroscience majors.

Requirements as they will appear in the Undergraduate Calendar can be found in Appendix F.

8. Program Structure, Learning Outcomes and Assessment

The overriding objective of the program is to provide a thorough education in the methods and ethics of scientific inquiry, using neuroscience as the discipline for exploration, and to provide graduates with breadth and depth of understanding about the field of neuroscience that will position them for further advanced study and for employment in a variety of neuroscience-related professions or industries.

Students will develop proficiency in the following abilities from the chosen and alternative stream Neuroscience courses, and prerequisites and elective courses will enhance their competencies. At the end of the program, successful students should be able to:

1. Integrate and apply theoretical perspectives and major findings across broad areas of neuroscience, i.e., cellular and molecular, behavioural and cognitive, and systems.
2. Demonstrate knowledge of, and recognize the relationships between, the structure and function of molecules and tissues involved in neurobiological systems at all levels: molecular, cellular, and organismal.

   Specific core knowledge demonstrated through written and oral assignments, and other course activities include:
   a. The core principles of nervous system structure and function.
   b. The molecular and cellular fundamentals of neural excitability and synaptic physiology.
   c. The principles of information processing in neuronal circuits and networks.
   d. The fundamental principles of sensory processing across modalities.
   e. The fundamental principles of motor system functioning.
   f. The general organization of the brain and its relation to physiological and cognitive processes.
   g. The basic principles of neural development.
   h. The range of typical and atypical cognitive processes and the pathological mechanisms underlying common diseases and disorders of the nervous system.
   i. The molecular, cellular, and cognitive bases of learning and memory.
   j. The basic principles of cognition, attention, language, emotion, and consciousness and the development of these functions.

3. Demonstrate detailed knowledge in one of the specialized Neuroscience streams.
4. Locate and retrieve scientific information, and to read, critique, and evaluate scientific articles, demonstrate scientific writing skills, and deliver oral presentations.
5. Perform basic laboratory techniques used in neuroscience research and identify and apply principles of laboratory safety.
6. Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods.
7. Develop testable research questions based upon in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions.
8. Represent information in a quantitative format to analyze and interpret quantitative information, including graphs and statistics.
9. Analyze and interpret preexisting or novel data, including research findings, to develop lines of argument, propose solutions, and communicate findings in both oral and written formats to diverse audiences.
10. Relate neuroscience to other disciplines, and apply learning from those disciplines within neuroscience, e.g., mathematics, computer science, physics, health sciences, sport, and society.
11. Work effectively and collaboratively in teams.
12. Demonstrate initiative, personal responsibility, and accountability in class and experiential settings.
13. Demonstrate academic integrity, social responsibility, and respect for diversity and different points of view.

The following table summarizes how learning outcomes map to specific courses or selections of courses in the proposed course requirements of the program. For a comprehensive mapping of courses to the Neuroscience program level objectives and undergraduate degree level expectations please see the attached Excel spreadsheet (Appendix I). The map demonstrates how the courses achieve the Neuroscience program level objectives. The newly proposed Neuroscience (NRSC) courses (see Appendix C) were designed to contribute to and fulfill program level objectives.

Program Learning Outcome	Courses through which the outcomes are achieved
1	NRSC 1001 1.00; NRSC 2000 3.00, NRSC 2100 3.00, NRSC 2200 3.00, NRSC 3000 3.00; PSYC 3250 3.00; KINE 3650 3.00; NRSC 4000/4002 6.00. In addition, students select 12 credits which develop this outcome from one of three Specialized Neuroscience streams and 12 credits from the other two alternative specialized streams.
2	BIOL 1000 3.00; BIOL 1001 3.00; PSYC 1010 6.00; NRSC 1001 1.00; NRSC 2000 3.00, NRSC 2100 3.00, NRSC 2200 3.00; NRSC 3000 3.00; PSYC 3250 3.00; KINE 3650 3.00, NRSC 4000/4002 6.00. In addition, students select 12 credits from one of three specialized Neuroscience streams and 12 credits from the other two alternative specialized streams in which many of these outcomes are developed (e.g., KINE 3670, KINE 4230…)
3	Students select 12 credits from one of three Specialized Neuroscience streams: Molecular and Cellular Neuroscience, Behavioural and Cognitive Neuroscience, and Systems Neuroscience streams, and 12 credits at the 3000 and 4000 level which develop this outcome from the other two alternative specialized streams.
4	NRSC 2200 3.00; PSYC 3250 3.00; NRSC 4000/4002 6.00; as well as many of the specialized neuroscience courses (e.g., PSYC 3270, KINE 4225…).
5	BIOL 1000 3.00; BIOL 1001 3.00; NRSC 2200 3.00; NRSC 3000 3.00; 4000/4002 6.00.
6	NRSC 1001 1.00; NRSC 2100 3.00; NRSC 2200 3.00; NRSC 3000 3.00; KINE 3650 3.00; NRSC 4000/4002 6.00.
7	The set of lab courses progressively develop this outcome (i.e. BIOL 1000 3.00; BIOL 1001 3.00; NRSC 2200 3.00, and others), culminating in the 4000-level Capstone course (NRSC 4000/4002 6.00).
8	This is achieved through the mathematics courses MATH 1013 3.00; MATH 1014 3.00 or MATH 1505 6.00; the second-year statistics course, the computational courses (EECS 15XX 3.00); and the sequence of lab courses in which mathematical and computing skills are applied.
9	Required courses in second and third year, as well as most other courses, develop this outcome through written and oral assignments.
10	This is achieved through the multidisciplinary nature of the program. Mathematics, computing, psychology, biology, and kinesiology & health science courses are all part of the requirements.
11	BIOL 1000 3.00; BIOL 1001 3.00; PSYC 1010 6.00; NRSC 2000 3.00; NRSC 4000/4002 6.00; PSYC 4260 3.00; PSYC 4270 3.00; KINE 3020 3.00.
12	PSYC 1010 6.00; NRSC 2000 3.00; NRSC 4000/4002 6.00; KINE 4225 3.00; PSYC 4260 3.00; PSYC 4270 3.00; KINE 4225 3.00.
13	BIOL 1000 3.00; BIOL 1001 3.00; PSYC 1010 6.00; NRSC 2000 3.00; NRSC 4000/4002 6.00.

Methods and criteria for assessing student achievement

Across the program, student achievement is measured through a variety of assessment methodologies. The program emphasizes experiential learning and methods of assessments that match these experiences, such as interviews, case-studies/simulations, team critical reflections, and an independent or team-based Capstone project. When the 22 possible sample neuroscience careers available for students with a neuroscience background were explored using Talent Neuron (an online talent market intelligence portal that gathers data and analytics from 800 sources providing real-time labour market insights), the transferable soft skills such as oral and written communication, team work, ability to work independently, and problem solving appeared consistently across these careers. These soft skills are developed and evaluated through the Neuroscience courses proposed in this program.

Appendix G provides two tables. The first shows the alignment of program learning outcomes and assessment methodologies in Neuroscience (NRSC) courses. The second provides detailed criteria for assessing student achievement and/or success in acquiring these outcomes.

Neuroscience (NRSC) courses: These courses were created with specific methods and criteria for assessing student achievement, not only with the course in mind, but also the program learning outcomes. Each of the assessment methodologies focuses on ensuring the assessments are appropriate for the evaluation of student achievement for the intended program learning outcomes.

The assessment practices in the program include:

- Laboratory participation
- Critical reflections
- Case-studies/Simulations
- Neuroscientist interviews
- Team reflection presentation
- Peer to peer evaluation
- Public presentation
- Journal article critiques
- Tests & examinations
- Personal response systems
- Self-evaluation
- Research proposal
- Research Capstone final report

Much of the assessment of experiential learning in the program have been designed following principles of Universal Design. Many of the assessments in the program are flexible, accessible, and enable students to make choices to be more involved in the learning process. Central to these principles is the design of the Capstone project. The Neuroscience Capstone project (NRSC 4000/4002 6.00) provides students the choice of an intensive research project engaged in a laboratory or hospital setting or a team-based project to develop solutions to applied research problems in the lab or community (industry, hospital) settings. This Capstone project is described in more detail next.

Capstone Project: The program incorporates a research component with a uniquely flexible capstone experience that engages students individually (NRSC 4000 6.00) or in teams (NRSC 4002 6.00) in research in an independent lab, clinical settings, or with other community/industry partners. The assessments of the Capstone include: 1) a précis and reading list (5%); 2) an initial project proposal including the introduction and methods sections (25%); 3) oral presentation (20%); 4) final report (40%); 5) critical reflection or peer to peer/self-reflection (5%); and 6) laboratory involvement/citizenship (5%).

The project includes a student-supervisor/course director agreement outlining tasks and learning expectations for the project and detailing hours involved. Students either individually (NRSC 4000 6.00) or in a team (NRSC 4002 6.00) submit for approval a project proposal to the supervisor/course director. Within the first month of the course, a short précis (abstract) and reading/reference list will be submitted for evaluation (5% of the final grade). Based on this information, the supervisor/course director will provide formative feedback to the student/team on their proposed research proposal. Four months after beginning the project (approximately January 15th), the student(s)/team(s) will hand in to the supervisor/course director a draft of the Introduction and Methods of the project. The aim of submitting this early draft is to provide an opportunity for feedback on the student's writing (evaluated and worth 25%). At the same time the supervisor/course director will provide feedback on the performance of the student(s)/team(s) in terms of meeting the learning outcomes specified in the agreement. The format of this evaluation will vary from project to project, but the requirements of this evaluation will be specified in the original documents.

Students will also have a final presentation which will be evaluated (20%). All of the faculty members and students associated with the Neuroscience program will be invited to attend this presentation. This final presentation will be evaluated using a rubric adapted from the Oral Communication Value rubric proposed by AACU (American Academy of Colleges and Universities; see *value@aacu.org*) that evaluates skills such as reflection (e.g., uses concepts learned about neuroscience to draw further conclusions and links it to research, showing a recognition and ability to critique the beliefs and assumptions held), language (e.g., language supports the effectiveness of communication and is appropriate to the topic and audience as well as grammatical and clear, etc.); delivery (e.g., posture, gesture, eye contact, and vocal expressiveness showing confidence and authority, looking more often at the audience than at his/her speaking materials/notes, etc.); supporting material (e.g., explanations, examples, illustrations, statistics, analogies, and quotations from relevant authorities are appropriate); central message (e.g., compelling, precisely stated, appropriately repeated, memorable, and strongly supported, etc.).

Students will be assessed on their work in labs, modelling the importance of developing professional skills that are valuable to future careers. While lab meetings either at York or in the hospital/industry organization may look different from project to project, all students will be assessed on

research/laboratory citizenship (5% of their final grade) contributing to the creation and ongoing support of a positive, collegial, lab (research) environment.

For the individual research projects (NRSC 4000 6.00), students will submit to their supervisor a short, written, self-reflection (evaluated at 5%) designed to provide students with an opportunity to critically reflect on their experience. They will be asked to critique their own thoughts, attitudes, and actions related to neuroscience research, and describe how or why they have changed or stayed the same as a result of their research experience. They can be asked to identify at least one attitude/action that they think they could apply, do better, or do differently; this can apply to any aspect of their professional or academic life.

For the team-based projects (NRSC 4002 6.00), students will submit to their supervisor an evaluation of their collaboration (peer-to-peer and self, evaluated at 5%) designed to provide students with an opportunity to critically reflect on their experience conducting a team-based project in the neuroscience program. A collaboration rubric will be created or adapted from the Team Value rubric proposed by AACU (American Academy of Colleges and Universities; see *value@aacu.org*) whereby students assess and critique their contributions and their peers' contributions to the development of the project (e.g., role in researching and gathering information, ability to share and relay information, punctuality); responsibility in ensuring the project outcomes are fulfilled (e.g., fulfills team role & duties, contributes to the development of the final paper); and ability to be a valuable team player (e.g., listens to others, expresses self to others, makes fair decisions).

At the end of the term, the supervisor(s)/course director will provide the student with a grade of the final report (40%) and an assessment of the degree to which the student has met the agreed-upon expectations and the learning objectives.

Laboratory Participation: The program incorporates an applied research component with laboratory experiences in neuroscience through a culminating research-based Capstone experience where students will be assessed on their initial project proposal, public presentation, and final report.

Critical Reflections: Students will be assessed by critical reflections in individual or in teams in NRSC 1001 1.00, NRSC 2200 3.00, NRSC 3000 3.00, and NRSC 4000/40002 6.00 to assess skills such as integrating theoretical perspectives in neuroscience, demonstrating knowledge of neurobiological systems, analyzing and interpreting pre-existing or novel data, relating neuroscience to other disciplines, and working effectively in teams. Students will be asked to write critical reflections on guest lectures, journal articles, media postings, and/or laboratory techniques. The main assessment criteria evaluate students' abilities to address questions such as: "what?" (e.g., what did they learn about the Neuroscience process covered, what techniques were used to investigate the system), "so what?" (e.g., how does this information contribute to our knowledge in the field of neuroscience, or how do the techniques used further our understanding of this system), and "what now?" (e.g., what more would they like to know about this topic or what further research needs to be done, or, are there other techniques that could better investigate the system in this context).

Journal Article Critiques: There will be journal article critiques in NRSC 2000 3.00 and NRSC 2200 3.00 to assess students' knowledge of (a) neurobiological systems, (b) locating, retrieving, critiquing, and evaluating scientific information, (c) describing diverse experimental research methods, (d) analyzing data including research findings, and (e) relating neuroscience to other disciplines. Criteria for assessing student achievement for the journal critiques include: (a) analyzing a research article, (b) critically reflecting on the research process, and (c) discussing their emerging understanding of the purpose and process of these methodologies.

Tests and Examinations: There will be traditional tests and examinations measuring student knowledge, comprehension, and application of theoretical perspectives, major findings, and neurobiological relationships. The examinations in NRSC 2100 3.00 and NRSC 3000 3.00 will include multiple choice questions to assess whether students can correctly identify key course concepts, as well as matching and/or short answer questions designed to assess students' ability to describe and explain the structure and function of the human brain.

Case Studies and Simulations: Students will be assessed by response to case studies/simulations, such as classic cases of brain abnormalities in NRSC 2100 3.00. Students will be assessed on their engagement in the exercises (e.g., they must be present in class and complete the exercise), as well as their reflective responses. Responses will be assessed both on accuracy, as well as their ability to make critical connections among core course concepts.

Modes of delivery

Modes of delivery are often face-to-face with a lecture format in currently existing courses. The newly proposed neuroscience courses may be face-to-face with a lecture format or they may be blended or use a flipped classroom format. Blended or flipped classroom formats will be used in order to create the opportunity for student engagement and experiential activities. Experiential learning is integral to the program. This is particularly true of the Capstone course where mentorship and supervision are vital. As a mode of learning, such mentorship during the delivery of seminars, labs, and capstone experiences in NRSC 1001 1.00, NRSC 2200 3.00, NRSC 3000 3.00, and NRSC 4000/4002 6.00 is an effective approach to particularly achieving learning outcomes 3 through 13, listed at the beginning of section 8.

9. Resources

As indicated in Appendix H, there are significant faculty strengths in all areas of the program. In total, there are approximately 40 faculty members with strengths in the Neuroscience domain. Although there are more faculty members in the Behavioural/Cognitive and Systems area, there are also sufficient faculty members in the Molecular/Cellular area to easily mount the program with three streams. However, we flag this area as one which will need development in the future. Most faculty members operate research labs and therefore may be contributors to the new *Neuroscience Techniques* (NRSC 2200 3.00) course and to the Capstone thesis course. Faculty strength can also be seen in the presence of four Canada Research Chair holders and one Distinguished Research Professor.

The program does not rely on participation of emeriti faculty nor is it anticipated that contract faculty will be called upon. However, there are at least two recent retirees with expertise in neuroscience who may wish to participate, and they would be welcome to do so.

A number of existing courses required in the program are laboratory courses – namely BIOL 1000 3.00, BIOL 1001 3.00, CHEM 1000 3.00, and CHEM 1001 3.00. These are very large courses and we expect the additional students will be absorbed with very small impact on resources. Some courses in the specialized Neuroscience streams are also laboratory courses - namely KINE 3020 3.00 and KINE 4225 3.00. Similarly, we don't anticipate student demand will require significant additional resources.

The new *Neuroscience Techniques* course (NRSC 2200 3.00) is being designed as an innovative blended format course providing Neuroscience majors with an overview of, and exposure to, neuroscience techniques and methodologies in the fields of systems neuroscience, cognitive neuroscience, cellular and molecular neuroscience, and computational and theoretical neuroscience. These techniques could include any of the following: EEG, fMRI, behavioural methods such as psychophysics and eye/body tracking, electrophysiology, patch and dynamic clamp, transgenic mouse technology, molecular imaging, neuronal coding and communication, neuronal networks, and brain-machine interfaces. Research faculty members have a large array of research equipment, and we have a flagship fMRI Facility. There is not, however, enough space nor time in individual labs for the cohort of students enrolled (60-70) to learn multiple techniques and gain a hands-on experience with it. Therefore, the course proposes to use online simulations or computer lab activities that will allow students to explore different neuroscience techniques using software such as "Backyard Brains" (https://backyardbrains.com/experiments/). In addition, demonstrations of neuroscience techniques will be made available through video recordings of different techniques from research labs at York and posted in the course learning management system for students to review. Given the complexity of some of these techniques, students will also need to be provided tutorials that show them how to build and analyze graphs using different techniques and methods. Ultimately, students will be provided with a sample of data generated from the technique used and asked to produce a graph of the data, as well as a short explanation of their final product. Therefore, this course will require purchase of software and/or a license for software that emulates or simulates different neuroscience techniques, resources to video record different neuroscience techniques in the lab, and development of online tutorials to show how to build and analyze data based on different neuroscience techniques.

Faculty, Research and Administrative Resources

With the newly proposed Neuroscience courses and the anticipated increase in demand for research opportunities and supervision of Capstone projects, both Faculties will require additional faculty hires to supplement the current cohort of Neuroscience researchers and teachers.

Currently, research can be conducted in existing teaching laboratories and can leverage our unique research facilities (e.g. York MRI Facility). Research faculty members already have laboratory and research space, including space for graduate students. The two Faculties also have sufficient general office space for faculty members and graduate students. With new hires, additional space will be required.

For the first few years, we anticipate the need for a half-time administrative assistant position, but when steady-state student numbers reach more than 200, a full-time position will likely be required.

Other Supports and Services

Information technology and library facilities are also important elements of the academic quality, and we anticipate that University-wide facilities will be adequate.

Class sizes and capacity for supervision

With the exception of the new NRSC courses, class sizes will be determined by the Faculties and Departments/School offering the courses. Some of the NRSC courses will be open to students outside the Neuroscience program and, if lecture-based, may have elasticity in the class size to accommodate more students. Others such as NRSC 2200 3.00 *Neuroscience Techniques*, will be restricted to Neuroscience majors and hence have a class size of about 60-70 students.

The 4000-level Capstone course(s) expect to enroll up to 60-70 students working alone or in groups. The first cohort will be in 2023. These courses will require neuroscience faculty members to supervise student capstone projects. Given there are approximately 40 faculty members who either are core or affiliated with the neuroscience area, this is achievable if faculty members supervise at least 1 student each. The Capstone experience could also be completed by students enrolling in the team-based course (NRSC 4002). If other processes and procedures need to be put in place to ensure students are enrolled in a course they want, then this will need to be fleshed out by the Neuroscience committee.

10. Enrolment Projections

The table shows enrolment based on intake beginning at 70 students in the inaugural year of the program. Retention of 85% into year 2 and 90% into year 3 are built into the model. This results in steady state of 242 across both Faculties by 2024.

Enrolment projection for a proposed annual intake of 70						
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Total
Retention		0.85	0.9	1	0.1	
2020	70	-	-	-	-	70
2021	70	59.5	-	-	-	130
2022	70	59.5	54	-	-	183
2023	70	59.5	54	54	-	237
2024	70	59.5	54	54	5	242
2025	70	59.5	54	54	5	242
2026	70	59.5	54	54	5	242
2027	70	59.5	54	54	5	242

11. Support Statements

Support statements (found in Appendix J) are provided by:

- The Deans of the Faculties of Health and Science, with respect to the adequacy of existing personnel (administrative and faculty), physical and financial resources necessary to support the program, as well as the commitment to any plans for new/additional resources necessary to implement and/or sustain the program
- Vice-President Academic and Provost, with respect to the adequacy of existing personnel (administrative and faculty), physical and financial resources necessary to support the program, as well as the commitment to any plans for new/additional resources necessary to implement and/or sustain the program
- University Librarian confirming the adequacy of library holdings and support
- University Registrar confirming the implementation schedule and any administrative arrangements
- Relevant Faculties/units/programs confirming consultation and support for the proposed program, as appropriate
- Professional associations, government agencies, or policy bodies with respect to the need and demand for the proposed program, as appropriate

APPENDICES

Appendix A: Proposed Governance Model
Appendix B: Student Survey
Appendix C: New Course Proposals Summary and Details
Appendix D: Neuroscience Paths to Completion for Students in Health and Science
Appendix E: Description of Courses
Appendix F: Calendar Copy
Appendix G: Assessment of Student Achievement for New Neuroscience Courses
Appendix H: Neuroscience Faculty Members (Core vs. Affiliated)
Appendix I: Undergraduate Degree Level Expectations (UDLE) Mapping against Program Learning Objectives (Program Learning Outcomes) and Each Course in the Program (Excel spreadsheet)
Appendix J: Supporting statements

Appendix A: Proposed Governance Model

Many details of the administration of the program are beyond the scope of this proposal, hence what we provide next is a broad overview of the governance model and some guiding principles for the proposed program. This model has been developed from best practices based on feedback from Vice-Provost Academic, the shared council model such as the Digital Media program and the Global Health program. In the future, this model may change, and an interdisciplinary undergraduate program may be anchored to a single program as the Vice-Provost Academic is working on developing a process for interfaculty undergraduate programs. In the meantime, the following is proposed:

Principle of Equitable and Fair Sharing - Governance of the Neuroscience Program will be equitable based on the revenue and costs between two Faculties (Health and Science) and among three departmental units (Department of Psychology, School of Kinesiology & Health Science, and Department of Biology). Not only will Course Directors share in the teaching and supervising students' Capstone projects, but also administrative responsibility and support will be shared.

Establishment of the Neuroscience Committee – The two Faculties shall establish a six-person Neuroscience Committee (the "Committee") as a shared Committee. This Committee shall include an Associate Dean from each Faculty (*ex officio*), as well as a neuroscience program coordinator who will Chair this committee. For the first four years of running the program we would recommend that the remaining members of the committee be comprised of the Chair of the School or Department or his/her designate of each of the three programs. After four years, the Neuroscience committee may decide on a different make-up of the committee members (e.g. three members appointed annually in advance of the start of the academic year by the three participating units in accordance with their internal procedures). These members will be from the Department of Psychology, School of Kinesiology & Health Science, and Department of Biology. The person serving as Chair of the Committee shall rotate every three years, or as the Committee may otherwise decide, between the two Faculties.

Mandate of the Neuroscience Committee – The Committee will meet as needed to advise on matters related to a variety of governance issues. Central to the Committee's mandate will be review and revision of curriculum needs and initiatives, marketing, recruitment and enrolment. The Committee will also provide advice to the respective Faculties on matters related to advising, resources, and administrative support, and to the respective Deans on matters of advising, teaching assignments, TA assignments, and complement planning. An initial task of the Committee will to be to establish terms of reference (terms of membership, goals, deliverables, decision making process, communication, determine approval processes for new curriculum, resources, etc.).

Supporting Positions - The Faculties will establish two positions to directly support the Neuroscience program, one at the Faculty level and one at the staff level. A Neuroscience Program Coordinator position will be filled by a Faculty member as a service responsibility, in accordance with the Academic Administrative Positions Appendix P in the Collective Agreement for medium sized interdisciplinary programs. This position will rotate every three years between the two Faculties, or as the Committee may otherwise decide, and the Coordinator should also serve as Chair of the Neuroscience Committee simultaneously. In the short term, we also propose that the neuroscience coordinator support marketing and recruitment initiatives, serve as the course director for the newly proposed 1 credit Frontiers in Neuroscience course and facilitate students' finding a supervisor(s) for the 6 credit Neuroscience Capstone Experience course. In the longer term the neuroscience committee members can propose next steps in supporting and resourcing these courses. A Neuroscience Program Assistant will be the key supporting staff position, hired or appointed as a joint endeavor of the two Faculties. The job responsibilities associated with the Neuroscience program may start as part-time and change over time as the program matures, but we foresee that in the beginning this person will be providing academic advice, following up with student queries related to program requirements, etc. In addition to the responsibilities of the Committee listed in the preceding paragraph, the Committee will also provide advice and direction to the Program Coordinator and to the Assistant, in the latter case through the leadership of the Executive Officers of each Faculty.

Applications and Enrolments - The initial intention is to cap the program at about 70 students per entering year, allowing for ½ of the enrollees annually from each Faculty. We propose that a suitable admission GPA (e.g. 80%) to ensure over-enrollment in the program does not occur. The Committee shall deliberate on enrolment cut-offs, and both Faculties will apply the same standards and grade cut-offs for the applicant pool from their respective Faculties. If in a particular year for one of the Faculties there are not ½ the students who meet the standard or who express interest in enrolling, then the unused spots may be filled by students in the other Faculty, providing they meet the cut-off or standard established by the Committee for that year. Although all students admitted to the program will have identical neuroscience program requirements, their respective home Faculties shall remain the home Faculty and they will be responsible for satisfying their home Faculty requirements (e.g., in terms of first year course requirements).

Finances - Under the SHARP budget model, there is a default mechanism for the distribution of costs and revenues where undergraduate students from one Faculty take courses offered by another Faculty. SHARP also sets out specific costs that are borne by each Faculty in their operations. Currently, for instance, enrollment revenues (tuition and government grants) are distributed 40% to the Faculty offering the course and 60% to the student's home Faculty. It is possible that this ratio may be adjusted by the university from time-to-time, or that a different mechanism may be employed in the future. Regardless of the detail, it is important to state the underlying principle that applies in general and will apply to the Neuroscience Program, particularly in those courses created for Neuroscience using the NRSC rubric: Where two Faculties are engaged in undergraduate teaching where there is, prior to adjustment, a greater cost in one Faculty and a greater benefit in another, the costs and revenues will be adjusted so that there is a fair distribution of such costs and revenues between the two Faculties. If this principle requires an adjustment to the ratios or other mechanisms set out in the SHARP budget, then those ratios and mechanisms will indeed be adjusted accordingly. Without limiting the generality of the foregoing, this fair distribution will consider revenues from student enrollments, administrative support costs, space costs, lab costs, and teaching assignments. Where such adjustments are made, they shall be approved by the Deans of the respective Faculties in order to give effect to the fairness principle, and similarly, they shall be approved by the Central Administration for the same reason.

Academic Misconduct, Petitions, Appeals - For matters of academic misconduct in courses with established rubrics (e.g. PSYC, KINE, BIOL, etc.), students will be subjected to the process established by the Faculty that has mounted that particular course, in the usual manner. For matters of academic misconduct in courses using the new NRSC rubric – which will be a shared rubric between the two Faculties – students will be subjected to the process used by their home Faculty, either Health or Science. For petitions and appeals, students will access the system established by their home Faculty.

Appendix B: Student Survey Analysis

2900 students who had been admitted by mid-February 2014 to any program in the Faculty of Science or the Faculty of Health for the September 2014 class were sent a survey consisting of the following 5 questions:

1. How interested are you in an undergraduate program in Neuroscience? (scale 1 to 5) (continue if interest is 3 or more)

2. To what extent are you *more* interested in Neuroscience than the program to which you have currently applied? (scale 1 to 5)

3. To what extent are you interested in a minor in Neuroscience, i.e. a smaller set of courses that would complement your undergraduate program? (scale 1 to 5)

4. Are you *more* likely to accept admission to a neuroscience program than to the program you've applied to at York? (scale 1 to 5)

5. If you were to study at the graduate (MSc) level at York to what extent are you interested in a graduate diploma in Neuroscience? (scale 1 to 5)

1167 (40%) responded and of those 965 answered the first question at 3 or higher and hence were asked to continue the survey. Here we analyse the data this survey provides.

Key Findings

In general terms the survey indicates that good students (as determined by high school average) are interested in neuroscience (65% of those in the >90% range) and that 30% of such students are more likely to accept an offer of admission to a neuroscience program than to the program they applied to. Also, 30% of students who applied to a program as their second or higher choice are more likely to accept an offer of admission to neuroscience. The survey clearly indicates strong interest amongst students, and also that such a program would attract net new students, i.e. ones who would not normally have come to York.

Question 1

As can be seen from the bar charts below, 101 and 105 admittees were roughly equally interested in neuroscience with around 60% being "very" or "somewhat" interested (Figure 1.1).

This expression of interest is broken down according to choice of program at York, the student's high school average, and the program they applied to in subsequent charts.

Admittees to a program of their first choice were somewhat less interested in neuroscience than those admitted to a second, third or fourth choice program (Figure 1.2). The level of interest amongst higher choice applicants is of particular interest since neuroscience represents a way of attracting these students to York.

Figure 1.1: General interest level in neuroscience

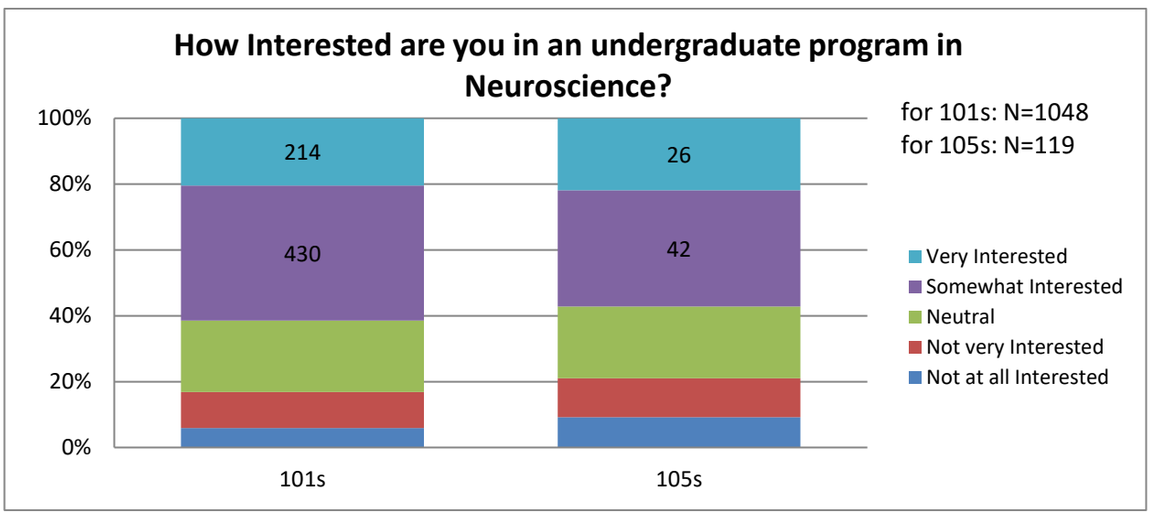
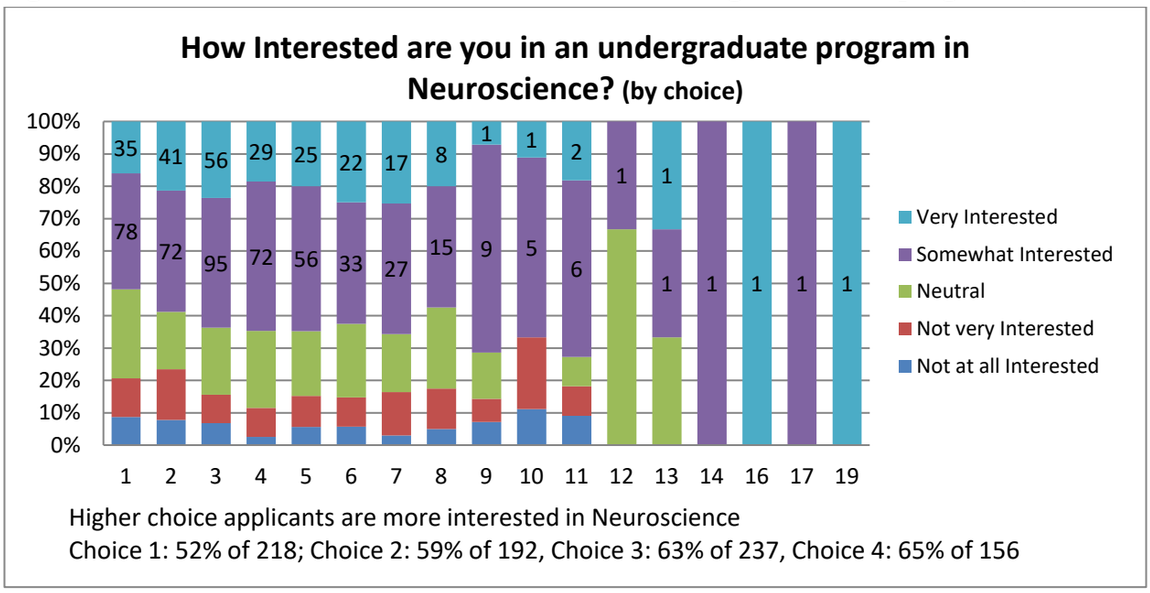
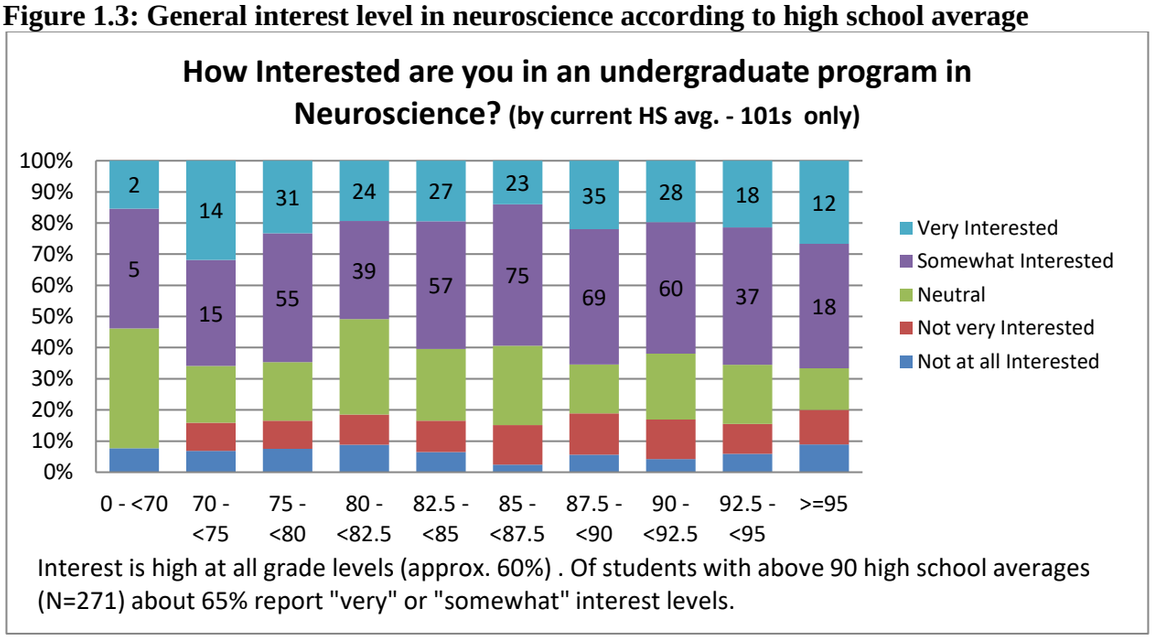


Figure 1.2: General interest level in neuroscience according to choice of program (1st, 2nd, 3rd etc.)



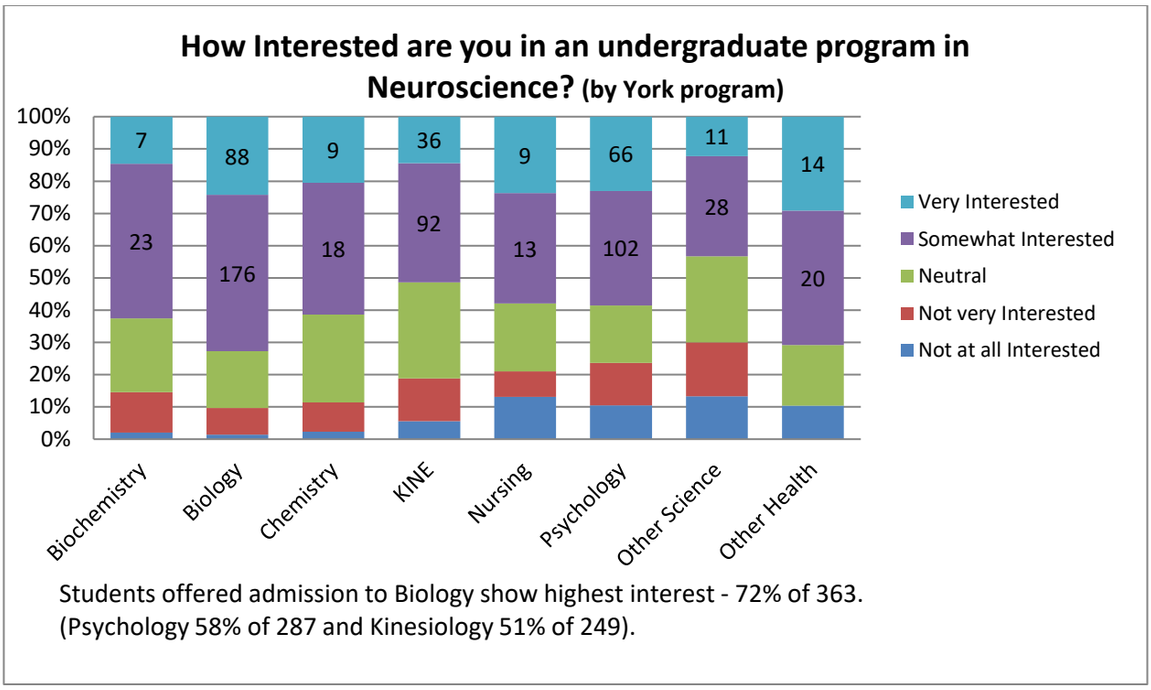
Although strong at all grade levels, interest in neuroscience is strongest amongst high performing students as can be seen in the Figure 1.3. The data here uses the student's current average which typically consists of a few (perhaps 3) final marks if the student is taking semester courses or mostly midterm marks if the courses are not semester.

Figure 1.3: General interest level in neuroscience according to high school average



When considered according to which program the student has been admitted to (Figure 1.4) we see that biology admittees are most interested in neuroscience – about 72% of 363. The lowest level of interest is amongst kinesiology admittees – about 51% of 249 students. Note that chemistry and biochemistry students are equally interested – about 60%.

Figure 1.4: General interest level in neuroscience according to program admitted to.



Question 2

Question 2 asked students if they were more interested in neuroscience than the program they had applied to. Only students who had answered question 1 at 3 (neutral) or higher were expected to continue with the survey. A total of 853 students answered this question.

When examined according to program choice (Figure 2.1) we see that about 26% of those admitted to their 1st choice program are “very” or “somewhat” more interested in neuroscience. This percentage increases to around 50% for those admitted to their 5th or 6th choice programs. At choices 3, 4, 5, 6 and 7 there are 528 admittees and of these 223 (42%) are more interested in neuroscience than the program they applied to.

This can be interpreted to mean that York might better convert such higher choice admittees if they had been admitted to a neuroscience program. It also suggests that internal poaching of students from existing programs to neuroscience will likely be limited.

Figure 2.1: More interest in neuroscience according to choice.

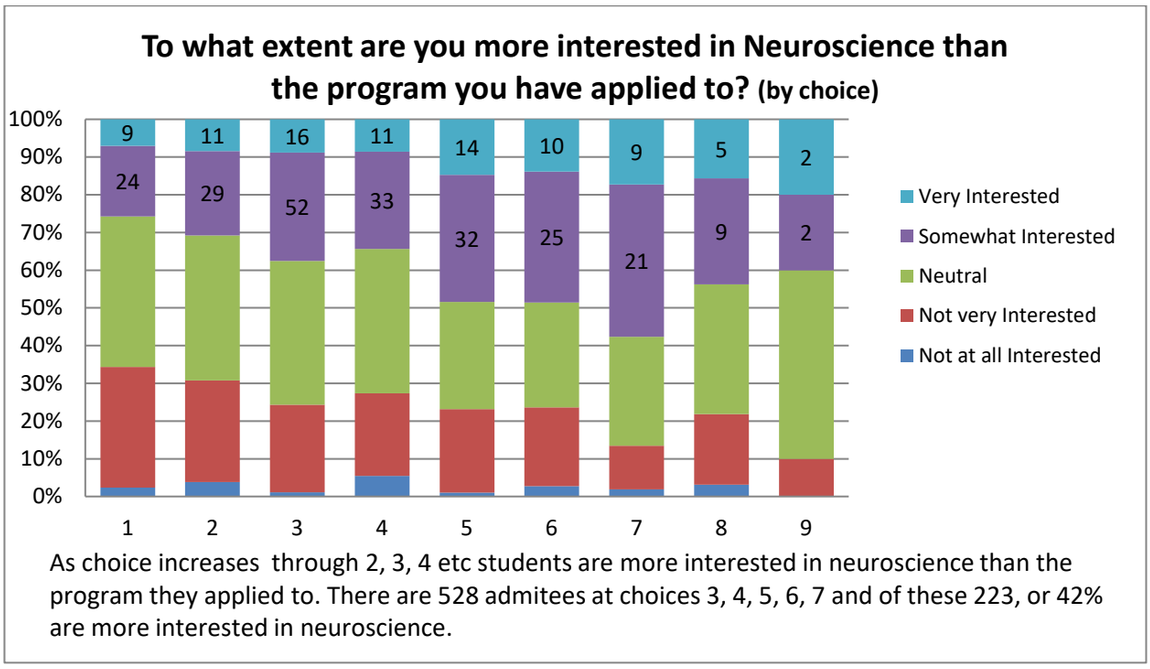


Figure 2.2 examines this question according to the high school average of the student. Generally around 40% are more interested in neuroscience than the program they applied to across the spread of high school performance. However, in the 95+ group (36 students) this rises to 50%. Note that there are 220 students with averages of 90 or better and 93 of those are more interested in neuroscience.

Figure 2.2: More interest in neuroscience according to high school average.

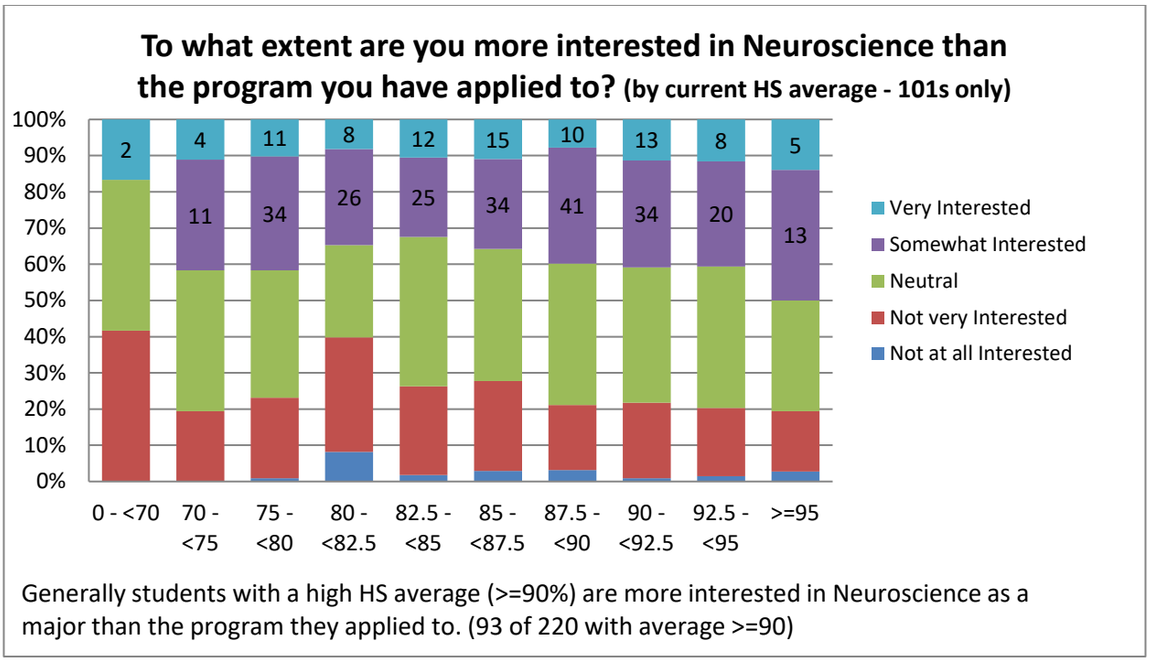
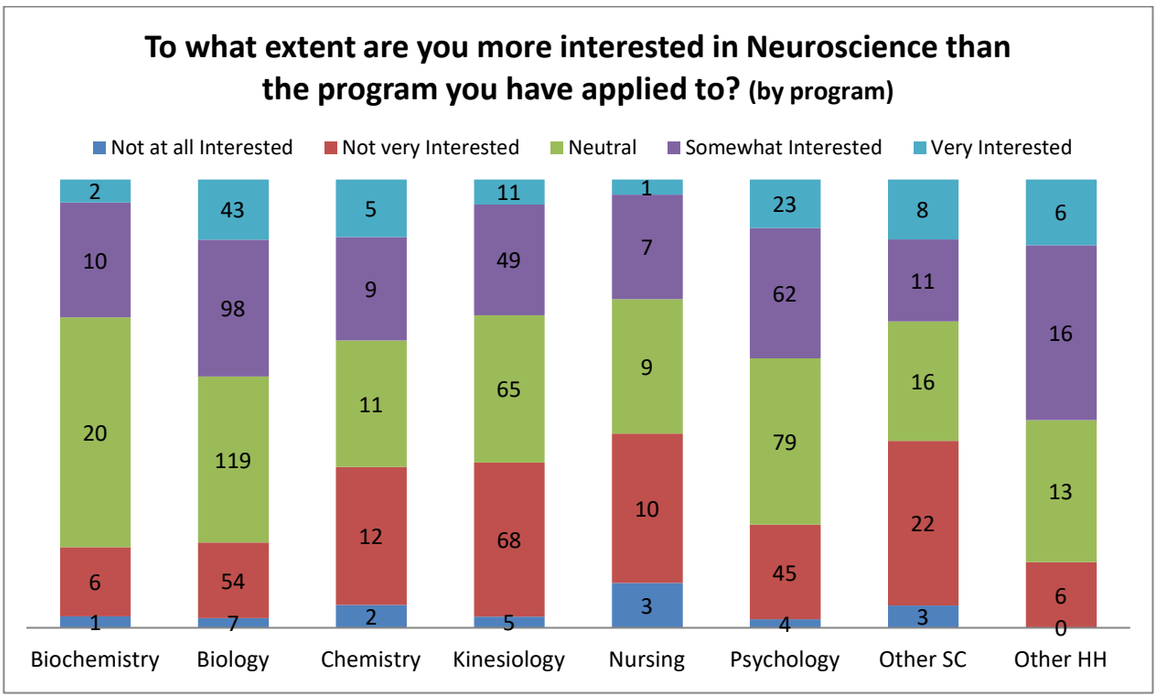


Figure 2.3 examines this question according to the program the respondent has been admitted to. 44% of 321 biology admittees are "very" or "somewhat" more interested in neuroscience than biology; 30% of 198 kinesiology admittees are "very" or "somewhat" more interested in neuroscience than kinesiology; and 40% of psychology are "very" or "somewhat" more interested in neuroscience than psychology.

Figure 2.3: More interest in neuroscience - according to program.



Remember that the respondents span all choice values, i.e. the 44% of biology admitees will include 3rd, 4th ad 5th choice (etc.) applicants.

Question 3

Question 3 asked student if they were interested in a minor in neuroscience. The minor was described as a smaller set of courses that would complement an undergraduate program. It was not made clear that at York major minor combinations are typically different subjects, nor if combinations such as a biology major with a neuroscience minor would be permitted. So this question should be interpreted as an expression of interest in say a stream consisting of a smaller set of courses than a major. A total of 846 students answered this question.

There is strong interest in such an option at all choices, as can be seen in Figure 3.1. At higher choice levels some 80%, of respondents are “very” or “somewhat” interested in a neuroscience “minor”! Besides the implications for recruitment this data suggests that any new (specialized) neuroscience courses are likely to be also in demand by non-neuroscience majors. It may be feasible that non-laboratory (resource intensive) courses be open to some non-neuroscience majors.

Figure 3.1: Interest in a minor - according to choice.

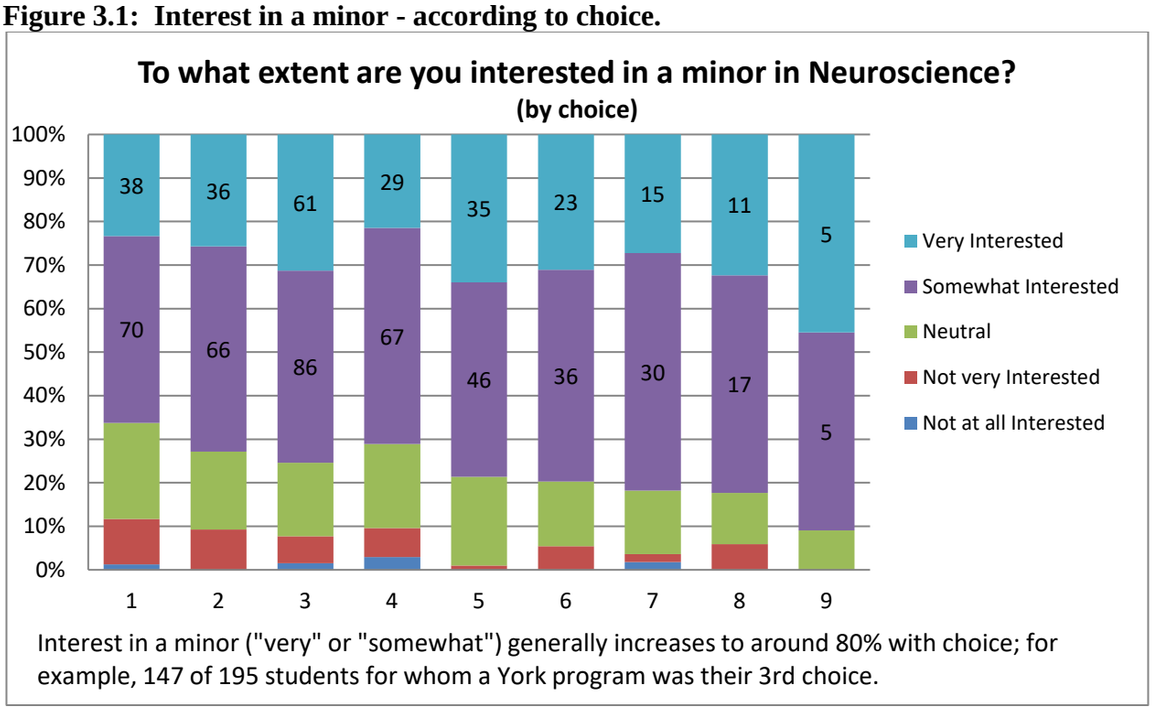


Figure 3.2: Interest in a minor - according to high school average.

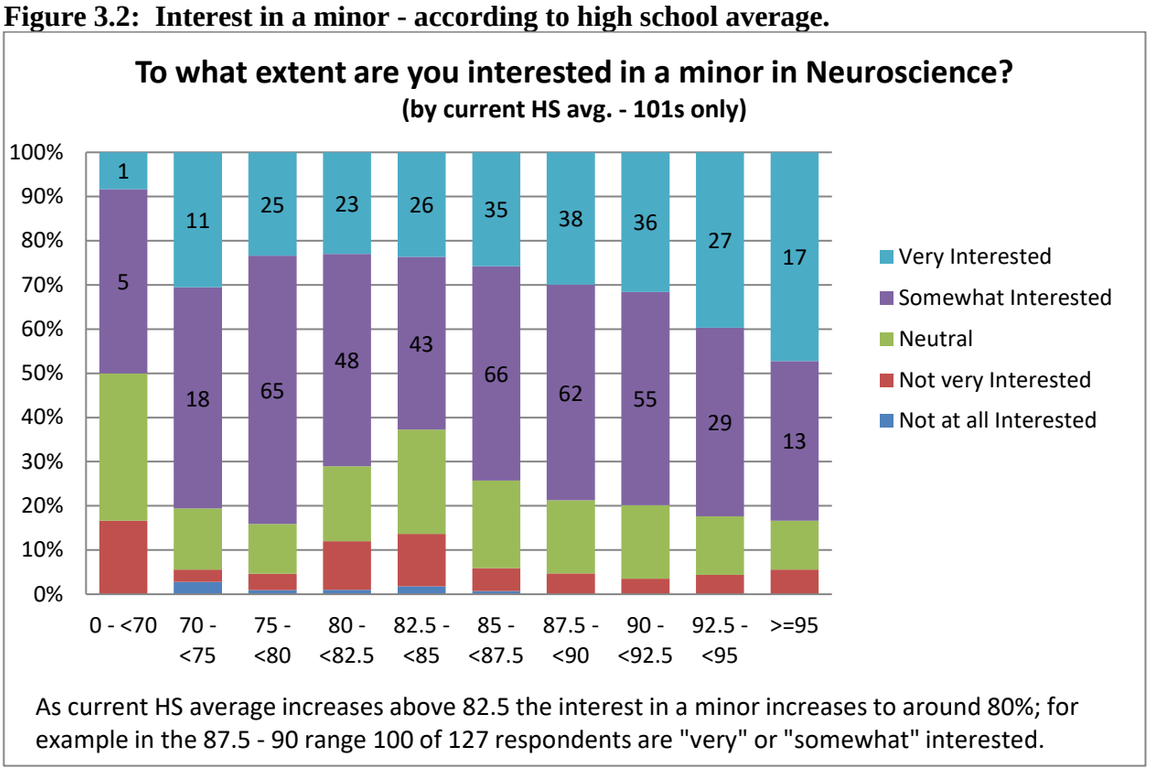
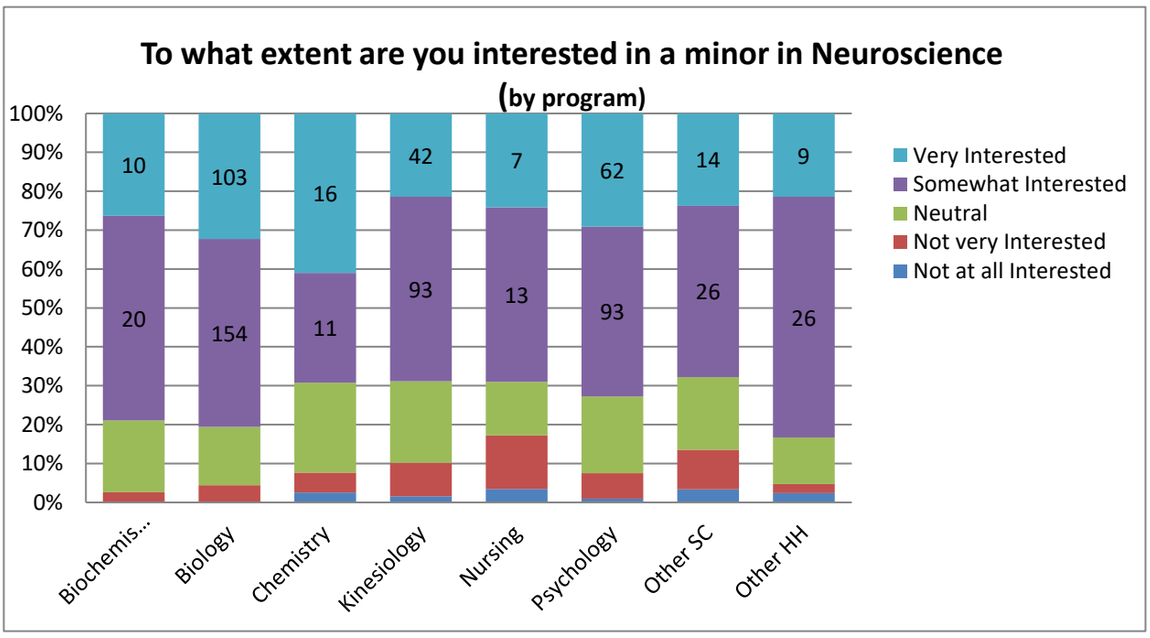


Figure 3.2 (above) shows similar results for interest in a “minor” according to high school average. Generally, interest at the “very” plus “somewhat” is in the 80% range.

Students who have been admitted to the biology or biochemistry programs indicate interest in the minor at the 80% level, whereas the other larger programs are at the 70% level. This is shown in Figure 3.3. It is interesting to note that students outside of biology, psychology and kinesiology indicate a high level of interest in a minor.

Figure 3.3: Interest in a minor - according to program.



Question 4

This question asks if the student is *more* likely to accept admission to a neuroscience program than to the program they had applied to at York. The question is pertinent to the recruitment objective, particularly for non-first choice applicants; it is also pertinent to the possibility of poaching students from other programs who would come to York anyway.

Figure 4.1 shows the data according to the admittees choice. For those admitted to a program of their 1st choice about 21% respond that they are “very” or “somewhat” more likely to accept admission to a neuroscience program. This increases to about 28% for 2nd and 3rd choice admittees, 31% for 4th choice and 40% for 5th choice. This is a promising result in terms of restricted poaching and recruitment efficacy.

Figure 4.1: More likely to accept - according to choice.

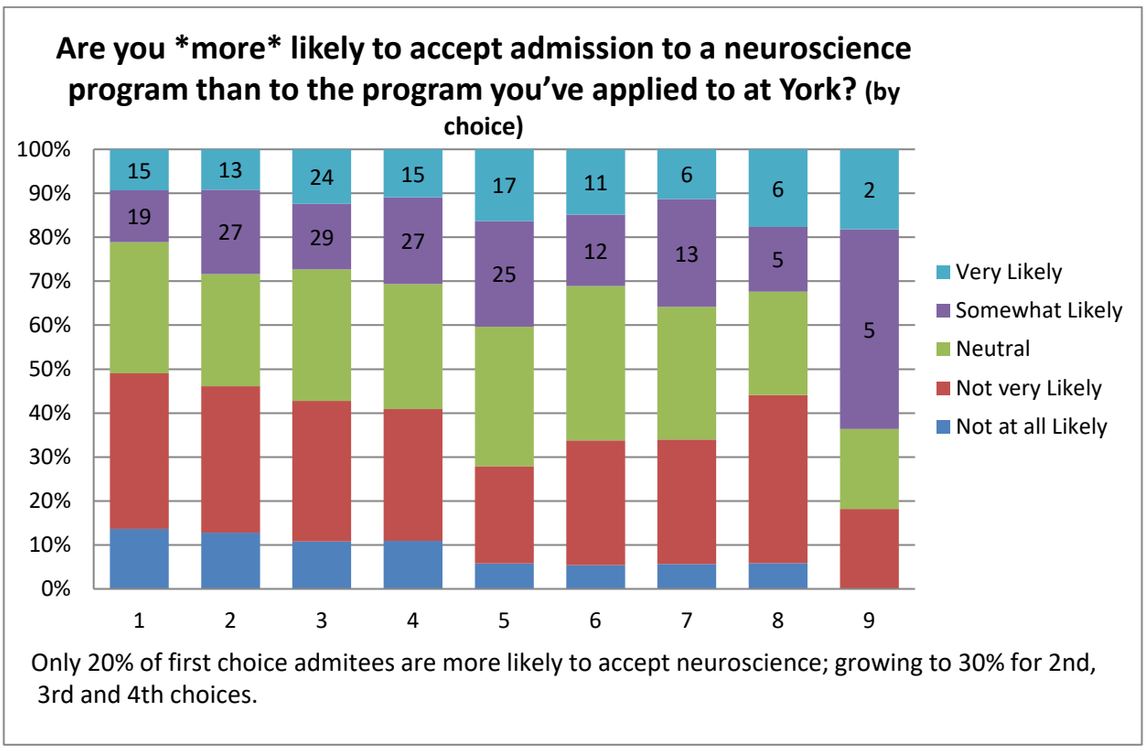


Figure 4.2: More likely to accept - according to current high school average.

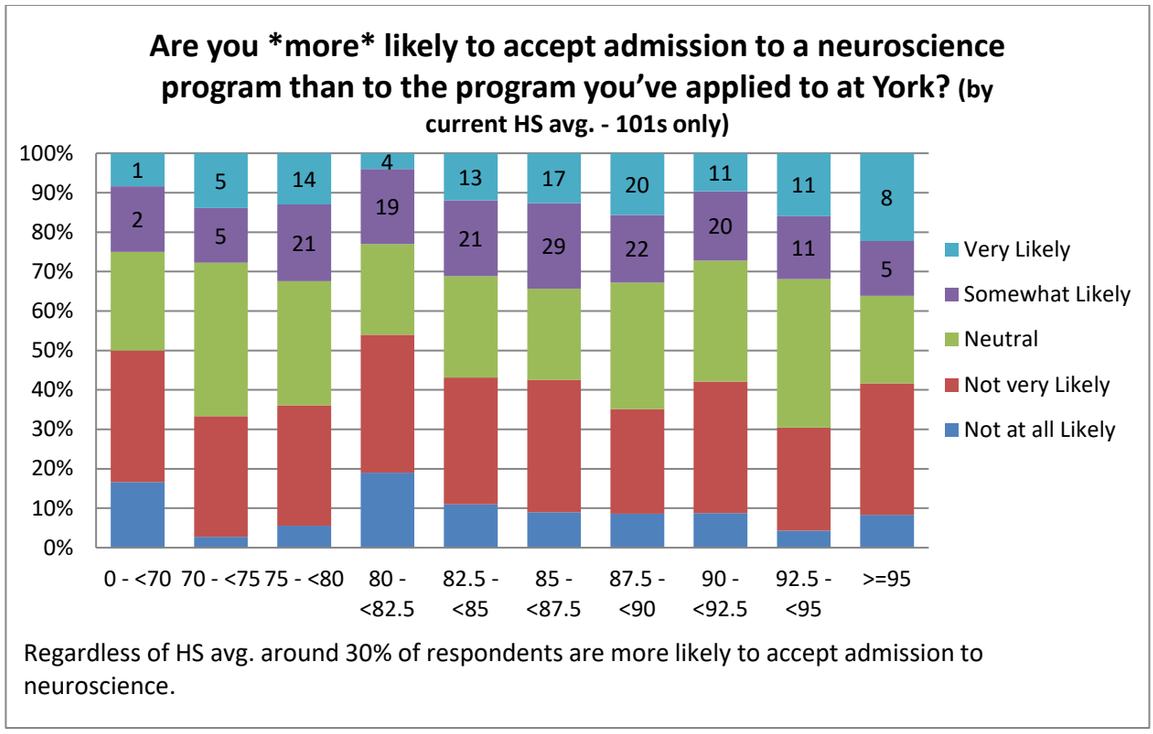
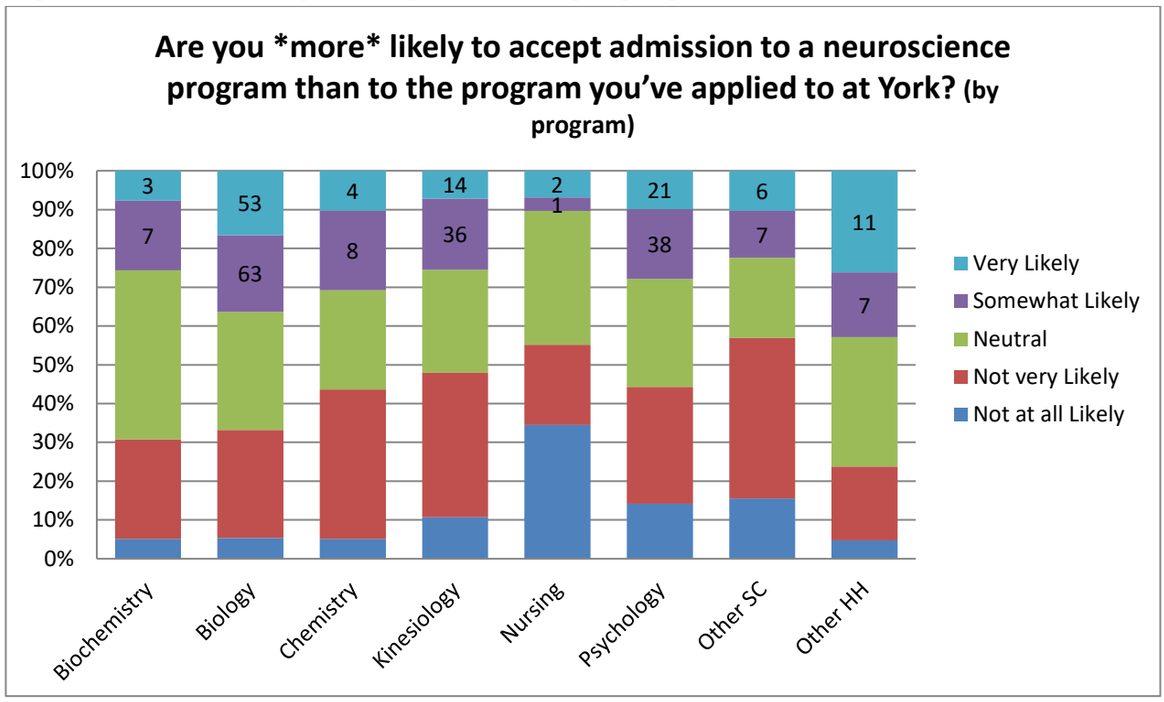


Figure 4.2 (above) shows the responses to this question according to current high school average. In general responses in the "very" plus "somewhat" range do not vary with high school average. However, although the numbers are small, it is interesting to note that "very" likely to accept responses do increase in the above 90% range.

Around 37% of respondents admitted to biology report being "very" or "somewhat" more likely to accept admission to neuroscience. This can be seen in Figure 4.3a. For psychology and kinesiology the figures are about 28% and 25% respectively.

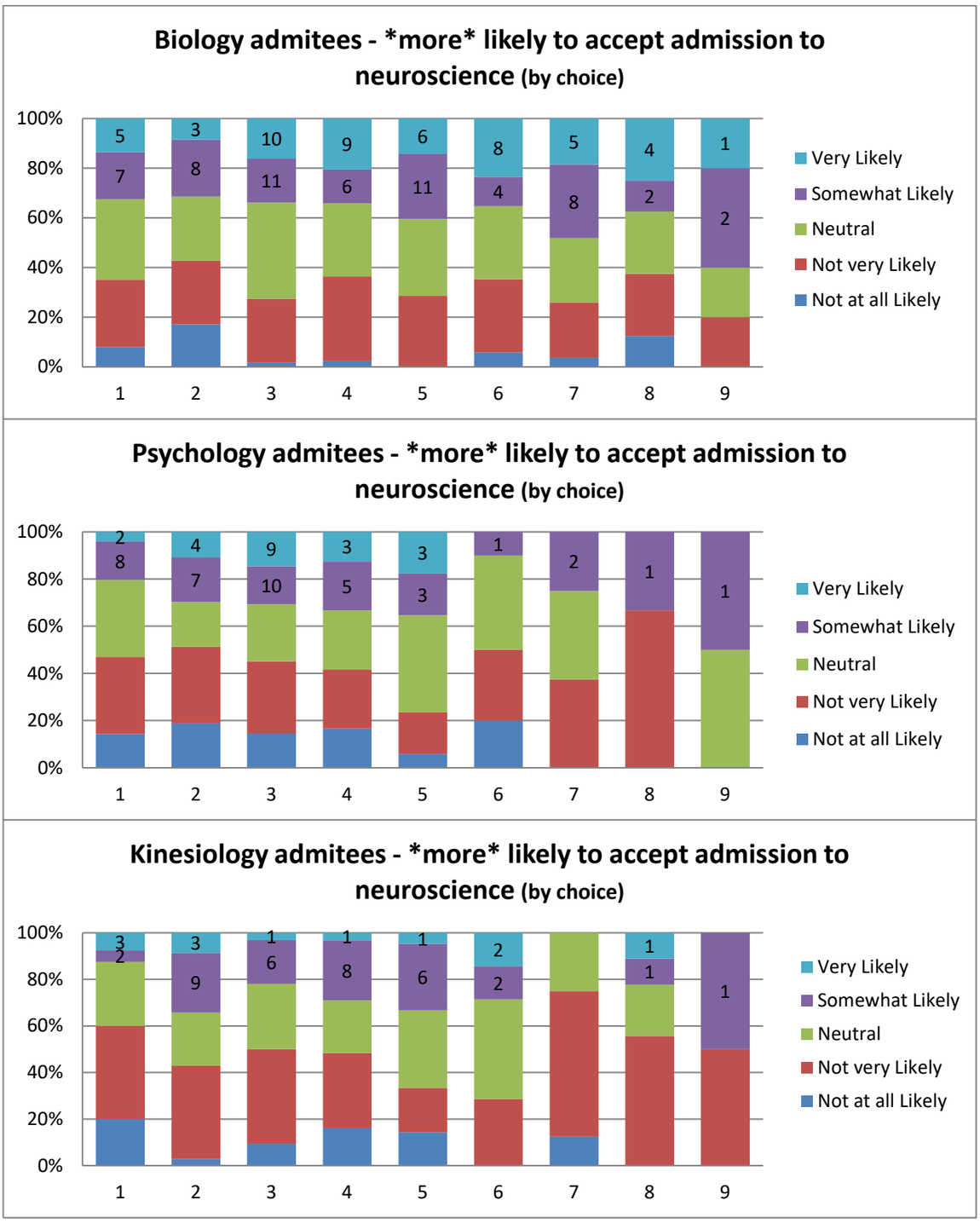
Figure 4.3a: More likely to accept - according to program.



To better understand to what extent "poaching" is likely to occur the data for these three programs – biology, psychology and kinesiology – is examined separately according to choice. The charts of Figure 4.3b show the results.

For biology around 30% of 1st choice admittees are "very" or "somewhat" more likely to accept admission to neuroscience. This increases to around 40% for 5th choice admittees. For psychology admittees around 20% of 1st choice admittees report being "very" or "somewhat" more likely to accept admission to neuroscience and this increase to around 36% through to 5th choice admittees. For kinesiology the figures are around 11% for 1st choice increase to around 32% through to 5th choice admittees.

Figure 4.3b: For Biology, Psychology and Kinesiology admittees - more likely to accept according to choice.



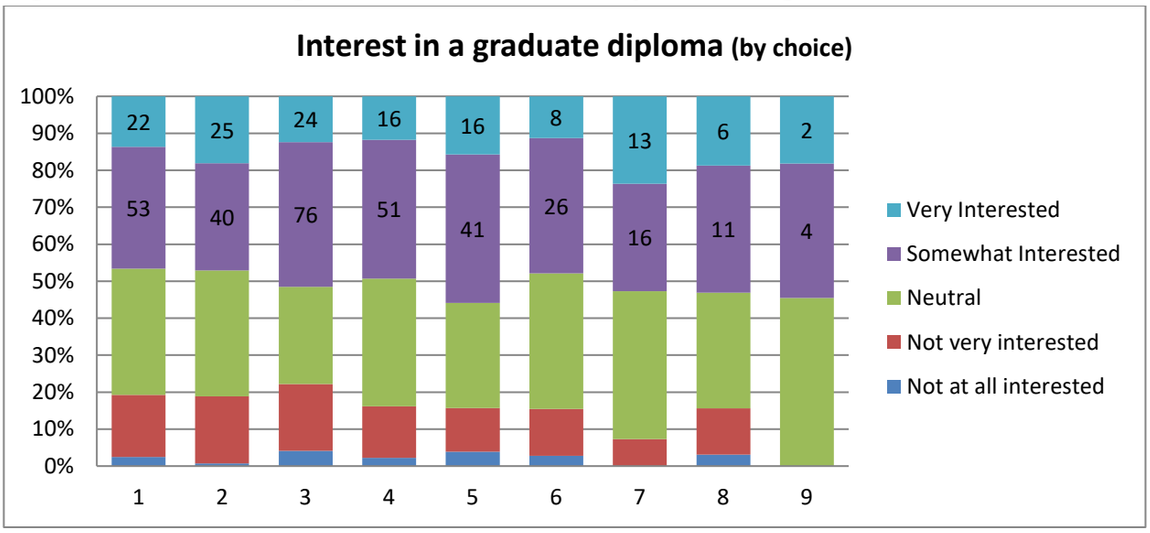
Although some "poaching" is to be expected, the data indicates that the recruitment objective is also attainable. Students who place their chosen program at York fairly low in their choice (e.g., above 5th choice) and who often accept their offer at a lower conversion rate are more likely to accept an offer of admission to a neuroscience program.

Question 5

This question asks to what extent, if the student was to study at the graduate level, are they interested in a graduate diploma in neuroscience. The definition of a "graduate diploma" was not provided and hence the responses should be taken as a general expression of interest in graduate level studies in neuroscience.

Figure 5.1 shows around 15 to 20% of respondents are "very" interested in graduate-level neuroscience. A further 35% or so are "somewhat" interested.

Figure 5.1: Interest in graduate neuroscience study - according to choice.



Figures 5.2 and 5.3 show responses to the same question according to high school average and York program to which the respondent has been admitted.

Roughly 15% are “very” interested across the range of high school averages and around 35% are “somewhat” interested.

Around 18% of biology and psychology admittees are “very” interested compared with around 9% of kinesiology admittees. Around 40% of biology admittees are “somewhat” interested compared with around 35% of psychology admittees and 30% of kinesiology admittees.

At this early stage in their post-secondary education there appears to be strong interest in neuroscience as a field of graduate-level study.

Figure 5.2: Interest in graduate neuroscience study - according to high school average.

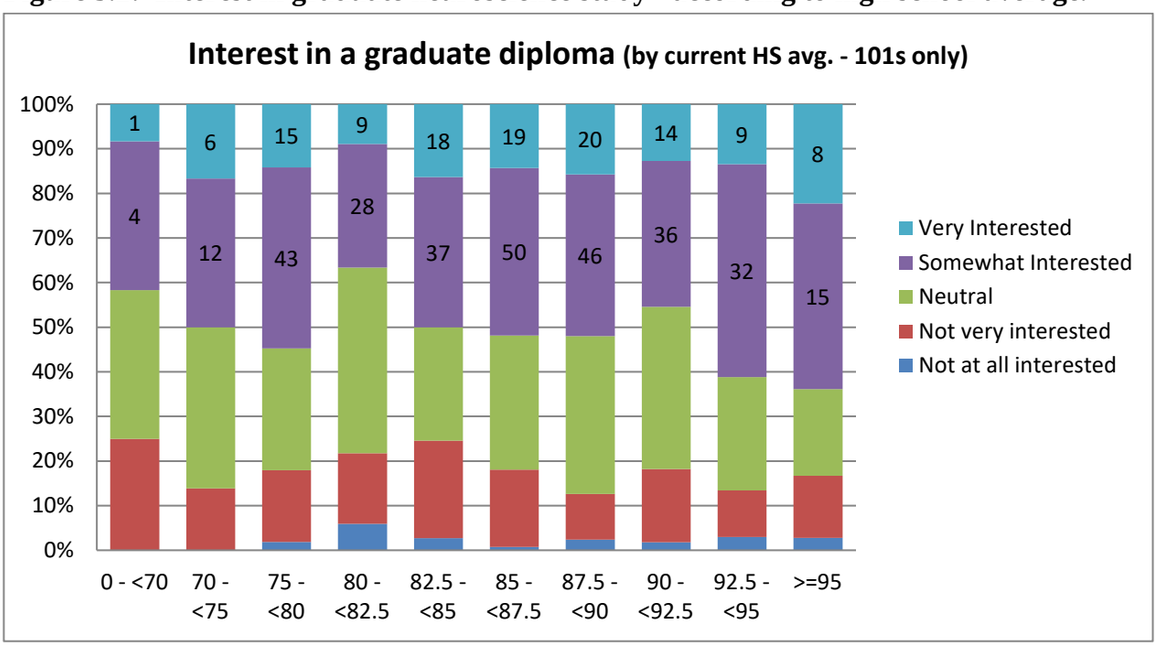
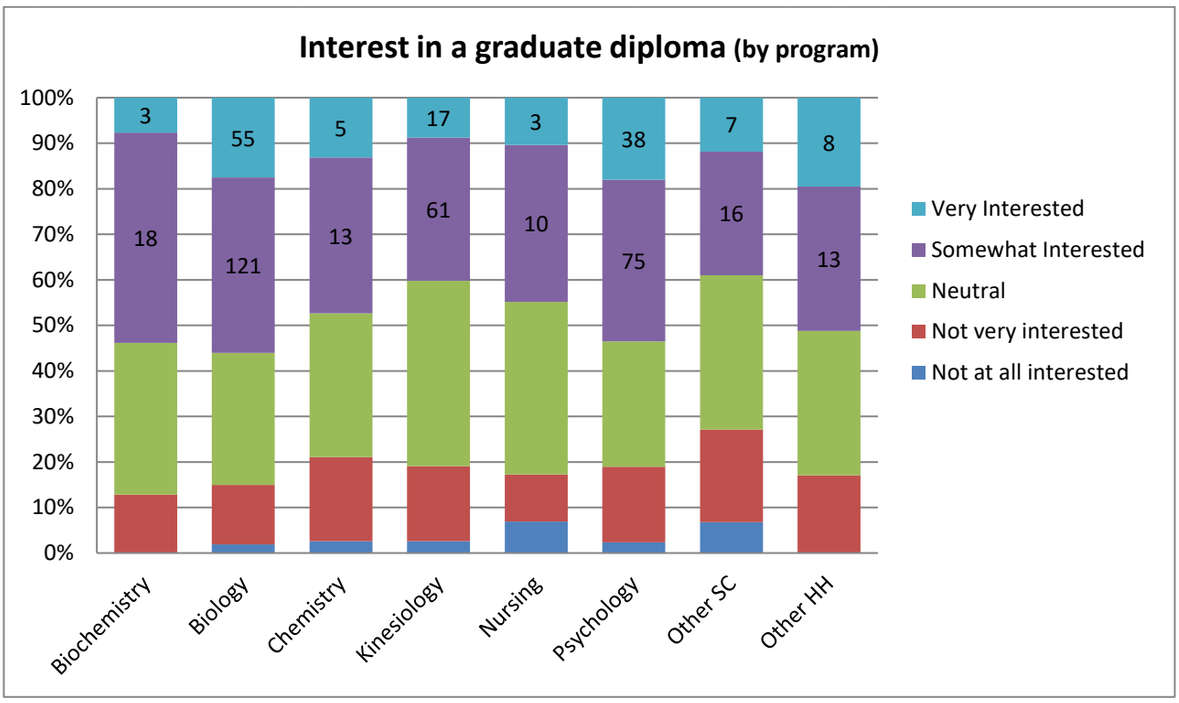


Figure 5.3: Interest in graduate neuroscience study - according to program.



Appendix C –New Course Proposals Summary and Details

Seven new course proposals are attached. Efforts have been made to design these courses in such a way to contribute to and fulfill program level objectives. In an effort to differentiate the proposed new courses within the Neuroscience degree from potentially similar courses/degrees offered by other universities, and become an attractor for high quality students, technology enhanced learning and experiential education were included where appropriate. There is one support statement provided from Learning Technology Services for all the new courses.

Overview

1. NRSC 1001 1.00 ***Frontiers of Neuroscience***

Introduces the breadth of research directions of faculty members at York University within the field of neuroscience. Familiarizes students with professionalism, research ethics, and explores neuroscience related facilities and organizations in the wider community.

2. NRSC 2000 3.00 ***Fundamental Molecular and Cellular Neuroscience***

Survey of the key areas of neuroscience including a historic perspective, gross anatomy and histology of the nervous system, development of the nervous system, molecular and cellular neuroscience, and neurological disorders. Introduces methodologies of research and experimentation in neuroscience.

3. NRSC 2100 3.00 ***Systems, Behavioural, and Cognitive Neuroscience***

Explores the structure and function of the human brain. Topics include the organization of the central nervous system, the function and neural basis of sensory and movement systems, consciousness, language, thought and memory.

4. NRSC 2200 3.00 ***Neuroscience Techniques***

Provides students with an overview of and exposure to experimentation techniques and methodologies in the fields of systems and cognitive, cellular and molecular, and computational and theoretical neuroscience. These could include any of the following: EEG, fMRI, behavioural methods such as psychophysics and eye/body tracking, electrophysiology, patch and dynamic clamp, transgenic mouse technology, molecular imaging, neuronal coding and communication, neuronal networks, and brain-machine interfaces.

5. NRSC 3000 3.00 ***Molecular and Cellular Basis of Perception and Cognition***

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

6. NRSC 4000 6.00 & NRSC 4002 6.00 ***Neuroscience Capstone Experience***

A Capstone neuroscience research project under the supervision of a neuroscience core/affiliated faculty member. An individual or team-based intensive research project engaged in a laboratory, or in the community (industry, hospital), leading to the creation of an original piece of research, final written paper, as well as an oral presentation to the neuroscience community at York.

health | YORK UNIVERSITÉ UNIVERSITY

New Course Proposal Form
Faculty of Health Curriculum Committee

School/Department: Biology, Psychology, Kinesiology, and Health Science

Course Number Information:

Faculty: HH **Rubric:** NRSC (i.e. HLST) **Course #:** 1001 **Weight:** 1.0 (i.e. 3.00, 6.00 or 0.00)

Effective Session for Change: **Term:** Fall/Winter (i.e. Fall, Fall/Winter, Winter) **Year:** 2020 (i.e. 2017-18, 2018)

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

Frontiers of Neuroscience

Short Title: **Maximum 40 characters**, including punctuation and spaces. The short title appears on any documents where space is limited (transcripts and lecture schedules).

Frontiers of Neuroscience

Brief Course Description: For editorial consistency, verbs should be in the present tense and begin the description; e.g., "Analyzes the nature and extent of...," rather than "This course will analyze..." or “This course analyzes…”.

This is the official description of the course as it will appear in the Undergraduate Calendar. The course description should be carefully written to convey what the course is about. If applicable, include information regarding the language of instruction if other than English.

Introduces the breadth of research directions of faculty members at York University within the field of neuroscience. Familiarizes students with professionalism, research ethics, and explores neuroscience related facilities and organizations in the wider community.

- **List course(s) where applicable:**

Integration†:		Course Credit Exclusions*:	
Prerequisites:		Cross-listed to:	
Corequisites:			

†Integrated courses are graduate courses integrated (taught with) 4000-level undergraduate courses

*Course credit exclusion is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both.

- Include the following information only if the course is: limited to a specific group of students; closed to a specific group of students; if there is any additional information necessary for students to know before enrolling (notes); if the course includes experiential education, and whether the students will work with a community partner and/or if it will involve going off-campus.

Open to:	Honours and Specialized Honours BSc students
Not open to	
Notes:	This course is expected to be completed within the first 30 credits of study but if needed students can be given the opportunity to enroll in this course if they have not yet completed 60 credits.

- **Science Course:**

	YES	NO
Denotes courses in KINE or PSYC to count as science credit for BSc degree programs	X	

Expanded Course Description

- Please provide a detailed course description that effectively conveys what this course is about. Please ensure that this description includes but is not limited to: 1) course topics/theories; 2) course learning objectives; 3) course learning outcomes; and 4) a description of any experiential education (EE) and/or technology-enhanced learning (also referred to as eLearning) activities.

Term	Definition
Course Learning Objectives	Statements of the overall learning and teaching goals for the course and represent what the instructor would expect students to learn and retain in the course. They articulate what the teacher plans to achieve in the course.
Learning Outcomes	Statements of what the student will achieve by the end of the course. They provide a framework for assessment by stating what you expect the learners to be able to demonstrate after completing the course. A succinct learning outcome specifies the tasks students are expected to be able to perform and the level of competence expected for the tasks.
Experiential Education (EE)	The blending of theory/course work with concrete experience. Effective EE activities require students to reflect on and demonstrate their understanding of the relationship(s) between theory/course work and concrete experience.
Structured Reflection	Structured reflection is any planned activity or exercise that requires students to refer back and critically examine the concrete experience in light of existing theory and/or what is being covered in the course.
Technology-Enhanced Learning (eLearning)	The use of technology to support students' interaction: with and access to the content; to course learning activities; and with other students and faculty members in order to develop knowledge and skills

Refer to the last page of the course proposal for resources on course learning objectives and outcomes, experiential education and technology-enhanced learning.

1) Neuroscience is an exciting and wide-ranging discipline, many of the topics will not be introduced in any technical depth until upper year courses.

This course has been designed to expose students to a sampling of research topics in neuroscience. It is organized around a series of invited talks by individual researchers and research groups, a number of laboratory tours, and other events that will introduce students to specific research directions in neuroscience, issues related to professionalism and ethics in science, and opportunities to become engaged with different research and technical groups and events related to neuroscience.

Formally, the course will consist of 12 one-hour presentations spread over two terms. The first presentation will describe the logistics of the course, provide information about the neuroscience degree, and answer student's questions about the neuroscience degree. The remaining 11 presentations will be invited talks by researchers (or research groups), and/or representatives of other groups associated with neuroscience such as research ethics, the Ontario Brain Institute, and the Krembil Neuroscience Centre.

In addition to these 12 formal meetings, a set of extracurricular events will also be organized including research lab tours, visits to off-campus labs and facilities, etc.

This course is offered on a pass-fail basis only.

2) Course Learning Objectives:

- Introduce students to the main areas of study in neuroscience
- Present a variety of different research directions in the field of neuroscience
- Facilitate discussions between students and researchers and other members of the (York) neuroscience community
- Provide information about the purpose and function of research ethics

3) Expected Learning Outcomes: Students who have passed this course will be expected to be able to

- Recognize the main areas of study in neuroscience.
- Identify five different research directions in neuroscience and describe one briefly.

- Describe the research activities of one neuroscientist at York and/or a research member of community organization (e.g. neuroscience research center).
- Explain the purpose and function of research ethics

4) Experiential education is described in more detail in the next section.

Experiential Education/Technology-Enhanced Learning

EE remains a top priority for York University and the Faculty of Health as it offers a range of benefits for students related to academic performance, civic engagement and employability (for more information on the benefits of EE for students and course directors, please go to: **http://health.yorku.ca/experiential-education/faculty/**. Course directors are invited to integrate EE into their course where possible, but it is understood that some EE strategies may not be feasible in every course.

Course proposals with EE must be reviewed by Andra Petro, EE Coordinator (apetro@yorku.ca) prior to the submission of the proposal to the Faculty of Health Curriculum Committee.

• ***Please indicate (X) if the course uses any EE and/or technology-enhanced learning?***	***YES***	***X***	***NO***	
• ***If NOT, please outline some of the reasons EE or technology-enhanced learning could not be incorporated the course.***				
• ***If YES, please indicate (X) whether your course will include one or more of the following types of EE and technology-enhanced learning. Refer to York's Common Language for Experiential Education for complete definitions and further details.***				
X	***Classroom based (e.g. guest speakers, role playing, visual media, case studies, simulations, workshops and laboratory, course-based research etc.)***			
X	***Community based (e.g. community-based learning; community-based research; community service learning)***			
	Work focused (e.g. placement/practicum)			
Please outline how you plan to engage students in reflection (critically examining a concrete experience) around the EE activities described above.				

Experiential education:
In class, students will choose one in-class presentation by a guest speaker and write and hand in a one-minute paper answering the question “What was the most important concept they learned from the guest speaker?”, and/or “What would they like to learn more about?”. Although potentially not requiring students to engage in deep reflection, this one-minute paper is an opportunity for students to examine their experiences in terms of what they have learned so far and to identify potential areas for further exploration both in the course and throughout their time in the neuroscience degree program.

In community, as part of the organized series of extracurricular events, students (in groups) will interview 2 different neuroscientists from the community of neuroscientists at York and in the GTA. Questions posed could be “what type of neuroscience research questions he/she is trying to answer, how they go about answering their research questions, what have they discovered”. Then students will be asked to choose one interview and write a critical reflection paper describing: What (what did they learn about the research direction), so what (why does this research direction matter to them and to the field of neuroscience), and what now (identify at least one belief/attitude/action that they think they could apply, do better, or do differently as a result of what they learned about the neuroscience research). The community-based elements of this course will help students begin to understand the place and purpose of research in neuroscience while also exposing them to the current context of how research is conducted in the field.

Technology enhanced learning:
The learning management system (Moodle) will be used to build a forum for the cohort of students to engage together online. The Moodle course will be the space where students submit their one-minute paper and their reflection paper, ask questions, and coordinate off campus visits. Online mini quizzes using multiple-choice questions will formatively evaluate the students’ knowledge of the main areas of study in neuroscience and research ethics. If applicable, recordings using lecture capture technology of the monthly presentations can be made available for students. Students will also have access to Adobe connect or Zoom (video conferencing software) to hold their interviews with the neuroscientists.

Instruction/Course Format

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

  - Offered every year.

- ***Number of School/Department members currently competent to teach the course.***

Many (any core or affiliated neuroscience faculty members).

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

Any faculty member associated with the Neuroscience program could be the course director. But we recommend that the faculty member who becomes the Neuroscience program coordinator takes on the responsibility of being the course director.

- ***An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved. This information is required to indicate whether an effective length of term is being maintained.***

  - Twelve 1-hour presentations once a month of which the student must attend 10
  - 4 extra-curricular events distributed over the two terms of which students must engage in 2.

- ***In absence of scheduled contact hours, please provide an indication of the estimated time students are likely to spend engaged in learning activities required by the course.***

Estimated time to engage in learning activities will probably be about 5 hours a month.

- ***In the absence of scheduled contact hours, please indicate how the course design encourages student engagement and supports students in achieving the learning objectives.***

This course seeks to engage students in the broader culture of neuroscience with specific emphasis on research initiatives within the University (and elsewhere in Ontario) and to build a cohort of interested students. Students will be exposed to a set of organized presentations (approximately one hour in length) that will focus on research directions of faculty and groups within the university potentially outlining connections between their research, and where the students will learn more about the neuroscience field being discussed in the curriculum. Presentations may also be provided by outside researchers, outside professional groups, and relevant outside volunteer organizations.

Student engagement will be encouraged through the Moodle site, monthly presentations, and extracurricular activities on and off campus. The extra-curricular events will vary from term to term but are likely to include tours of specific research labs at York and other locations, and tours of hospital sites of particular interest to neuroscience students. Learning outcomes will be achieved by attending and contributing the 1-minute paper, engaging in critical reflection, and completing the mini-quizzes online.

Evaluation:

1. ***Please provide a detailed description of the basis of evaluation for the proposed course, including the type and percentage value of each assignment.***

Evaluation is on a pass/fail basis.

Students must achieve 15 points in order to obtain a pass. Points are assigned as follows:

- 1 point is assigned for attendance at each presentation of which the student must attend 10 (for a maximum of 10 points)
- 2 points are assigned for attending at least 2 extra-curricular activities
- 1 point for handing in a one-minute paper
- 2 points for their critical reflection (0 assigned for below benchmark, 1 for reaching benchmark, 2 assigned for mastery (see for definitions of critical reflection http://health.yorku.ca/experiential-education/faculty/#squelch-taas-tab-content-1-6)
- 1 bonus point is assigned for assisting in hosting a speaker. Hosting includes introducing the speaker, organizing questions afterwards, thanking the speaker, and publishing (with approval by the course director) an on-line summary of the speaker's comments.

2. If the course is to be integrated (i.e., graduate/undergraduate), please list the additional evaluation requirements for graduate students.

n/a

3. If the proposed course is employs technology-enhanced forms of delivery (i.e., non "face-to-face", please identify how the integrity of learning evaluation will be maintained (will "on-site" examinations be required, etc.)

n/a

Other Resources:

1. Please provide a statement regarding the adequacy of physical resources (equipment, space, etc.). As well, please indicate if any other resources are required. Approval of a new course will be considered only if adequate resources are available to support the course.

Lecture hall to host the presentations for about 60-70 students will be required.

2. If there is a technology-enhanced component to the course, a statement is required from the Learning Technology Services indicating whether resources are adequate to support the course. Requests for

statements can directed to Rob Finlayson (rfinlays@yorku.ca). Please note, it will take two weeks to get a statement of support.

Course Rationale:

1. ***How will the course contribute to the educational objectives of the School/Department and of the Faculty?***

An educational objective of both Faculties is to create a high impact experience for their students in the upper years. The goal of this course is to raise awareness and to present students with a wide introduction to ongoing research initiatives in neuroscience and ultimately create the opportunity for that high impact experience. Much of the neuroscience content is expanded on explicitly in third-and-fourth year courses across the Kinesiology & Health Science, Biology, and Psychology programs, but are not often addressed in lower year courses, which concentrate on fundamentals. By introducing these neuroscience topics in the first year, it is anticipated that students will at least be made aware of the possible neuroscience streams of courses that they can select as their chosen or alternative streams while at the same time introducing students to neuroscience researchers that could end up supervising them for their Capstone course experience. This course is the beginning of the neuroscience program being able to contribute to research intensification within the programs.

2. ***What is the relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content? If overlap exists, please indicate the nature and extent of consultation which has taken place. If the course is to be cross-listed, integrated or listed as a course credit exclusion with another course, approval is required from all the relevant Faculties/units.***

There is no overlap with other courses.

3. ***If applicable, please indicate the relationship of the proposed course to interdisciplinary programs; i.e. for which interdisciplinary program(s) will the course count for major/minor credit. As well, please indicate the nature and extent of consultation that has taken place with the relevant interdisciplinary program coordinator(s).***

n/a

4. ***What is the expected enrolment in the course?***

Expected enrolment is roughly 60-70.

Bibliography:

Please list the <u>required readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.).

Each invited speaker will be asked if they wish to provide a selected reading for those students who want to learn more about their area. Any readings will be made available on the Moodle course site

Please list any <u>suggested readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.)

This will depend on the speaker invited.

Please list any <u>online resources</u> for the course (please include complete bibliographical information as above).

n/a

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

n/a

Library Support Statement:

Proposals for new courses must include a **library support statement** from the Bibliographer responsible for the relevant discipline to indicate whether resources are adequate to support the course. To request a support statement, see the list of subject and liaison librarians at http://www.library.yorku.ca/web/about-us/contact-us/liaison-librarians/.

Consultation/Approval:

- The Faculty of Health Curriculum Committee will only consider new course proposals that have been approved by the unit responsible for offering the course.
- If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

Course Number Information:

Faculty:	Rubric: (i.e. HLST)	Course #:	Weight: (i.e. 3.00, 6.00 or 0.00)
HH	NRSC	2000	3.0

Effective Session for Change: Term: (i.e. Fall, Fall/Winter, Winter)	Year: (i.e. 2017-18, 2018)
Fall	2021

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

Fundamental Molecular and Cellular Neuroscience

Short Title: <u>Maximum 40 characters</u>, including punctuation and spaces. The short title appears on any documents where space is limited (transcripts and lecture schedules).

Molecular and Cellular Neuroscience

Brief Course Description: For editorial consistency, verbs should be in the present tense and begin the description; e.g., "Analyzes the nature and extent of...," rather than "This course will analyze..." or “This course analyzes…”.

This is the official description of the course as it will appear in the Undergraduate Calendar. The course description should be carefully written to convey what the course is about. If applicable, include information regarding the language of instruction if other than English.

Survey of the key areas of neuroscience including a historic perspective, gross anatomy and histology of the nervous system, development of the nervous system, molecular and cellular neuroscience, and neurological disorders. Introduces methodologies of research and experimentation in neuroscience.

- **List course(s) where applicable:**

Integration†:		Course Credit Exclusions*:	
Prerequisites:	SC/BIOL 1000 3.00; SC/BIOL 1001 3.00; HH/PSYC 1010 6.00	Cross-listed to:	
Corequisites:			

†Integrated courses are graduate courses integrated (taught with) 4000-level undergraduate courses

*<u>Course credit exclusion</u> is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both.

- Include the following information only if the course is: limited to a specific group of students; closed to a specific group of students; if there is any additional information necessary for students to know before enrolling (notes); if the course includes experiential education, and whether the students will work with a community partner and/or if it will involve going off-campus.

Open to:	Honours and Specialized Honours BSc students
Not open to	
Notes:	

- **Science Course:**

	YES	NO
Denotes courses in KINE or PSYC to count as science credit for BSc degree programs	X	

Expanded Course Description

- Please provide a detailed course description that effectively conveys what this course is about. Please ensure that this description includes, but is not limited to: 1) course topics/theories; 2) course learning objectives; 3) course learning outcomes; and 4) a description of any experiential education (EE) and/or technology-enhanced learning (also referred to as eLearning) activities.

Term	Definition
Course Learning Objectives	Statements of the overall learning and teaching goals for the course and represent what the instructor would expect students to learn and retain in the course. They articulate what the teacher plans to achieve in the course.
Learning Outcomes	Statements of what the student will achieve by the end of the course. They provide a framework for assessment by stating what you expect the learners to be able to demonstrate after completing the course. A succinct learning outcome specifies the tasks students are expected to be able to perform and the level of competence expected for the tasks.
Experiential Education (EE)	The blending of theory/course work with concrete experience. Effective EE activities require students to reflect on and demonstrate their understanding of the relationship(s) between theory/course work and concrete experience.
Structured Reflection	Structured reflection is any planned activity or exercise that requires students to refer back and critically examine the concrete experience in light of existing theory and/or what is being covered in the course.
Technology-Enhanced Learning (eLearning)	The use of technology to support students' interaction: with and access to the content; to course learning activities; and with other students and faculty members in order to develop knowledge and skills

Refer to the last page of the course proposal for resources on course learning objectives and outcomes, experiential education and technology-enhanced learning.

The course is a core course of the neuroscience program. It provides an introductory survey of the key areas of neuroscience, providing the foundation for subsequent more advanced courses.

1) Course topics:
Section 1: Introduction - Neuroscience in a historic perspective; Gross Anatomy and Histology of the Nervous System (NS); Introduction to Neuroscience Methods

Section 2: Development of the Nervous System - Specification of cell identity in the nervous system; Axon navigation and target finding; Synapse formation and refinement; Pre/Postembryonic development of the brain; Development of the Sensory Nervous System; Development of the Motor Nervous System; Development and Regeneration of the peripheral nervous system; Aging and senescence in the brain

Section 3: Molecular and Cellular Neuroscience - Neuronal communication: Electrical and Chemical Synapses; Building an excitable membrane: Ion Channels and Transporters; Extracellular Communication in the NS (I): Neurotransmitter and Receptors; Extracellular Communication in the NS (II): Signaling Molecules and Extracellular Matrix; Intracellular Communication in the NS (I): Molecular basis of synaptic plasticity; Intracellular Communication in the NS (II): Translating electrical and chemical signals into memories; Molecular and cellular basis of addiction.

Section 4: Introduction to the Molecular and Cellular Basis of Neurological Disorders - Inherited Neurological Disorders such as developmental disorders of the CNS and PNS, and channelophathies; acquired neurological disorders such as ischemia and neuronal cell death, and neuroinflammation; genetic basis of complex neurological disorders such as autism, schizophrenia, epilepsy

2) Course Learning Objectives:

- Provide a broad, introductory overview to the key areas of neuroscience
- Explore a number of key processes and structures studied in neuroscience
- Demonstrate how to critically review and analyze a journal article presenting research in the field
- Inspire reflection on a media article discussing current research and/or topics in neuroscience
- Guide students toward an individual approach to and process for critically analyzing neuroscience information presented in journal articles and in the media

3) Expected Learning Outcomes: Students who have passed this course will be expected to be able to

- Distinguish the different cell types present in the peripheral and central nervous system and outline the mechanisms by which the central and peripheral nervous systems form.
- Describe the many properties of ion channels and how they contribute to the resting membrane potential and the propagation of the action potential.

- Distinguish the different types of cell surface receptor for neurotransmitters and hormones and distinguish between voltage- and ligand-gated ion channels.
- Explain the mechanisms by which nervous impulses are conducted along the axons of myelinated and unmyelinated axons.
- Explain the basic molecular mechanisms underlying chemical transmission in the nervous system.
- Describe how action potentials and voltage-sensitive calcium channels regulate neurotransmission.
- Describe the basic mechanism by which neurons communicate, e.g. synaptic transmission and electrical coupling.
- Describe how synaptic information is integrated and the synaptic basis of LTP and LTD.
- Describe how ion channels and cell surface receptors contribute to cell function in physiological systems, e.g. the retina and auditory systems.
- Describe how drug development can be used to elucidate the nature of the molecular targets used in the treatment of specific CNS disorders.
- Relate basic neuroscience concepts to animal and human psychology and behaviour.
- Explain the mechanisms of action of drugs of abuse and the use of drugs to treat neurological and psychiatric disorders.
- Determine and analyze the accuracy and relevance of information presented in online and/or in print media presenting on new drug development to address a brain disorder (e.g., dementia, addiction).
- Describe the purpose and process of at least two research methodologies used in neuroscience (e.g., electrophysiological, brain imaging)
- Discuss their approach to and process for analyzing research articles based on information presented in class.

4) Experiential Education is expanded on in the next section.

Experiential Education/Technology-Enhanced Learning

EE remains a top priority for York University and the Faculty of Health as it offers a range of benefits for students related to academic performance, civic engagement and employability (for more information on the benefits of EE for students and course directors, please go to: **http://health.yorku.ca/experiential-education/faculty/**. Course directors are invited to integrate EE into their course where possible, but it is understood that some EE strategies may not be feasible in every course.

Course proposals with EE must be reviewed by Andra Petro, EE Coordinator (apetro@yorku.ca) prior to the submission of the proposal to the Faculty of Health Curriculum Committee.

• ***Please indicate (X) if the course uses any EE and/or technology-enhanced learning?***	***YES***	***X***	***NO***	
• ***If NOT, please outline some of the reasons EE or technology-enhanced learning could not be incorporated the course.***				
• ***If YES, please indicate (X) whether your course will include one or more of the following types of EE and technology-enhanced learning. Refer to York's Common Language for Experiential Education for complete definitions and further details.***				
X	***Classroom based (e.g. guest speakers, role playing, visual media, case studies, simulations, workshops and laboratory, course-based research etc.)***			
	Community based (e.g. community-based learning; community-based research; community service learning)			
	Work focused (e.g. placement/practicum)			
Please outline how you plan to engage students in reflection (critically examining a concrete experience) around the EE activities described above.				
Experiential Education: Students will have the opportunity to analyze research and media articles that draw on the knowledge and concepts being taught in class. Depending on enrollment, students could work in groups to critically reflect and write about one media article elaborating on reflection questions such as "What" (e.g., what neuroscience issue is being addressed?), "So What" (e.g., how does this information relate to your neuroscience content?), and "Now what" (e.g., What would they like to learn more about pertaining to this topic?). The analysis of the research article will also offer students the opportunity to critically reflect on the				

research processes followed and/or discussed in the article, supporting students' emerging understanding of the purpose and process of at least two of these methodologies**.**

Not only is it important for students to have a foundational understanding of the range of topics/subjects covered, but students will also need to develop fundamental skills in working with/understanding/exploring these topics so that they are ready for subsequent courses that will demand a more sophisticated set of transferable skills (e.g. problem solving, communication, information handling). Therefore, we propose that the students will benefit from an EE approach that emphasizes reflection on the learning process (not only the content itself) to assist students in identifying and developing skills that will be important to their success in future courses. That said, students will analyze their approach to reading a research article pertinent to the topics covered in the course as part of a debriefing conversation following their group work activity described in the first paragraph. This latter activity will help students build an awareness of their own analytical thought processes. Both EE activities will begin to build skills in academic writing that will be needed for the upper level Capstone course.

Technology Enhanced Learning: Students will be able to work together online through the Moodle discussion forums or Wiki features, in order to engage in their written work. Personal response systems (e.g., iClickers/REEF) can be used to provide low-stakes, timely feedback to both students and instructor regarding student comprehension of course material. This course will leverage learning technologies, video software, and simulations to describe the neuroscience content and showcase the processes. Students will also have access to a Moodle site where these videos/simulations will be available for later review.

Instruction/Course Format

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

At least one section every year. This course will have to be offered in the Fall term as it is a prerequisite for NRSC 2100.

- ***Number of School/Department members currently competent to teach the course.***

About 10 from the Departments of Biology, Psychology, and Kinesiology & Health Science.

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

The first year possibly Georg Zoidl, Dorota Crawford. In subsequent years a new faculty hire would support the offering of this course.

- ***An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved. This information is required to indicate whether an effective length of term is being maintained.***

In the first year this course may be offered in the usual 3 lecture hours per week for 12 weeks. Given the depth of factual based information, it can also be designed and delivered using the flipped classroom format whereby online lectures/videos/simulations are available for students to review before class but at their own pace, and before exams as a study aid. In-class time can then be used for maximizing learning using personal response system technology to formatively assess student knowledge and other student engagement activities to delve deeper into their learning.

- ***In absence of scheduled contact hours, please provide an indication of the estimated time students are likely to spend engaged in learning activities required by the course.***

The course will typically meet once weekly for 3 hours.

- ***In the absence of scheduled contact hours, please indicate how the course design encourages student engagement and supports students in achieving the learning objectives.***

Student engagement with the course material will be encouraged and enhanced using simulations that demonstrate the structures and functions of, for example, ion channels and neural pathways. These simulations and similar demonstrations offer students the opportunity to engage with the material by 'seeing' these processes occur rather than simply reading about these processes in the text book. Having the content available online through videos and simulations also allows students to review the content at their own pace and prior to exams.

Engagement will also be encouraged in class using activities such as Think, Pair, Share, and the personal response system technology. The assignments are designed to inspire students to think critically about how "what they are learning" can be applied to real world scenarios. This will include, for example, an opportunity to analyze media and journal articles that discuss the various functions and topics being taught. These activities will also serve as a means to support students in achieving the learning outcomes of the course, as students will be required to demonstrate an application and synthesis of knowledge by explaining, describing, and discussing the content in producing the final product for this assignment. Group work will contribute to students building essential skills in interpersonal communication and collaboration. Opportunities for critical reflection will also help students to explore their individual learning process and to build skills in critical thinking and communication that will be essential to their success in future courses and in their chosen careers.

Evaluation:

4. ***Please provide a detailed description of the basis of evaluation for the proposed course, including the type and percentage value of each assignment.***

Students will be evaluated using assessments that consider both their understanding of key course concepts as well as their development of key thinking and writing skills.

Two non-cumulative exams, a mid-term and a final, plus participation in class through personal response system polls will assess students' content knowledge. The mid-term will be weighted 30% and the final exam will be worth 30% of the total mark. Responses to the personal response system polls will be worth 10% of the grade.

The final 30% of the mark will be divided between the reflection activity on the media article and the journal article critique assignment. These two assessments are weighted toward skill development alongside an emerging self-awareness – students will be expected to work toward successfully completing the assignment itself but also will be assessed on how well they critically reflect on their learning in and from this experience.

5. If the course is to be integrated (i.e., graduate/undergraduate), please list the additional evaluation requirements for graduate students.

n/a

6. If the proposed course employs technology-enhanced forms of delivery (i.e., non "face-to-face", please identify how the integrity of learning evaluation will be maintained (will "on-site" examinations be required, etc.)

All exams will take place in class or during the scheduled exam time-period.

Other Resources:

3. Please provide a statement regarding the adequacy of physical resources (equipment, space, etc.). As well, please indicate if any other resources are required. Approval of a new course will be considered only if adequate resources are available to support the course.

Existing space and library resources are adequate.

4. If there is a technology-enhanced component to the course, a statement is required from the Learning Technology Services indicating whether resources are adequate to support the course. Requests for statements can directed to Rob Finlayson (rfinlays@yorku.ca). Please note, it will take two weeks to get a statement of support.

Course Rationale:

5. ***How will the course contribute to the educational objectives of the School/Department and of the Faculty?***

This course contributes to the educational objectives of the Neuroscience major as it is the first of 5 new neuroscience courses in the newly proposed neuroscience program. It provides a foundational survey of key topics and is therefore prerequisite to subsequent courses, allowing those courses to treat specific neuroscience topics in much greater depth.

As an introductory survey level course aimed at providing an overview of key concepts and ideas in the field, it will be open to majors and non-neuroscience majors. This will allow various other upper level existing courses which currently cater to students with little background in the neuroscience field (such as some of the courses contributing to each neuroscience stream such as BIOL 4370 3.0, KINE 3670 3.0, KINE 4500 3.0, KINE 4505 3.0, PSYC 4380 3.00 to name a few) to refrain from having to review these beginning level concepts and thus spend more time engaging in specialized in-depth treatments of specific areas. In the future and if applicable such upper level courses will need to specify NRSC 2000 3.0 as a prerequisite.

This course contributes to the educational objectives of the two Faculties and 3 academic units as it contributes to the depth and breadth of knowledge as well as the application of knowledge for a BSc degree.

6. ***What is the relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content? If overlap exists, please indicate the nature and extent of consultation which has taken place. If the course is to be cross-listed, integrated or listed as a course credit exclusion with another course, approval is required from all the relevant Faculties/units.***

In PSYC 2240 3.00 Biological Basis of Behaviour, a few weeks are spent learning about general anatomy and physiology, nerve cells, neural impulses, synapses, memory, and some psychological disorders. However, PSYC 2240 does not go into the depth of detail about molecular and cellular physiology that this new course does. In addition, PSYC 2240 spends about two-thirds of the course on topics not covered in this new course (e.g., emotional behaviours, reproductive behaviours, genetics, evolution, wakefulness, sleep). Therefore, it is felt that there are enough differences in depth and breadth of topics that these two courses do not need to be cross-listed with each other.

7. ***If applicable, please indicate the relationship of the proposed course to interdisciplinary programs; i.e. for which interdisciplinary program(s) will the course count for major/minor credit. As well, please indicate the nature and extent of consultation that has taken place with the relevant interdisciplinary program coordinator(s).***

n/a

8. ***What is the expected enrolment in the course?***

Expected enrolment: 100-150

Bibliography:

Please list the <u>required readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.).

There are a number of core textbooks that will serve as reference books throughout the neuroscience program and will be used again in other core neuroscience courses. Three are:

- Neuroscience 6th Ed., Purves, D. et. al. (Eds.), Oxford University Press. (2017)
- Principles of Neurobiology, L. Luo, Taylor & Francis Ltd (2015)
- Fundamental Neuroscience, Squire et. al. (Eds.), Academic Press (2012)

This course will also use journal articles and examples from current literature in Medline/Pubmed such as Nature Neuroscience Reviews, Trends in Neuroscience, etc.

Please list any <u>suggested readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.)

Examples from current literature will change each year but in general will be found in Medline/Pubmed (Nature Neuroscience Reviews, Trends in Neuroscience, etc.)

Please list any <u>online resources</u> for the course (please include complete bibliographical information as above).

For students, the experiential education guide is a useful resource: http://ee_guide.info.yorku.ca/.

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

n/a

<u>Library Support Statement</u>:

Proposals for new courses must include a **<u>library support statement</u>** from the Bibliographer responsible for the relevant discipline to indicate whether resources are adequate to support the course. To request a support statement, see the list of subject and liaison librarians at http://www.library.yorku.ca/web/about-us/contact-us/liaison-librarians/.

Consultation/Approval:

- The Faculty of Health Curriculum Committee will only consider new course proposals that have been approved by the unit responsible for offering the course.
- If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

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New Course Proposal Form
Faculty of Health Curriculum Committee

School/Department: Biology, Psychology, Kinesiology and Health Science

Course Number Information:

Faculty: HH **Rubric:** NRSC (i.e. HLST) **Course #:** 2100 **Weight:** 3.0 (i.e. 3.00, 6.00 or 0.00)

Effective Session for Change: **Term:** Winter (i.e. Fall, Fall/Winter, Winter) **Year:** 2021 (i.e. 2017-18, 2018)

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

Systems, Behavioural & Cognitive Neuroscience

Short Title: <u>Maximum 40 characters</u>, including punctuation and spaces. The short title appears on any documents where space is limited (transcripts and lecture schedules).

Systems, Behavioural & Cognitive Neuroscience

Brief Course Description: For editorial consistency, verbs should be in the present tense and begin the description; e.g., "Analyzes the nature and extent of...," rather than "This course will analyze..." or "This course analyzes…".

This is the official description of the course as it will appear in the Undergraduate Calendar. The course description should be carefully written to convey what the course is about. If applicable, include information regarding the language of instruction if other than English.

Explores the structure and function of the human brain. Topics include the organization of the central nervous system, the function and neural basis of sensory and movement systems, consciousness, language, thought and memory.

- **List course(s) where applicable:**

Integration†:		Course Credit Exclusions*:	
Prerequisites:	NRSC 2000 3.0.	Cross-listed to:	
Corequisites:			

†Integrated courses are graduate courses integrated (taught with) 4000-level undergraduate courses

*<u>Course credit exclusion</u> is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both.

- Include the following information only if the course is: limited to a specific group of students; closed to a specific group of students; if there is any additional information necessary for students to know before enrolling (notes); if the course includes experiential education, and whether the students will work with a community partner and/or if it will involve going off-campus.

Open to:	Honours BSc and Specialized Honours students
Not open to	
Notes:	

- **Science Course:**

	YES	**NO**
Denotes courses in KINE or PSYC to count as science credit for BSc degree programs	X	

Expanded Course Description

- Please provide a detailed course description that effectively conveys what this course is about. Please ensure that this description includes, but is not limited to: 1) course topics/theories; 2) course learning objectives; 3) course learning outcomes; and 4) a description of any experiential education (EE) and/or technology-enhanced learning (also referred to as eLearning) activities.

Term	Definition
Course Learning Objectives	Statements of the overall learning and teaching goals for the course and represent what the instructor would expect students to learn and retain in the course. They articulate what the teacher plans to achieve in the course.
Learning Outcomes	Statements of what the student will achieve by the end of the course. They provide a framework for assessment by stating what you expect the learners to be able to demonstrate after completing the course. A succinct learning outcome specifies the tasks students are expected to be able to perform and the level of competence expected for the tasks.
Experiential Education (EE)	The blending of theory/course work with concrete experience. Effective EE activities require students to reflect on and demonstrate their understanding of the relationship(s) between theory/course work and concrete experience.
Structured Reflection	Structured reflection is any planned activity or exercise that requires students to refer back and critically examine the concrete experience in light of existing theory and/or what is being covered in the course.
Technology-Enhanced Learning (eLearning)	The use of technology to support students' interaction: with and access to the content; to course learning activities; and with other students and faculty members in order to develop knowledge and skills

Refer to the last page of the course proposal for resources on course learning objectives and outcomes, experiential education and technology-enhanced learning.

1) As a core component of the neuroscience degree, this course provides students an opportunity to explore the structure and function of the human brain. Potential topics to be covered:

The Neural Basis of Cognition

- The Organization of the Central Nervous System
- The Functional Organization of Perception and Movement
- The Organization of Cognition
- Functional Imaging of Cognition

Perception

- Sensory Coding
- The Somatosensory System: Receptors and Central Pathways
- The Constructive Nature of Visual Processing
- Low-Level Visual Processing: The Retina
- Visual Processing and Action
- The Inner Ear
- The Auditory Central Nervous System
- Smell and Taste: The Chemical Senses

Movement

- The Organization and Planning of Movement
- The Motor Unit and Muscle Action
- Voluntary Movement: The Primary Motor Cortex
- The Control of Gaze
- The Vestibular System
- The Cerebellum

The Unconscious and Conscious Processing of Neural Information

- The Sensory, Motor, and Reflex Functions of the Brain Stem
- Emotions and Feelings
- Sleep and Dreaming

Language, Thought, Affect, and Learning

- Language
- Learning and Memory
- Cellular Mechanisms of Implicit Memory Storage and the Biological Basis of Individuality
- Prefrontal Cortex, Hippocampus, and the Biology of Explicit Memory Storage

2) Course Learning Objectives:

- Provide an introductory overview of the structure and function of the human brain
- Discuss case studies or famous cases of brain abnormalities to explore the function of various structures in the brain
- Facilitate simulation activities using videos that demonstrate and explain brain function to provide multimodal opportunities for learning about brain structures and their associated functions

3) Expected Learning Outcomes:

Students who have passed this course are expected to be able to:

- Describe the structural organization of the human central nervous system
- Describe the brain's major components, lobes of the cerebral cortex, and the gross functional organization, including the areas responsible for sensory systems and motor output
- Identify the various techniques by which we can measure brain function
- Describe how the techniques used to measure brain function capture information about how the brain works
- Describe the sensory systems, including the coding of information at the sensory receptors, through the processing of this information in the cortex

- Describe the motor system, from the areas in the brain responsible for planning movements, the contributions of the cerebellum, through the actions of motor units
- Explain the functions/structure of the brain that control eye and head movements and their relationship to the vestibular system
- Explain what is meant by consciousness
- Describe which functions of the brain are conscious or unconscious
- Describe language and how it differs from other animal communication systems
- Identify the parts of the brain responsible for producing and comprehending language
- Describe memory systems in the brain
- Differentiate between declarative and procedural memories.

4) Experiential education is explored in more detail in the next section.

Experiential Education/Technology-Enhanced Learning

EE remains a top priority for York University and the Faculty of Health as it offers a range of benefits for students related to academic performance, civic engagement and employability (for more information on the benefits of EE for students and course directors, please go to: **http://health.yorku.ca/experiential-education/faculty/**. Course directors are invited to integrate EE into their course where possible, but it is understood that some EE strategies may not be feasible in every course.

Course proposals with EE must be reviewed by Andra Petro, EE Coordinator (apetro@yorku.ca) prior to the submission of the proposal to the Faculty of Health Curriculum Committee.

• ***Please indicate (X) if the course uses any EE and/or technology-enhanced learning?***	***YES***	***x***	***NO***	
• ***If NOT, please outline some of the reasons EE or technology-enhanced learning could not be incorporated the course.***				
• ***If YES, please indicate (X) whether your course will include one or more of the following types of EE and technology-enhanced learning. Refer to York's Common Language for Experiential Education for complete definitions and further details.***				
x	***Classroom based (e.g. guest speakers, role playing, visual media, case studies, simulations, workshops and laboratory, course-based research etc.)***			
	Community based (e.g. community-based learning; community-based research; community service learning)			
	Work focused (e.g. placement/practicum)			
Please outline how you plan to engage students in reflection (critically examining a concrete experience) around the EE activities described above.				

Experiential Education: Students will have the opportunity to develop transferable skills such as problem solving by exploring case studies where famous cases of brain abnormalities are used to discuss what structures or functions of the brain are damaged and therefore interfering with the functioning of the normal human brain. Students will be asked to write a critical reflection based on a provided case study e.g., addressing the questions "what?" (e.g., what did they learn about the structure/function covered, what neuroimaging techniques were used to measure the structure/function), "so what" (how does this information contribute to our knowledge in the field of neuroscience), and "what now" (what more would they like to know about this topic or what further research needs to be engaged in to expand on this topic). This activity should encourage reflection on the integration of key course concepts and how the student worked to determine which structures and/or functions of the brain were being impacted.

Technology Enhanced Learning: In class polls providing low stakes, timely feedback (e.g., by using personal response system technology) can be used to help students to evaluate their understanding of the course content and for the course director to receive real time formative feedback of the students understanding of the course material. As much of this course focuses on the systems and functions in the normal human brain, technology will be used to provide students with a diversity of means to review and learn course content. For example, video simulations of brain function (e.g. data collected from fMRI, etc.,) and video recordings that explain brain function (e.g. from YouTube, MERLOT.org) will offer a multimodal means of reviewing core concepts. Students will also have access to a Learning Management System (Moodle) site where these videos/simulations will be available for later review.

Instruction/Course Format

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

One section will be offered every year, in the winter term.

- ***Number of School/Department members currently competent to teach the course.***

There are a number of faculty who can teach this course, drawn from the departments of Psychology and Kinesiology. They include Doug Crawford, Joseph DeSouza, Laurence Harris, Richard Murray, Jennifer Steeves, Laurie Wilcox, Mazyar Fallah, Dorota Crawford, Denise Henriques, and Lauren Sergio.

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

In the first year, possibly Joseph DeSouza. In subsequent years, a new neuroscience hire would support the offering of this course.

- ***An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved. This information is required to indicate whether an effective length of term is being maintained.***

In the first year this course may be offered in the usual 3 lecture hours per week for 12 weeks. Given the depth and breadth of factual based information, it can also be designed and delivered using the flipped classroom whereby online lectures/videos/simulations are available for students to review before class but at their own pace, and before exams. Or it can be adapted to a blended format whereby in class time is replaced with online learning activities (e.g., discussion forums promoting debates in pairs/groups that help students to problem solve about case-studies; learning objects could be created that allow students to practice matching of structures to functions.)

Any in-class time can then be used for maximizing learning using personal response system technology to evaluate student knowledge and student engagement activities to delve deeper into their learning. For example, an in-class activity could be used such as "Think, Pair, Share" where students are posed a question about the content, pair up with a partner to discuss it, and then share what they know with each other and eventually with the rest of the class. In class time could also be used to engage in problem solving about the case study.

- ***In absence of scheduled contact hours, please provide an indication of the estimated time students are likely to spend engaged in learning activities required by the course.***

Currently the course is being proposed to hold scheduled contact hours once weekly for 3 hours.

- ***In the absence of scheduled contact hours, please indicate how the course design encourages student engagement and supports students in achieving the learning objectives.***

If the course is to be offered in a flipped or blended format, student engagement with the course material will be enhanced with the use of video and similar technologies designed to offer multiple means of interacting with key course concepts. Students will also have the opportunity to work with peers to review and respond to case studies and/or simulations that will offer 'real life' examples of the complex structure and function of the human brain, particularly when there are abnormalities or accidents that impede its normal function. In class activities will also offer students the opportunity to engage with their peers in small and large group discussions, e.g. inspired by Think, Pair, Share activities. Engagement with the course material and their peers supports the achievement of the courses' learning objectives by offering multiple means to discuss and review key course concepts. The use of video as a strategy for delivering course content reflects an opportunity for multiple means of engaging with and learning about key concepts, ensuring (where possible) that students with a variety of learning preferences can work toward understanding the material. Case studies also offer a means to integrate and make connections among the material, as this course emphasizes an understanding of normal brain functioning, such that each concept cannot be understood in isolation. Taking a 'systems approach' to the course material (e.g. using reflective activities to help students consider brain function and neurological processes) will help to meet the descriptive level outcomes for the course. Students will be guided to move beyond only identifying core structures or key functions of the brain to begin understanding how these structures and functions work together.

Evaluation:

7. ***Please provide a detailed description of the basis of evaluation for the proposed course, including the type and percentage value of each assignment.***

Students will be evaluated with three non-cumulative equally weighted onsite written exams (25% each), one in the final exam time-period. Exams will include both multiple choice questions to assess if students can correctly identify key course concepts, alongside matching and/or short answer questions designed to assess students' ability to describe and explain the structure and function of the normal human brain. Responses to the in-class polls will be worth 10% of the grade. 15% of the students' final grade will be calculated from their work on responding to the in-class case study/simulation exercises. Students will be assessed on the engagement with/participation in the exercises (e.g. they must be present in class and complete the exercise) as well as their reflective responses. Responses will be assessed both on accuracy (against the course material) as well as their ability to make critical connections between core course concepts.

8. If the course is to be integrated (i.e., graduate/undergraduate), please list the additional evaluation requirements for graduate students.

n/a

9. If the proposed course is employs technology-enhanced forms of delivery (i.e., non "face-to-face", please identify how the integrity of learning evaluation will be maintained (will "on-site" examinations be required, etc.)

All exams will be taken in class or during the scheduled exam time-period.

Other Resources:

5. Please provide a statement regarding the adequacy of physical resources (equipment, space, etc.). As well, please indicate if any other resources are required. Approval of a new course will be considered only if adequate resources are available to support the course.

Lecture hall, with space for approximately 100-150 students, internet connection, and audiovisual equipment.

6. If there is a technology-enhanced component to the course, a statement is required from the Learning Technology Services indicating whether resources are adequate to support the course. Requests for statements can directed to Rob Finlayson (rfinlays@yorku.ca). Please note, it will take two weeks to get a statement of support.

Course Rationale:

9. ***How will the course contribute to the educational objectives of the School/Department and of the Faculty.***

As a core course of the Neuroscience degree program this course contributes to the educational objectives of the Neuroscience major. Students will be introduced to the fundamentals of neuroscience in this course, as well as with NRSC 2000 3.0 and NRSC 2200 4.0, all taken in the second year. These courses will serve as the background for more specialized courses that the students will take at the 3000- and 4000- level.

As this course is designed to provide an overview of the structure and function of the normal human brain, concepts relevant to a variety of science-based and similar courses, it will be open to non-neuroscience majors. This will allow various other upper level existing courses which currently cater to students with little background in the neuroscience field (such as some of the courses contributing to each neuroscience stream such as BIOL 4370 3.0, KINE 3670 3.0, KINE 4500 3.0, KINE 4505 3.0, PSYC 4380 3.00 to name a few) to spend less time reviewing these beginning level concepts and spend more time engaging in specialized in-depth treatments of specific areas. In the future and if applicable such upper level courses will need to specify NRSC 2100 3.0 as a prerequisite.

This course contributes to the educational objectives of the two Faculties and 3 academic units as it contributes to the depth and breadth of knowledge as well as the application of knowledge for a BSc degree.

10. ***What is the relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If overlap exists, please indicate the nature and extent of consultation which has taken place. If the course is to be cross-listed, integrated or listed as a course credit exclusion with another course, approval is required from all the relevant Faculties/units.***

Existing courses PSYC 2220 3.00 Sensation and Perception I, PSYC 2240 3.00 Biological Basis of Behaviour, PSYC 3260 3.00 Cognition, PSYC 3265 3.00 Memory, and PSYC 3270 3.00 Sensation and Perception II cover similar material but from a distinctly different psychological perspective. These courses are sufficiently different to be included as chosen or alternative courses in the proposed neuroscience program streams.

11. ***If applicable, please indicate the relationship of the proposed course to interdisciplinary programs; i.e. for which interdisciplinary program(s) will the course count for major/minor credit. As well, please indicate the nature and extent of consultation that has taken place with the relevant interdisciplinary program coordinator(s).***

n/a

12. ***What is the expected enrolment in the course?***

Expected enrolment: 100-150

Bibliography:

Please list the <u>required readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.).

The textbook proposed below will serve as reference books throughout the neuroscience program and will be used again in other core neuroscience courses:

Principles of Neural Science, 5th Edition. Kandel, E.R. et al., McGraw-Hill, New York. 2012. ISBN 0-07-139011-1

Please list any suggested readings for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.)

This will depend on the instructor.

Please list any online resources for the course (please include complete bibliographical information as above).

For students, the experiential education guide is a useful resource: http://ee_guide.info.yorku.ca/

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

n/a

Library Support Statement:

Proposals for new courses must include a **library support statement** from the Bibliographer responsible for the relevant discipline to indicate whether resources are adequate to support the course. To request a support statement, see the list of subject and liaison librarians at http://www.library.yorku.ca/web/about-us/contact-us/liaison-librarians/.

Consultation/Approval:

- The Faculty of Health Curriculum Committee will only consider new course proposals that have been approved by the unit responsible for offering the course.
- If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

health | YORK UNIVERSITÉ UNIVERSITY

New Course Proposal Form
Faculty of Health Curriculum Committee

School/Department: Biology, Psychology, Kinesiology and Health Science

Course Number Information:

Faculty:	**Rubric:**	**Course #:**	**Weight:**
HH	NRSC (i.e. HLST)	2200	3.0 (i.e. 3.00, 6.00 or 0.00)

Effective Session for Change: **Term:** Winter (i.e. Fall, Fall/Winter, Winter) **Year:** 2022 (i.e. 2017-18, 2018)

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

Neuroscience Techniques

Short Title: **Maximum 40 characters**, including punctuation and spaces. The short title appears on any documents where space is limited (transcripts and lecture schedules).

Neuroscience Techniques

Brief Course Description: For editorial consistency, verbs should be in the present tense and begin the description; e.g., "Analyzes the nature and extent of...," rather than "This course will analyze..." or "This course analyzes…".

This is the official description of the course as it will appear in the Undergraduate Calendar. The course description should be carefully written to convey what the course is about. If applicable, include information regarding the language of instruction if other than English.

Provides students with an overview of and exposure to experimentation techniques and methodologies in the fields of systems and cognitive, cellular and molecular, and computational and theoretical neuroscience. These could include any of the following: EEG, fMRI, behavioural methods such as psychophysics and eye/body tracking, electrophysiology, patch and dynamic clamp, transgenic mouse technology, molecular imaging, neuronal coding and communication, neuronal networks, and brain-machine interfaces.

- **List course(s) where applicable:**

Integration†:		Course Credit Exclusions*:	
Prerequisites:	NRSC 2000 3.0	Cross-listed to:	
Corequisites:	NRSC 2100 3.0.		

†Integrated courses are graduate courses integrated (taught with) 4000-level undergraduate courses

*Course credit exclusion is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both.

- Include the following information only if the course is: limited to a specific group of students; closed to a specific group of students; if there is any additional information necessary for students to know before enrolling (notes); if the course includes experiential education, and whether the students will work with a community partner and/or if it will involve going off-campus.
-

Open to:	Students registered in the Neuroscience program
Not open to	
Notes:	

- **Science Course:**

	YES	NO
Denotes courses in KINE or PSYC to count as science credit for BSc degree programs	X	

Expanded Course Description

- Please provide a detailed course description that effectively conveys what this course is about. Please ensure that this description includes, but is not limited to: 1) course topics/theories; 2) course learning objectives; 3) course learning outcomes; and 4) a description of any experiential education (EE) and/or technology-enhanced learning (also referred to as eLearning) activities.

Term	Definition
Course Learning Objectives	Statements of the overall learning and teaching goals for the course and represent what the instructor would expect students to learn and retain in the course. They articulate what the teacher plans to achieve in the course.
Learning Outcomes	Statements of what the student will achieve by the end of the course. They provide a framework for assessment by stating what you expect the learners to be able to demonstrate after completing the course. A succinct learning outcome specifies the tasks students are expected to be able to perform and the level of competence expected for the tasks.
Experiential Education (EE)	The blending of theory/course work with concrete experience. Effective EE activities require students to reflect on and demonstrate their understanding of the relationship(s) between theory/course work and concrete experience.
Structured Reflection	Structured reflection is any planned activity or exercise that requires students to refer back and critically examine the concrete experience in light of existing theory and/or what is being covered in the course.
Technology-Enhanced Learning (eLearning)	The use of technology to support students' interaction: with and access to the content; to course learning activities; and with other students and faculty members in order to develop knowledge and skills

Refer to the last page of the course proposal for resources on course learning objectives and outcomes, experiential education and technology-enhanced learning.

This could be a blended format course that consist of in class lectures, demonstrations, computer lab work, and online activities.

1) In class time will be spent discussing and/or debating techniques and methodological developments in neuroscience, describing how similar theoretical questions were / are investigated using different approaches, the advantages and disadvantages of each method, and the role of ethics in neuroscience.

Online or in computer lab activities will explore a minimum of 4 different neuroscience techniques and methods through video demonstrations and online experiments using software/hardware such as "Backyard Brains" (https://backyardbrains.com/experiments/).

Demonstrations of neuroscience techniques will be video recorded within different research labs and posted in the course learning management system for students to review. Students will review research articles that use the technique and engage in online discussion/journal club focusing on a key question critiquing the technique.

Students will be provided tutorials that show them how to build and analyze graphs using different techniques/methods. Students will be provided with a sample of data generated from the technique used and asked to produce a graph of the data, as well as a short explanation of their final product.

A guest speaker from the office of research ethics can be invited to discuss research ethics. Students will be invited to review the TCPS tutorial modules on research ethics (http://www.pre.ethics.gc.ca/eng/index/), as well as the senate policy on ethics (http://secretariat-policies.info.yorku.ca/policies/ethics-review-process-for-research-involving-human-participants-policy/) and provide in advance questions to be posed to the guest speaker.

At the end of the course students will present either orally in class or by developing a video module or podcast posted in the course learning management system a critical reflection about the laboratory/experimental technique. They will describe: What (what did they learn about the lab and the technique(s) they use), so what (what key course concepts does this technique help them to understand, what usefulness and limitations are associated with the technique), and what now (what more would they like to know about this technique or are there other techniques that could better investigate the nervous system in this context). If this final component is team based, students will complete a peer-to-peer and self-evaluation on their contribution to and participation in the team-based presentation.

2) Course Learning Objectives:

- Provide an overview of neuroscience experimental techniques used to investigate a variety of research questions

- Facilitate reviews of research articles and video recordings describing neuroscience techniques to critique the advantages and constraints associated with its use
- Guide students in building and analyzing graphical representations of quantitative data obtained using different techniques
- Consider the ethical implications of selecting and engaging in different neuroscience techniques

3) Expected Learning Outcomes:

Students who successfully complete the course will be able to

- Critique the purpose and process of four neuroscience experimental techniques for the investigation of a variety of research questions
- Describe the usefulness and limitations of four different available neuroscience techniques, including their spatial and temporal resolutions and degrees of invasiveness.
- Analyze quantitative information by graphically represent experimental data
- Describe an appropriate neuroscience technique to answer specific questions about structure and function of the brain and behavior.
- Communicate and critique the features of at least one experimental neuroscience technique
- Discuss ethics involved in engaging in different neuroscience techniques.

4) experiential education is described in more detail in the next section

Experiential Education/Technology-Enhanced Learning

EE remains a top priority for York University and the Faculty of Health as it offers a range of benefits for students related to academic performance, civic engagement and employability (for more information on the benefits of EE for students and course directors, please go to: http://health.yorku.ca/experiential-education/faculty/. Course directors are invited to integrate EE into their course where possible, but it is understood that some EE strategies may not be feasible in every course.

Course proposals with EE must be reviewed by Andra Petro, EE Coordinator (apetro@yorku.ca) prior to the submission of the proposal to the Faculty of Health Curriculum Committee.

• ***Please indicate (X) if the course uses any EE and/or technology-enhanced learning?***	***YES***	***x***	***NO***	
• ***If NOT, please outline some of the reasons EE or technology-enhanced learning could not be incorporated the course.***				
• ***If YES, please indicate (X) whether your course will include one or more of the following types of EE and technology-enhanced learning. Refer to York's Common Language for Experiential Education for complete definitions and further details.***				
x	***Classroom based (e.g. guest speakers, role playing, visual media, case studies, simulations, workshops and laboratory, course-based research etc.)***			
	Community based (e.g. community-based learning; community-based research; community service learning)			
	Work focused (e.g. placement/practicum)			
Please outline how you plan to engage students in reflection (critically examining a concrete experience) around the EE activities described above.				

Experiential Education: students will be given the opportunity to analyze and interpret data using a specific type of technique and discuss a variety of neuroscience techniques used for experimentation. A final presentation will be a reflective exercise prompting students to consider how a technique demonstrates key course concepts. They also will be asked to review tutorial modules on research ethics (http://www.pre.ethics.gc.ca/eng/index/), as well as the senate policy on ethics (http://secretariat-policies.info.yorku.ca/policies/ethics-review-process-for-research-involving-human-participants-policy/) and provide in advance questions to be posed to the guest speaker.

Technology-Enhanced Learning: This course is being proposed as a blended format course whereby a minimum of one-third of in class time will be replaced with online learning activities reviewing lab techniques, engaging in simulations, and participating in the journal club/discussion forums. Students will have the opportunity to explore a variety of techniques used in experimentation. The use of various software and hardware tools will be guided by the instructor to practice the skills students will be expected to develop in the neuroscience major. Learning technologies (e.g. engaging in discussion forums/journal club online in the course learning management system, etc.) will also be used to demonstrate and disseminate information related to core course concepts.

Instruction/Course Format

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

One section of the course will be offered each year.

- ***Number of School/Department members currently competent to teach the course.***

Any of the core neuroscience faculty are capable of being the course director.

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

Erez Freud, Denise Henriques, Susan Murtha

- ***An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved. This information is required to indicate whether an effective length of term is being maintained.***

This course is being proposed as a blended format course whereby a minimum of one-third of in class time will be replaced with online learning activities reviewing lab techniques, engaging in simulations, and participating in the journal club/discussion forums.

- ***In absence of scheduled contact hours, please provide an indication of the estimated time students are likely to spend engaged in learning activities required by the course.***

Approximately 2 hours each week online

- ***In the absence of scheduled contact hours, please indicate how the course design encourages student engagement and supports students in achieving the learning objectives.***

Principles of universal design for learning (flexible, accessible, enabling students to make choices and be more involved in the learning process) will be applied to course design to ensure students engage in the online forums.

Access to resources to show students how to critique and review journal articles, how to create online video modules and/or podcasts, how to build a graph in Excel from data provided, etc., will be found or created and added to the Moodle course for students use as needed. Where applicable students will be provided with a grading rubric for how they will be evaluated in online discussion forums and with their presentations.

Evaluation:

10. ***Please provide a detailed description of the basis of evaluation for the proposed course, including the type and percentage value of each assignment.***

In order to follow the principles of universal course design for learning the expectation is that students will be evaluated on the following:

- Three of four best submissions of graphs based on data provided using different techniques (45%, i.e., 15% each)
- Three of four best submissions to the online Journal /Discussion forums guided by prompt questions (30%, i.e., 10% each)
- Oral reflection presentation (in person or online) about one of the techniques (25%)
    - If the oral presentation is done as a team, then the final presentation is worth 22% and students engage in a peer to peer and self-evaluation for collaborating together on the team presentation (3%) (guidelines and rubrics for team work will be provided)

Note: no formal final exams are suggested for this course. However, if the CD deems that having a formal final exam is an appropriate option for students who miss a high percentage of the online or in computer lab and in class activities that could not be made up in another way, then that option could be exercised.

11. ***If the course is to be integrated (i.e., graduate/undergraduate), please list the additional evaluation requirements for graduate students.***

n/a

12. ***If the proposed course is employs technology-enhanced forms of delivery (i.e., non "face-to-face", please identify how the integrity of learning evaluation will be maintained (will "on-site" examinations be required, etc.)***

Blended format.

Other Resources:

7. ***Please provide a statement regarding the adequacy of physical resources (equipment, space, etc.). As well, please indicate if any other resources are required. Approval of a new course will be considered only if adequate resources are available to support the course.***

Software that emulates/simulates different techniques will need to be purchased for this course.

8. If there is a technology-enhanced component to the course, a statement is required from the Learning Technology Services indicating whether resources are adequate to support the course. Requests for statements can directed to Rob Finlayson (rfinlays@yorku.ca). Please note, it will take two weeks to get a statement of support.

Course Rationale:

13. ***How will the course contribute to the educational objectives of the School/Department and of the Faculty?***

This course contributes to the educational objectives of the newly proposed Neuroscience degree. This course has the unique opportunity to help students develop essential knowledge about the breadth of neuroscience techniques. An emphasis on skills alongside the already described knowledge acquisition will complement the intended learning outcomes of the other core neuroscience courses being proposed. Currently, although expertise in the neurosciences is well represented among the faculty, there is no specific course that covers either the breadth of experimental techniques currently used in neuroscience research, or the ethical implications of conducting research using those techniques. This new course proposal fills that gap. Successfully completing this course will contribute to the students' ability to achieve the following neuroscience program expectations:

- Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods.
- Relate neuroscience to other disciplines and apply learning from those disciplines within neuroscience
- Analyze and interpret pre-existing or novel data, including research findings, and communicate the findings in both oral and written formats
- Integrate and apply theoretical perspectives and major findings across broad areas of neuroscience
- Represent information in a quantitative format, to analyze and interpret quantitative information, including graphs and statistics.

14. ***What is the relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If overlap exists, please indicate the nature and extent of consultation which has taken place. If the course is to be cross-listed, integrated or listed as a course credit exclusion with another course, approval is required from all the relevant Faculties/units.***

Currently, although there are other research methods courses and other neuroscience courses offered there is little if any overlap between this course and any other course due to the breadth of exposure to different neuroscience techniques. The course complements other proposed new courses in the neuroscience program. The course promotes development of knowledge about neuroscience techniques and skill development in critical analysis and reflection.

15. ***If applicable, please indicate the relationship of the proposed course to interdisciplinary programs; i.e. for which interdisciplinary program(s) will the course count for major/minor credit. As well, please indicate the nature and extent of consultation that has taken place with the relevant interdisciplinary program coordinator(s).***

n/a

16. ***What is the expected enrolment in the course?***

Enrolment is capped at about 60-70 students.

Bibliography:

Please list the <u>required readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.).

Each technique will be covered by a review article plus potentially 1-3 example results articles. The papers will be shared online with hyperlinks in the course learning management system (e.g., Moodle) course.

Please list any <u>suggested readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.)

This will be dependent on the technique covered.

Please list any <u>online resources</u> for the course (please include complete bibliographical information as above).

For faculty members, there are some useful resources on reflection available on the Faculty of Health website: http://health.yorku.ca/experiential-education/ and on the Teaching Commons website: http://teachingcommons.yorku.ca/resources-2/experiential-education/.

For students the experiential education guide is a useful resource: http://ee_guide.info.yorku.ca/. Other excellent resources exist for guiding students on writing journals such as: https://emedia.rmit.edu.au/learninglab/content/writing-reflective-journal

An excellent resource of rubrics to guide and evaluate a number written/oral/team work skills can be found on the AACU website (see *value@aacu.org*)

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

n/a

Library Support Statement:

Proposals for new courses must include a **library support statement** from the Bibliographer responsible for the relevant discipline to indicate whether resources are adequate to support the course. To request a support statement, see the list of subject and liaison librarians at http://www.library.yorku.ca/web/about-us/contact-us/liaison-librarians/.

Consultation/Approval:

- The Faculty of Health Curriculum Committee will only consider new course proposals that have been approved by the unit responsible for offering the course.
- If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

New Course Proposal Resources

Learning Objectives/Outcomes - http://teachingcommons.yorku.ca/resources-2/elearning/elearning/identifying-learning-outcomes-and-selecting-assessment-tasks/

Key questions for writing learning objectives/outcomes and assessment tasks:

- What essential knowledge, skills, and attitudes etc. would you expect the students to acquire?
- How sophisticated or complex (memorization, analysis, creation, etc.) would you expect students learning to be?
- What will students be able to do to demonstrate/articulate their level of learning?
- How do we know that they have learned it? What information is needed to be collected to verify/demonstrate students' learning of learning outcomes?
- How informative are each of these assessment task to understanding the student learning process?
- Are these clearly stated and communicated to students?

For information about learning objectives, please contact Health's Educational Developer, **Barbara Kerr**, by email at kerrb@yorku.ca or by phone at ext. 20691.

Experiential Education (EE) - http://health.yorku.ca/experiential-education/faculty

The Faculty of Health EE website includes:

- The common language for Experiential Education
- Examples of experiential education in the Faculty of Health
- Tools for and examples of reflection activities
- Available resources and support

For information about the different types of and activities to engage in EE, please contact the EE coordinator, **Anda Petro** by email at apetro@yorku.ca or by phone at ext. 40655.

Technology-Enhanced Learning - http://lts.info.yorku.ca/health/

The Faculty of Health enjoys priority service from the Learning Technology Services (LTS) unit. Their services can be accessed at http://lts.info.yorku.ca/health/. Additionally, you can contact **Sairam Chinnam** directly by email at schinnam@yorku.ca or by phone at ext. 40205.

Additional resources on technology-enhanced can be located at the Teaching Commons. For example, you can view sample blended eLearning courses at York University at http://teachingcommons.yorku.ca/resources-2/elearning/elearning/sample-blended-elearning-courses-at-york-university/. You can also contact **Yelin Su**, Educational Developer by email at ysu@yorku.ca or by phone at ext. 22117 for additional assistance.

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New Course Proposal Form
Faculty of Health Curriculum Committee

School/Department: Biology, Psychology, Kinesiology and Health Science

Course Number Information:

Faculty:	HH	**Rubric:** (i.e. HLST)	NRSC	**Course #:**	3000	**Weight:** (i.e. 3.00, 6.00 or 0.00)	3.0

Effective Session for Change: **Term:** Fall (i.e. Fall, Fall/Winter, Winter) **Year:** 2022 (i.e. 2017-18, 2018)

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

Molecular and Cellular Basis of Perception and Cognition

Short Title: **Maximum 40 characters,** including punctuation and spaces. The short title appears on any documents where space is limited (transcripts and lecture schedules).

Molecular and Cellular Basis of Perception and Cognition

Brief Course Description: For editorial consistency, verbs should be in the present tense and begin the description; e.g., "Analyzes the nature and extent of...," rather than "This course will analyze..." or “This course analyzes…”.

This is the official description of the course as it will appear in the Undergraduate Calendar. The course description should be carefully written to convey what the course is about. If applicable, include information regarding the language of instruction if other than English.

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

- **List course(s) where applicable:**

Integration†:		Course Credit Exclusions*:	
Prerequisites:	NRSC 2000 3.0 and NRSC 2100 3.0	Cross-listed to:	
Corequisites:	NRSC 2200 3.0		

†Integrated courses are graduate courses integrated (taught with) 4000-level undergraduate courses

*Course credit exclusion is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both.

- Include the following information only if the course is: limited to a specific group of students; closed to a specific group of students; if there is any additional information necessary for students to know before enrolling (notes); if the course includes experiential education, and whether the students will work with a community partner and/or if it will involve going off-campus.

Open to:	Honours and Specialized Honours BSc students
Not open to	
Notes:	

- **Science Course:**

	YES	**NO**
Denotes courses in KINE or PSYC to count as science credit for BSc degree programs	X	

Expanded Course Description

- Please provide a detailed course description that effectively conveys what this course is about. Please ensure that this description includes, but is not limited to: 1) course topics/theories; 2) course learning objectives; 3) course learning outcomes; and 4) a description of any experiential education (EE) and/or technology-enhanced learning (also referred to as eLearning) activities.

Term	Definition
Course Learning Objectives	Statements of the overall learning and teaching goals for the course and represent what the instructor would expect students to learn and retain in the course. They articulate what the teacher plans to achieve in the course.
Learning Outcomes	Statements of what the student will achieve by the end of the course. They provide a framework for assessment by stating what you expect the learners to be able to demonstrate after completing the course. A succinct learning outcome specifies the tasks students are expected to be able to perform and the level of competence expected for the tasks.
Experiential Education (EE)	The blending of theory/course work with concrete experience. Effective EE activities require students to reflect on and demonstrate their understanding of the relationship(s) between theory/course work and concrete experience.
Structured Reflection	Structured reflection is any planned activity or exercise that requires students to refer back and critically examine the concrete experience in light of existing theory and/or what is being covered in the course.
Technology-Enhanced Learning (eLearning)	The use of technology to support students' interaction: with and access to the content; to course learning activities; and with other students and faculty members in order to develop knowledge and skills

Refer to the last page of the course proposal for resources on course learning objectives and outcomes, experiential education and technology-enhanced learning.

Since the beginning of life on Earth perception of the world outside of organisms has been critical for the survival of any species. When sensory systems got more complex converting sensory information to long lasting memories became highly advantageous. Today, they enable us to respond to a constantly changing environment evoking physiological responses and behaviours. This is facilitated through highly complex processes originating in specialized nerve cells communicating with our brains. Understanding the molecular, structural and cellular basis of perception and how perception is converted into long lasting memories, maintained and protected over a lifetime is one of the most important questions in Neurobiology.

1) As a core component of the Neuroscience program, this course explores the molecular, structural and cellular basis of complex brain functions focussing on perception, learning and memory. Potential topics include:

1: The Biological Foundations of Sensory Perception, Learning and Memory

- General Introduction
- Introduction to Methods in Sensory Perception, Learning and Memory Research

2: The Somatosensory System - Touch, Feeling, and Pain

- Anatomy, histology and development of the Somatosensory System
- Structure and function of mechanoreceptors detecting changes and fluctuations in pressure, position, and movement.
- Structure and function of thermoreceptors detecting hot and cold temperatures both of the outside world and inside the body.
- Structure and function of pain receptors detecting pressure, chemicals, and severe heat.
- Integrating somatosensory functions at molecular and cellular level.
- Dysfunctions of somatosensory systems.

3: The Chemosensory Systems - Taste and Smell

- Anatomy, histology and development of the Olfactory and Gustatory System
- Olfactory receptors: molecular basis for recognition and discrimination of odors.
- Olfaction and stem cells.
- Taste Perception and Coding in vertebrates and insects.
- Chemosensory perception in the gut.

- The role of ion channels and receptors in chemosensation.
- Signaling pathways in chemosensation.
- Animal models and methods to study chemosensation.
- Disorders of smell and taste senses and the link to diseases or conditions, such as Obesity, Diabetes, Hypertension, Malnutrition and Degenerative diseases of the nervous system.

4: Molecular and Cellular Basis of Hearing in Animals

- Anatomy, histology and development of the EAR

- COCHLEA:

- The hair cell cytoskeleton: an intricate scaffold that underlies hearing.
- Gap junction communication, homeostasis and genetic causes of deafness.
- The uniquely shaped hair bundle: morphogenetic events that control bundle development and polarity
- Motoring to the tip: myosin motor proteins regulating stereociliary length
- Constricting the base: myosins shape the taper of stereocilia
- At the heart of hearing: the mechanotransduction machinery of hair cells.
- Function and development of auditory hair cells.
- Animal models revealing the molecular and cellular basis for specific sensory connections.

- VESTIBULAR SYSTEM.

- Structures helping control one's sense of steadiness or balance.
- Molecules building specialized structures.

5: Molecular and Cellular Basis of Vision

- Anatomy, histology and development of the eye

- CORNEA:

- Epithelium: development, stem cells, barrier function, immunology, molecular biology of homeobox genes
- Stroma: wound healing, neovacularization, matrix structure and remodeling, - ion channels, cell junctions and transporters

- ANTERIOR CHAMBER AND LENS:

- Molecular mechanisms of ocular morphogenesis
- Molecular, cellular, and developmental biology of the lens, with emphasis on the regulation and evolution of gene expression
- Molecular and cellular basis of transparency and cataract formation
- Ion channels, cell junctions, and transporters in the function of the lens, and ciliary epithelium
- Mechanisms of fluid balance and control of intra-ocular pressure
- Molecular and cellular control of the extracellular matrix

- RETINA:

- Photoreceptors: biochemistry, molecular biology, cell biology and physiology of differentiation, signal transduction, and signal transmission; molecular and cellular biology of inherited and age-related retinal degenerations
- Pigment epithelium: molecular and cellular studies of polarity of membrane proteins; synthesis of interphotoreceptor matrix, growth factors and retinoid carrier proteins; transplantation
- Central connections: neurophysiology of transmission; contrast and colour perception and the physiology of amblyopia
- Developmental biology and retinal organization; retinal stem cells.

- ANIMAL MODELS AND GENETICS IN VISION RESEARCH

- Mouse and other mammalian models for studying vision disorders and probing fundamental mechanisms
- Non-mammalian models, including zebrafish, Xenopus, Drosophila
- Application of human genetics to understanding disease genes and risk factors and develop new approaches to cell and gene therapy for ocular disease.

6: Integrating Sensory Perception, Learning and Memory

- Calcium, calcium binding proteins and the role of kinases.
- Ion channels and receptors and their role in structural and functional dynamics at synapses
- ATP, adenosine and purinergic signaling in synaptic plasticity
- Cytoskeletal dynamics and synaptic plasticity

- Epigenetic regulation of memory formation and maintenance
- Channelopathies and dysfunctions of Sensory Perception, Learning and Memory
- Tauopathies and dysfunctions of Sensory Perception, Learning and Memory.
- Application of genome engineering and optogenetics to understand disease genes and risk factors for learning and memory disorders.
- Mammalian and non-mammalian animal models for studying learning and memory

2) Course Learning Objectives:

- Provide an overview of the structures, components, and processes involved in how the brain perceives and processes sensory and cognitive information across the life-span
- Facilitate case study exercises and/or simulations to evaluate technologies currently in use to investigate the sensory systems and processes of the brain
- Facilitate reviews of journal articles and/or articles in the media to explore the various sensory processes and critique how they are discussed in these mediums

3) Expected Learning Outcomes:

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

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

4) experiential

Experiential Education/Technology-Enhanced Learning

EE remains a top priority for York University and the Faculty of Health as it offers a range of benefits for students related to academic performance, civic engagement and employability (for more information on the benefits of EE for students and course directors, please go to: **http://health.yorku.ca/experiential-education/faculty/**. Course directors are invited to integrate EE into their course where possible, but it is understood that some EE strategies may not be feasible in every course.

Course proposals with EE must be reviewed by Andra Petro, EE Coordinator (apetro@yorku.ca) prior to the submission of the proposal to the Faculty of Health Curriculum Committee.

• ***Please indicate (X) if the course uses any EE and/or technology-enhanced learning?***	***YES***	***x***	***NO***	
• ***If NOT, please outline some of the reasons EE or technology-enhanced learning could not be incorporated the course.***				

- ***If YES, please indicate (X) whether your course will include one or more of the following types of EE and technology-enhanced learning. Refer to York's Common Language for Experiential Education for complete definitions and further details.***

x	***Classroom based (e.g. guest speakers, role playing, visual media, case studies, simulations, workshops and laboratory, course-based research etc.)***
	Community based (e.g. community-based learning; community-based research; community service learning)
	Work focused (e.g. placement/practicum)

Please outline how you plan to engage students in reflection (critically examining a concrete experience) around the EE activities described above.

Experiential Education:
Students will have the opportunity to develop transferable skills such as problem solving and team work by exploring a real-world topic related to the nervous system with a focus on sensory processing, learning and memory. Students will be asked to work in teams (in class or online) to write a critical reflection on a journal article and/or media posting. They will be asked to address the questions: "what?" (e.g., what did they learn about the sensory process covered, what technologies were used to investigate the sensory system), "so what" (e.g., how does this information contribute to our knowledge in the field of neuroscience, does and/or how does the technologies used to investigate the sensory system further our understanding of this system), and "what now" (e.g., what more would they like to know about this topic or what further research needs to be engaged in to expand on this topic, are there other technologies that could better investigate the sensory system in this context). This activity should encourage reflection on the integration of key course concepts and give the student an opportunity to critique published decisions about or arguments related to real-world topics.

An additional in-class activity to encourage deeper understanding of the content could be used such as "Think, Pair, Share" where students are posed a question about the content, pair up with a partner to discuss it, and then share what they know with each other and eventually with the rest of the class.

Technology-Enhanced Learning:
Using simulations and/or a case study approach, students will evaluate technological tools currently in use to investigate sensory systems in health and disease and examine exemplars of sensory conditions of the central nervous system.

Personal response systems (e.g., iClickers/REEF) and online mini quizzes can be used to provide low-stakes, timely feedback to both students and instructor regarding student comprehension of course material.
Students will also have access to a Moodle site where recordings of lectures, and videos/simulations will be available for later review.

Instruction/Course Format

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

This course will be offered every year, in the winter term.

- ***Number of School/Department members currently competent to teach the course.***

3

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

When first offered, possible instructors could be Dorota Crawford, Georg Zoidl. In future years a new hire in the neuroscience area would support the offering of this course.

- ***An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved. This information is required to indicate whether an effective length of term is being maintained.***

In the first-year this course is offered, it may be offered in-class twice weekly (1.5 hours each session) for 12 weeks. However, given the depth and breadth of factual based information, it can also be re-designed and delivered using a blended format whereby half of the in-class time could be replaced with online learning activities involving online lecture recordings/videos/simulations. Students can review the content in preparation for class but at their own pace, and before exams as a study aid. Learning activities online could

also include discussion forums promoting debates in pairs/groups that help students to problem solve about exemplars of the consequences of sensory deficiencies in the nervous system.

Any in-class time can then be used for maximizing learning using personal response system technology to evaluate student knowledge and student engagement activities to delve deeper into their learning. For example, an in-class activity could be used such as “Think, Pair, Share” where students are posed a question about the content, pair up with a partner to discuss it, and then share what they know with each other and eventually with the rest of the class.

- ***In absence of scheduled contact hours, please provide an indication of the estimated time students are likely to spend engaged in learning activities required by the course.***

Currently the course is being proposed to hold scheduled contact hours twice weekly, 1.5 hours each session**.**

- ***In the absence of scheduled contact hours, please indicate how the course design encourages student engagement and supports students in achieving the learning objectives.***

- Course content will be posted in Moodle every week prior to class activities, including approximately three hours of required readings.
- Each week multiple choice questions (mini-quiz in Moodle) based on the course content will be available for students so that they can evaluate their understanding of the course content. The results from these quizzes can also provide formative information to the CD about the course content that students are having the most difficulty with in order for the CD to engage in just in time teaching in the classroom.
- Students will also have the opportunity to inform their understanding of the core course concepts and to apply this knowledge through the critical reflection exercise in exploring state of the art techniques and exemplars of sensory deficiencies.

Evaluation:

13. ***Please provide a detailed description of the basis of evaluation for the proposed course, including the type and percentage value of each assignment.***

Students will be evaluated with three non-cumulative equally weighted onsite written exams (25% each), one in the final exam time-period. Exams will comprise of both multiple-choice questions and matching/short answer questions to assess if students can correctly identify and describe and explain the core course concepts.

Responses to the polls and/or online mini-quizzes will be worth 10% of the grade.

12% of the students’ final grade will be calculated from their team work on the critical reflection activity. Responses will be assessed both on accuracy (against the course material) as well as their ability to make critical connections between core course concepts.

Because of the team work component, a Peer to peer and self-evaluation based on their collaboration experience will also be used (3%).

14. If the course is to be integrated (i.e., graduate/undergraduate), please list the additional evaluation requirements for graduate students.

n/a

15. If the proposed course employs technology-enhanced forms of delivery (i.e., non “face-to-face”, please identify how the integrity of learning evaluation will be maintained (will “on-site” examinations be required, etc.)

All exams will take place on site.

Other Resources:

9. Please provide a statement regarding the adequacy of physical resources (equipment, space, etc.). As well, please indicate if any other resources are required. Approval of a new course will be considered only if adequate resources are available to support the course.

Lecture hall with space for approximately 100 students. Internet access and audiovisual equipment.

10. If there is a technology-enhanced component to the course, a statement is required from the Learning Technology Services indicating whether resources are adequate to support the course. Requests for statements can directed to Rob Finlayson (rfinlays@yorku.ca). Please note, it will take two weeks to get a statement of support.

Course Rationale:

17. ***How will the course contribute to the educational objectives of the School/Department and of the Faculty?***

This course contributes to the educational objectives of the Neuroscience major because it explores in depth the molecular, structural and cellular basis of complex brain functions. It builds on the 2000-level NRSC courses and is key to student achievement of learning objectives described previously.

18. ***What is the relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content? If overlap exists, please indicate the nature and extent of consultation which has taken place. If the course is to be cross-listed, integrated or listed as a course credit exclusion with another course, approval is required from all the relevant Faculties/units.***

There is no significant overlap with other courses due to the molecular, cellular basis adopted in this course.

19. ***If applicable, please indicate the relationship of the proposed course to interdisciplinary programs; i.e. for which interdisciplinary program(s) will the course count for major/minor credit. As well, please indicate the nature and extent of consultation that has taken place with the relevant interdisciplinary program coordinator(s).***

n/a

20. ***What is the expected enrolment in the course?***

Expected enrolment is up to a 100.

Bibliography:

Please list the <u>required readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.).

There are a number of core textbooks that will serve as reference books throughout the neuroscience program and will be used again in other core neuroscience courses. They are

1. Principles of Neural Science, 5th Edition. Kandel, E.R. et al., McGraw-Hill, New York. 2012. ISBN 0-07-139011-1
2. Neuroscience 6th Ed., Purves, D. et. al. (Eds.),Oxford University Press. (2017)
3. Principles of Neurobiology, L. Luo, Taylor & Francis Ltd (2015)
4. Fundamental Neuroscience, Squire et. al. (Eds.), Academic Press (2012)

This course will also use

5. Examples from current literature in Medline/Pubmed such as Nature Neuroscience Reviews, Trends in Neuroscience, etc.

Please list any <u>suggested readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.)

Examples from current literature will change each year but in general will be found in Medline/Pubmed (Nature Neuroscience Reviews, Trends in Neuroscience, etc.)

Please list any <u>online resources</u> for the course (please include complete bibliographical information as above).

Online eJournals as appropriate.

For students the experiential education guide is a useful resource for explaining about reflection: http://ee_guide.info.yorku.ca/.

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

n/a

<u>Library Support Statement</u>:

Proposals for new courses must include a **<u>library support statement</u>** from the Bibliographer responsible for the relevant discipline to indicate whether resources are adequate to support the course. To request a support statement, see the list of subject and liaison librarians at http://www.library.yorku.ca/web/about-us/contact-us/liaison-librarians/.

Consultation/Approval:

- The Faculty of Health Curriculum Committee will only consider new course proposals that have been approved by the unit responsible for offering the course.
- If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

School/Department: Biology, Psychology, Kinesiology and Health Science

Course Number Information:

Faculty:	HH	**Rubric:**	NRSC	**Course #:**	4000	**Weight:**	6.00
			(i.e. HLST)				(i.e. 3.00, 6.00 or 0.00)

Effective Session for Change:	**Term:**	Fall	**Year:**	2023
		(i.e. Fall, Fall/Winter, Winter)		(i.e. 2017-18, 2018)

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

Neuroscience Individual Research Project

Short Title: **Maximum 40 characters**, including punctuation and spaces. The short title appears on any documents where space is limited (transcripts and lecture schedules).

Individual Research Project

Brief Course Description: For editorial consistency, verbs should be in the present tense and begin the description; e.g., "Analyzes the nature and extent of...," rather than "This course will analyze..." or “This course analyzes…”.

This is the official description of the course as it will appear in the Undergraduate Calendar. The course description should be carefully written to convey what the course is about. If applicable, include information regarding the language of instruction if other than English.

A Capstone neuroscience research project under the supervision of a neuroscience core/affiliated faculty member. An individual intensive research project engaged in a laboratory, or in the community (industry, hospital), leading to the creation of an original piece of research, final written paper, as well as an oral presentation to the neuroscience community at York.

- **List course(s) where applicable:**

Integration†:		Course Credit Exclusions*:	
Prerequisites:	NRSC 3000 3.0; NRSC 2200	Cross-listed to:	
Corequisites:			

†Integrated courses are graduate courses integrated (taught with) 4000-level undergraduate courses

*Course credit exclusion is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both.

- Include the following information only if the course is: limited to a specific group of students; closed to a specific group of students; if there is any additional information necessary for students to know before enrolling (notes); if the course includes experiential education, and whether the students will work with a community partner and/or if it will involve going off-campus.

Open to:	Only to students majoring in Neuroscience. Students must have honours standing, completed at least 84 credits in total, with an additional (on top of NRSC 3000) 18 credits from the 3000/4000-level Neuroscience alternative streams.
Not open to	
Notes:	The student will need to contact individual faculty members and find one that is taking on students (this may be facilitated by the Neuroscience Program Coordinator). The student and faculty member must sign a form in which they agree on the type and amount of work to be done.

• **Science Course:**	**YES**	**NO**
Denotes courses in KINE or PSYC to count as science credit for BSc degree programs	X	

Expanded Course Description

- Please provide a detailed course description that effectively conveys what this course is about. Please ensure that this description includes but is not limited to: 1) course topics/theories; 2) course learning objectives; 3) course learning outcomes; and 4) a description of any experiential education (EE) and/or technology-enhanced learning (also referred to as eLearning) activities.

Term	Definition
Course Learning Objectives	Statements of the overall learning and teaching goals for the course and represent what the instructor would expect students to learn and retain in the course. They articulate what the teacher plans to achieve in the course.
Learning Outcomes	Statements of what the student will achieve by the end of the course. They provide a framework for assessment by stating what you expect the learners to be able to demonstrate after completing the course. A succinct learning outcome specifies the tasks students are expected to be able to perform and the level of competence expected for the tasks.
Experiential Education (EE)	The blending of theory/course work with concrete experience. Effective EE activities require students to reflect on and demonstrate their understanding of the relationship(s) between theory/course work and concrete experience.
Structured Reflection	Structured reflection is any planned activity or exercise that requires students to refer back and critically examine the concrete experience in light of existing theory and/or what is being covered in the course.
Technology-Enhanced Learning (eLearning)	The use of technology to support students' interaction: with and access to the content; to course learning activities; and with other students and faculty members in order to develop knowledge and skills

Refer to the last page of the course proposal for resources on course learning objectives and outcomes, experiential education and technology-enhanced learning.

1. Course Topics or Theories:

This 6-credit Capstone project is similar to a research intensive honours thesis project however the expectation for this Capstone project involves contributing as an individual to the existing body of knowledge in the field of neuroscience by engaging in original empirical experimental/clinical research. Time commitment is at a minimum 10 hours a week. This Capstone project involves considerable self-directed work and must reflect critical thinking and analytical skills and an understanding of the scientific method. A strong project is built on carefully reviewing and analyzing the literature, communicating clearly, and acting ethically and professionally. Topics could range from molecular/cellular neuroscience, to behavioural/cognitive neuroscience, to systems neuroscience.

2. **Course Learning Objectives:**

- Students will work independently, and be a good research citizen

A written student-supervisor agreement outlining the tasks and learning expectations for the project and detailing the hours involved, will be filled in with the supervisor in early September. Students will also submit for approval a project proposal to the supervisor.

The student will work with his/her supervisor directly during which they will discuss each phase of the research (selecting a topic, designing the study, collecting the data, analyzing data, and communicating the results in writing and orally). In mid-January the supervisor will provide feedback on the performance of the student in terms of meeting the learning outcomes specified in the student-supervisor agreement. The format of this evaluation will vary from project to project, but the requirements of this evaluation will be specified in the original documents.

Research citizenship and professionalism skills will be developed through their work in labs and lab meetings, modelling the behaviors that are valuable to future careers in the field. While lab meetings and experiences may look different from project to project, all students will be evaluated (5% of their final grade) on how they contribute to the creation and ongoing support of a positive, collegial research environment.

Students will also submit to their supervisor a short, written, critical self-reflection (evaluated at 5%) designed to provide students with an opportunity to critically reflect on their experience conducting an individual research project in the neuroscience program. They can be asked to critique their own thoughts, attitudes, and actions related to neuroscience research, and describe how/why they have changed or stayed the same as a result of their research experience. They can be asked to identify at least one attitude/action that they think they could apply, do better, or do differently (it can apply to any aspect of their professional or academic life) as a result of what they have learned about research in neuroscience.

- Students will develop a project plan, implement their research, analyze and synthesis results, and communicate their results in writing and orally.

In late September/early October, students will hand in a short précis (abstract) of their intended research project along with a reference or reading list outlining what literature and why it will serve as foundational for their research project. This précis will be formatively reviewed by the supervisor and worth 5% of the student's final grade. Approximately mid-January the student will hand in to the supervisor a draft of the Introduction and Methods of the project. The aim of submitting this early draft is to provide an opportunity for feedback on the student's writing (evaluated and worth 25%) and their proposed methodology, its feasibility, and directly related to current literature and best experimental practices in the field.

At a public presentation of all Neuroscience Capstone projects the student will provide an oral presentation of the research to the faculty and students associated with the Neuroscience program. Students will be also given an option of using a poster, video, or other information sharing technologies to present their final project. This final presentation will be evaluated (20%).

At the end of the term, the supervisor(s) will provide the student with a grade of the final project (5% for précis & reading list, 25% for draft, 20% for oral presentation, 40% for final paper, 5% for research citizenship, and 5% for critical self-reflection) and an overall evaluation of the degree to which the student has met the agreed-upon expectations and the learning objectives.

3.**Expected Learning Outcomes:** while individual student work will vary based on their chosen projects, by the end of the course all students will be able to:

- Defend a chosen argument or stance based on collected evidence (e.g. data, literature, etc.)
- Describe, in depth, a key concept or core principle in the neuroscience field
- Determine and implement appropriate research skills to complete a laboratory or clinical or research project based on a mutually-determined topic or problem
- Display autonomy and professional capacity by learning to work effectively with others (supervisor, lab mates, team mates)
- Implement ethical practices in completing their chosen research project
- Analyze and defend their research both orally and in writing
- Display rigour and meticulousness in completing their chosen research project
- Display professionalism skills in all interactions with faculty supervisor, peers, and other members of the Neuroscience community

4. Experiential education/technology enhanced learning are described in more detail in the next section.

Experiential Education/Technology-Enhanced Learning

EE remains a top priority for York University and the Faculty of Health as it offers a range of benefits for students related to academic performance, civic engagement and employability (for more information on the benefits of EE for students and course directors, please go to: **http://health.yorku.ca/experiential-education/faculty/**. Course directors are invited to integrate EE into their course where possible, but it is understood that some EE strategies may not be feasible in every course.

Course proposals with EE must be reviewed by Andra Petro, EE Coordinator (apetro@yorku.ca) prior to the submission of the proposal to the Faculty of Health Curriculum Committee.

• ***Please indicate (X) if the course uses any EE and/or technology-enhanced learning?***	***YES***	***x***	***NO***	
• ***If NOT, please outline some of the reasons EE or technology-enhanced learning could not be incorporated the course.***				
• ***If YES, please indicate (X) whether your course will include one or more of the following types of EE and technology-enhanced learning. Refer to York's Common Language for Experiential Education for complete definitions and further details.***				
x	***Classroom based (e.g. guest speakers, role playing, visual media, case studies, simulations, workshops and laboratory, course-based research etc.)***			
x	***Community based (e.g. community-based learning; community-based research; community service learning)***			
	Work focused (e.g. placement/practicum)			

Please outline how you plan to engage students in reflection (critically examining a concrete experience) around the EE activities described above.

Experiential Education
This course is highly experiential, as students will have the opportunity to propose, design and pursue a research project that is centered on the real-world application of a key concept in the neuroscience degree. This laboratory/clinical research may also involve work in the field as part of the data collection and/or data analysis process. These projects will be developed in response to a topic mutually-identified by the student and their faculty supervisor. The final paper and accompanying presentation will give students the opportunity to share what they have learned, relate it back to concepts/theories, identify any gaps in their findings/knowledge (what they know what they don't know), and suggest ways to address these gaps in knowledge. The student will make meaning of their time conducting research and exploring relevant issues in neuroscience by presenting their findings to the neuroscience community at York.

Technology-Enhanced Learning
Students will have access to a variety of technological tools designed to support their research, including tools for data collection, data analysis, and/or information dissemination. Students will also have the option of using video or other information sharing technologies to present their work to the York neuroscience community.

Instruction/Course Format

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

This course will be offered every year usually during the Fall and Winter terms.

- ***Number of School/Department members currently competent to teach the course.***

All faculty members associated with the Neuroscience program could supervise this Capstone project.

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

This course requires a supervisor for the student.

- ***An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved. This information is required to indicate whether an effective length of term is being maintained.***

Approximately 10 hours per week (library research, lab-based/clinical research, data analysis, writing, etc.) over 8 months.

- ***In absence of scheduled contact hours, please provide an indication of the estimated time students are likely to spend engaged in learning activities required by the course.***

Beyond organizational meetings in early September and the public presentations at the end of the course, there are no formally scheduled meetings during the course. Students are expected to engage in about 10 hours a week on their projects. Students may be required to attend regular and/or scheduled lab meetings with their supervisor as part of their project requirements, which will be negotiated between the student and their supervisor.

- ***In the absence of scheduled contact hours, please indicate how the course design encourages student engagement and supports students in achieving the learning objectives.***

Students will be undertaking a self-directed deep exploration of a neuroscience research topic, including the critical analysis and synthesis of knowledge to identify and explain complex issues in the neuroscience field. Engagement in the research and achievement of learning objectives is facilitated by a neuroscience faculty member who will be offering formative feedback and advice throughout the year, and as well through valuable mentorship by graduate students associated with the research project.

Evaluation:

16. ***Please provide a detailed description of the basis of evaluation for the proposed course, including the type and percentage value of each assignment.***

The course requires an initial project proposal that will be submitted by the student to and approved by the supervisor. Each project is intended to propose a research-oriented solution to a particular real-world problem or identified challenge in the Neuroscience field. Projects will be expected to be, among other criteria, feasible, scalable, and directly related to current literature and best practices in the field.

Students will engage in considerable self-directed work and will meet with his/her supervisor during which they will discuss each phase of the research (selecting a topic, designing the study, collecting the data, analyzing data, and getting feedback on their written work and presentation). A short précis (abstract) and reading/reference list will be handed in no later than one month into the course and will be evaluated (5% of the final grade) to provide formative feedback to the student on their proposed research project. No later than 4 months after beginning the project (approximately January 15th) the student will hand in to the supervisor a draft of the Introduction and Methods sections of the project. The aim of submitting this draft is to provide an opportunity for feedback on the students' writing (evaluated and worth 25%) describing their Introduction and proposed Methods to be used for their research. At the same time the supervisor will provide feedback on the performance of the student in terms of their progress toward meeting the learning outcomes specified in the project proposal as well as the core outcomes specified for the course. The format of this evaluation will vary from project to project, but the requirements of this evaluation will be specified in the original project proposal.

Students will be assessed on their work in labs and lab meetings, modelling the importance of developing professionalism skills that are valuable to future careers in the field. While lab meetings and experiences may look different from project to project, all students will be assessed on research citizenship (5% of their final grade) on how they contribute to the creation and ongoing support of a positive, collegial, lab (research) environment.

At the beginning of September, the neuroscience program coordinator will establish a date and format for the oral presentation of all Neuroscience Capstone projects. This presentation will normally consist of either a short public oral presentation of the project. Students will be also given an option of using a poster or video or other information sharing technologies to present their final projects. All of the faculty, staff, and students associated with the Neuroscience program will be invited to attend this presentation. This final presentation will be evaluated (20%) using a rubric adapted from the Oral communication value rubric proposed by AACU (American Academy of Colleges and Universities see *value@aacu.org*) evaluating skills such as reflection (e.g., uses concepts learned about neuroscience to draw further conclusions and links it to research, shows that they recognize and can critique the beliefs and assumptions they hold etc.); language (e.g., language supports the effectiveness of communication, is appropriate to the topic and audience, grammatical, clear, etc.); delivery (e.g., posture, gesture, eye contact, and vocal expressiveness shows confidence and authority. looks more often at the audience than at his/her speaking materials/notes, etc.); supporting material (e.g., explanations, examples, illustrations, statistics, analogies, and quotations from relevant authorities are appropriate); central message (e.g., compelling, precisely stated, appropriately repeated, memorable, and strongly supported, etc.).

At the end of the term, the supervisor will provide the student with a grade of the final paper (40%) and an overall evaluation of the degree to which the student has met the agreed-upon expectations and the learning objectives.

Students will also submit to their supervisor a short, written, self-reflection (evaluated at 5%) designed to provide students with an opportunity to critically reflect on their experience in the neuroscience program and to outline how and what they have learned about neuroscience research, the field in general, and themselves. They will be asked to critique their own thoughts, attitudes, and actions related to neuroscience research, and describe how/why they have changed or stayed the same as a result of their research experience. They can be asked to identify at least one attitude/action that they think they could apply, do better, or do differently (it can apply to any aspect of their professional or academic life) as a result of what they have learned about neuroscience.

Marking Scheme:

Precis and reading list: 5%
Mid-way draft evaluation: 25%
Oral presentation evaluation: 20%
Final report: 40%
Research citizenship: 5%
Written self-reflection: 5%

17. If the course is to be integrated (i.e., graduate/undergraduate), please list the additional evaluation requirements for graduate students.

n/a

18. If the proposed course is employs technology-enhanced forms of delivery (i.e., non "face-to-face", please identify how the integrity of learning evaluation will be maintained (will "on-site" examinations be required, etc.)

n/a

Other Resources:

11. Please provide a statement regarding the adequacy of physical resources (equipment, space, etc.). As well, please indicate if any other resources are required. Approval of a new course will be considered only if adequate resources are available to support the course.

No new resources are required in order to mount this course. Where necessary, faculty supervising a research project will accommodate the student(s) in their laboratories.

12. If there is a technology-enhanced component to the course, a statement is required from the Learning Technology Services indicating whether resources are adequate to support the course. Requests for statements can directed to Rob Finlayson (rfinlays@yorku.ca). Please note, it will take two weeks to get a statement of support.

Course Rationale:

21. ***How will the course contribute to the educational objectives of the School/Department and of the Faculty?***

This course is the Capstone course for the Neuroscience program. It will contribute to the educational objectives of the Neuroscience program by giving the students an opportunity to engage in a valuable experience conducting research either in a lab or applied setting. Successfully completing this course will contribute to the students' ability to achieve the following neuroscience program expectations:

- Integrate and apply theoretical perspectives and major findings across broad areas of neuroscience
- Demonstrate a detailed knowledge in one of the Specialized Neuroscience streams
- Relate neuroscience to other disciplines, and apply learning from those disciplines within neuroscience e.g., mathematics, computer science, physics, health sciences, sport and society
- Locate and retrieve scientific information, and to read and critique scientific articles, demonstrate scientific writing skills, and deliver oral presentations.
- Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods.
- Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions.
- Analyze and interpret pre-existing or novel data, including research findings, and communicate the findings in both oral and written formats to diverse audiences.
- Represent information in a quantitative format, to analyze and interpret quantitative information, including graphs and statistics.
- Demonstrate initiative, personal responsibility, and accountability in the laboratory and other settings.

22. ***What is the relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content? If overlap exists, please indicate the nature and extent of consultation which has taken place. If the course is to be cross-listed, integrated or listed as a course credit exclusion with another course, approval is required from all the relevant Faculties/units.***

There already exists 4000 level thesis courses in Biology, Psychology and Kinesiology & Health Science, all of which operate in a similar manner. But not of all of which are in-depth in lab or clinically based research projects requiring a final written project, an oral presentation, and a written self-reflection. The expectation is that students will engage more fulsomely in the lab, with a research question, engage in analysis, problem solving, writing, and oral communication that will culminate in contributing to the existing body of knowledge.

The Specialized Honours Neuroscience program aims to distinguish itself by a robust research-level Capstone experience, which this course fulfils.

23. ***If applicable, please indicate the relationship of the proposed course to interdisciplinary programs; i.e. for which interdisciplinary program(s) will the course count for major/minor credit. As well, please indicate the nature and extent of consultation that has taken place with the relevant interdisciplinary program coordinator(s).***

n/a

24. ***What is the expected enrolment in the course?***

Expected enrolment will be approximately 35 students/year.

Bibliography:

Please list the <u>required readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.).

Required reading from library holdings will vary based on the specific project(s) and specific focus of the neuroscience faculty member in a given year. In general, the existing electronic journal subscriptions should be sufficient for this course.

Please list any <u>suggested readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.)

This will vary depending on the project.

Please list any <u>online resources</u> for the course (please include complete bibliographical information as above).

For faculty members, there are some useful resources on the Teaching Commons website: http://teachingcommons.yorku.ca/resources-2/experiential-education/. As well as a faculty resource page at https://spark.library.yorku.ca/faculty-teaching-with-spark-guidelines-for-using-spark/ comprised of modules that support topics such as academic integrity, effective literature search strategies research, writing, etc.

AACU (American Academy of Colleges and see *value@aacu.org*) has developed and provided different rubrics for evaluating writing, critical thinking, team work, oral presentation skills, etc. that could easily be adapted for the evaluation needs of this course.

An excellent resource that exists for guiding students on writing are the SPARK (Student Paper and Academic Research Kit) modules found online at https://spark.library.yorku.ca/

Universities

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

n/a

Library Support Statement:

Proposals for new courses must include a **library support statement** from the Bibliographer responsible for the relevant discipline to indicate whether resources are adequate to support the course. To request a support statement, see the list of subject and liaison librarians at http://www.library.yorku.ca/web/about-us/contact-us/liaison-librarians/.

Consultation/Approval:

- The Faculty of Health Curriculum Committee will only consider new course proposals that have been approved by the unit responsible for offering the course.
- If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

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New Course Proposal Form

Faculty of Health Curriculum Committee

School/Department: Biology, Psychology, Kinesiology and Health Science

Course Number Information:

Faculty: HH **Rubric:** NRSC (i.e. HLST) **Course #:** 4002 **Weight:** 6.00 (i.e. 3.00, 6.00 or 0.00)

Effective Session for Change: **Term:** Fall (i.e. Fall, Fall/Winter, Winter) **Year:** 2023 (i.e. 2017-18, 2018)

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

Neuroscience Team Research Project

Short Title: <u>Maximum 40 characters</u>, including punctuation and spaces. The short title appears on any documents where space is limited (transcripts and lecture schedules).

Team Research Project

Brief Course Description: For editorial consistency, verbs should be in the present tense and begin the description; e.g., "Analyzes the nature and extent of...," rather than "This course will analyze..." or “This course analyzes…”.

This is the official description of the course as it will appear in the Undergraduate Calendar. The course description should be carefully written to convey what the course is about. If applicable, include information regarding the language of instruction if other than English.

A Capstone neuroscience team-based research project under the supervision of a neuroscience core/affiliated faculty member and usually an advisor from the community (industry or hospital). An intensive team-based research project leading to the creation of an original piece of research, final written paper, as well as an oral presentation to the neuroscience community at York.

- **List course(s) where applicable:**

Integration†:		Course Credit Exclusions*:	
Prerequisites:	NRSC 3000 3.0; NRSC 2200	Cross-listed to:	
Corequisites:			

†Integrated courses are graduate courses integrated (taught with) 4000-level undergraduate courses

*<u>Course credit exclusion</u> is a formal status accorded to pairs of courses that are recognized as having sufficient overlap in content to warrant specifically excluding students from obtaining credit for both.

- Include the following information only if the course is: limited to a specific group of students; closed to a specific group of students; if there is any additional information necessary for students to know before enrolling (notes); if the course includes experiential education, and whether the students will work with a community partner and/or if it will involve going off-campus.

Open to:	Only to students majoring in Neuroscience. Students must have honours standing, completed at least 84 credits in total, with an additional (on top of NRSC 3000) 18 credits from the 3000/4000-level Neuroscience alternative streams.
Not open to	
Notes:	The student will need to contact individual faculty members and find one that is taking on students (this may be facilitated by the Neuroscience Program Coordinator). The student and faculty member must sign a form in which they agree on the type and amount of work to be done.

• **Science Course:**	**YES**	**NO**
Denotes courses in KINE or PSYC to count as science credit for BSc degree programs	X	

Expanded Course Description

- Please provide a detailed course description that effectively conveys what this course is about. Please ensure that this description includes but is not limited to: 1) course topics/theories; 2) course learning objectives; 3) course learning outcomes; and 4) a description of any experiential education (EE) and/or technology-enhanced learning (also referred to as eLearning) activities.

Term	Definition
Course Learning Objectives	Statements of the overall learning and teaching goals for the course and represent what the instructor would expect students to learn and retain in the course. They articulate what the teacher plans to achieve in the course.
Learning Outcomes	Statements of what the student will achieve by the end of the course. They provide a framework for assessment by stating what you expect the learners to be able to demonstrate after completing the course. A succinct learning outcome specifies the

	tasks students are expected to be able to perform and the level of competence expected for the tasks.
Experiential Education (EE)	The blending of theory/course work with concrete experience. Effective EE activities require students to reflect on and demonstrate their understanding of the relationship(s) between theory/course work and concrete experience.
Structured Reflection	Structured reflection is any planned activity or exercise that requires students to refer back and critically examine the concrete experience in light of existing theory and/or what is being covered in the course.
Technology-Enhanced Learning (eLearning)	The use of technology to support students' interaction: with and access to the content; to course learning activities; and with other students and faculty members in order to develop knowledge and skills

Refer to the last page of the course proposal for resources on course learning objectives and outcomes, experiential education and technology-enhanced learning.

1. **Course Topics or Theories:**
This 6-credit Capstone project is similar to a research intensive honours thesis project however the expectation for this Capstone project involves working as a team to contribute to the existing body of knowledge in the field of neuroscience by engaging in original empirical experimental/clinical research or solving an applied problem. Time commitment is at a minimum 10 hours a week. This Capstone project involves considerable self-directed and group work and must reflect critical thinking and analytical skills and an understanding of the scientific method. A strong project is built on carefully reviewing and analyzing the literature, communicating clearly, and acting ethically and professionally. Topics could range from molecular/cellular neuroscience, to behavioural/cognitive neuroscience, to systems neuroscience.

2. **Course Learning Objectives:**

- Students will work collaboratively in teams and be a good research citizen

The students will work in small research teams (approximately 4-5 students) through each phase of the research (selecting a topic, designing the study, collecting the data, analyzing data, and communicating the results in writing and orally). A written agreement outlining the proposed research project, scope of the research project, anticipated tasks and how work will be divided amongst group members, hours involved (time required), and resources required will be filled in with the course director in early September. Each student team will work directly with the course director to review and discuss their proposed project plan; this agreement must be signed by the students and the course director before work can begin on the project. In mid-January the course director will provide feedback on the performance of the student teams in terms of meeting the learning outcomes specified in the original agreement. The format of this evaluation will vary from project to project, but the requirements of this evaluation will be specified in the original documents.

Students will also submit to their supervisor at the end of the course an evaluation of their collaboration (peer-to-peer and self, evaluated at 5%) designed to provide students with an opportunity to critically reflect on their experience conducting a team-based project in the neuroscience program. A collaboration rubric can be created where students assess and critique their contributions and their peers contributions to the development of the project (e.g., role in researching and gathering information, ability to share and relay information, punctuality); responsibility in ensuring the project outcomes are fulfilled (e.g., fulfills team role & duties, contributes to the development of the final paper); ability to be a valuable team player (e.g., listens to others, expresses self to others, makes fair decisions).

Individually, students will also be assessed on their research citizenship: professionalism skills through their work in labs, lab meetings, in the community, modelling the behaviors that are valuable to future careers in the field. While lab meetings and experiences may look different from project to project, all students will be evaluated (5% of their final grade) on how they contribute to the creation and ongoing support of a positive, collegial research, team environment.

- Students will develop a project plan, implement their research, analyze and synthesis results, and communicate their results in writing and orally.

In late September/early October, each student team will hand in to the course director a short précis (abstract) of their intended research project along with a reference or reading list outlining what literature and why it will serve as foundational for their research project. This précis will be formatively reviewed by the course director and worth 5% of the students' final grade. Approximately mid-January the teams will hand in to the course director a draft of the Introduction and Methods of the project. The aim of submitting this early draft is to provide an opportunity for feedback on the group's collaborative writing (evaluated and worth 25%), proposed methodology for their project, and ensure it is grounded in a real-world problem or identified challenge in the

Neuroscience field. Projects will be expected to be, among other criteria, feasible, scalable, and directly related to current literature and best practices in the field.

At a public presentation of all Neuroscience Capstone projects the team will provide an oral presentation of the projects to the faculty and students associated with the Neuroscience program. Students will be also given an option of using a poster, video, or other information sharing technologies to present their final projects. This final presentation will be evaluated (20%).

At the end of the term, the course director will provide the students with a grade of the final project (5% for précis & reading list, 5% for a peer-to-peer and self- evaluation of their work with their project team, 25% for draft Intro and Methods, 20% for oral presentation, 40% for final project/paper, and 5% for research citizenship) and an overall evaluation of the degree to which each student has met the agreed-upon expectations and the learning objectives.

3. **Expected Learning Outcomes**: while student work will vary based on their chosen projects, by the end of the course all students will be able to

- Defend a chosen argument or stance based on collected evidence (e.g. data, literature, etc.)
- Describe, in depth, a key concept or core principle in the neuroscience field
- Determine and implement appropriate research skills to complete the project based on a mutually-determined topic or problem
- Display autonomy and professional capacity by learning to work effectively with others (course director, community advisor, team mates)
- Implement ethical practices in completing their chosen research project
- Analyze and defend their research both orally and in writing
- Display rigour and meticulousness in completing their chosen research project
- Display professionalism skills in all interactions with faculty and community advisor, peers, and other members of the Neuroscience community

4. Experiential education/technology enhanced learning are described in more detail in the next section.

Experiential Education/Technology-Enhanced Learning

EE remains a top priority for York University and the Faculty of Health as it offers a range of benefits for students related to academic performance, civic engagement and employability (for more information on the benefits of EE for students and course directors, please go to: **http://health.yorku.ca/experiential-education/faculty/**. Course directors are invited to integrate EE into their course where possible, but it is understood that some EE strategies may not be feasible in every course.

Course proposals with EE must be reviewed by Andra Petro, EE Coordinator (apetro@yorku.ca) prior to the submission of the proposal to the Faculty of Health Curriculum Committee.

• ***Please indicate (X) if the course uses any EE and/or technology-enhanced learning?***	***YES***	***x***	***NO***	
• ***If NOT, please outline some of the reasons EE or technology-enhanced learning could not be incorporated the course.***				
• ***If YES, please indicate (X) whether your course will include one or more of the following types of EE and technology-enhanced learning. Refer to York's Common Language for Experiential Education for complete definitions and further details.***				
X	***Classroom based (e.g. guest speakers, role playing, visual media, case studies, simulations, workshops and laboratory, course-based research etc.)***			
X	***Community based (e.g. community-based learning; community-based research; community service learning)***			
	Work focused (e.g. placement/practicum)			
Please outline how you plan to engage students in reflection (critically examining a concrete experience) around the EE activities described above.				

Experiential Education
This course is highly experiential, as students will have the opportunity to work as a team and propose, design, and pursue a research project that is centered on the real-world application of a key concept in the neuroscience degree. This laboratory/clinical research may also involve work in the field as part of the data collection and/or data analysis process. These projects will be developed in response to a topic mutually-identified by the student teams, the course director, and a community partner (industry, hospital). Working in small groups, students will also have the opportunity to experience and develop skills in teamwork, collaborative research & writing, and group presentations. These experiences and skills mirror those important for success in the diversity of careers available to students after graduation.

The final paper and accompanying presentation will give students the opportunity to share what they have learned, relate it back to concepts/theories, identify any gaps in their findings/knowledge (what they know what they don't know), and suggest ways to address these gaps in knowledge. The student will make meaning of their time conducting research and exploring relevant issues in neuroscience by presenting their findings to the neuroscience community at York.

Technology-Enhanced Learning
Students will have access to a variety of technological tools designed to support their research, including tools for collaborative research & writing (e.g. Google Docs), data collection, data analysis, and/or information dissemination. Students will also have the option of using video or other information sharing technologies to present their work to the York neuroscience community.

Instruction/Course Format

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

This course will be offered every year usually during the Fall and Winter terms.

- ***Number of School/Department members currently competent to teach the course.***

All faculty members associated with the Neuroscience program could teach this course.

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

This course requires a course director to guide the student teams, establish relationships and liaise with the community partner(s). A new hire in Neuroscience could teach this course. Gary Turner has indicated interest in offering it in the interim.

- ***An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved. This information is required to indicate whether an effective length of term is being maintained.***

Approximately 10 hours per week (library research, lab-based/clinical research, data analysis, writing, etc.) over 8 months.

- ***In absence of scheduled contact hours, please provide an indication of the estimated time students are likely to spend engaged in learning activities required by the course.***

Beyond organizational meetings in early September and the public presentations at the end of the course, there are no formally scheduled meetings during the course. Students are expected to engage in about 10 hours a week with their groups on their projects. Students may be required to attend regular and/or scheduled lab meetings with a/their lab supervisor as part of their course or project requirements, which will be negotiated between the student teams and the course director and/or advisor from the community (industry or hospital).

- ***In the absence of scheduled contact hours, please indicate how the course design encourages student engagement and supports students in achieving the learning objectives.***

Students will be undertaking a self-directed team based deep exploration of a neuroscience research topic, including the critical analysis and synthesis of knowledge to identify and explain complex issues in the neuroscience field. Engagement in the research and achievement of learning objectives is facilitated by a course director and advisor from the community who will be offering formative feedback and advice throughout the year, and as well potentially through valuable mentorship by graduate students associated with the research project.

Evaluation:

19. ***Please provide a detailed description of the basis of evaluation for the proposed course, including the type and percentage value of each assignment.***

The course requires an initial project proposal that will be submitted by each research team to the course director and approved by the course director. Each project is intended to propose and/or conduct one or multiple research-oriented solution(s) to a particular real-world problem or identified challenge in the Neuroscience field. Projects will be expected to be, among other criteria, feasible, scalable, and directly related to current literature and best practices in the field.

Students will engage in considerable self-directed work and the team will meet with the course director during which they will discuss each phase of the research (selecting a topic, designing the study, collecting the data, analyzing data, and getting feedback on their written work and presentation). A shortprécis(abstract) and reading/reference list will be handed in no later than one month into the course and will be evaluated (5% of the final grade) to provide formative feedback to the student teams on their proposed research project. No later than 4 months after beginning the project (approximately January 15th) the team will hand in to the supervisor a draft of the Introduction and Methods sections of the project. The aim of submitting this draft is to provide an opportunity for feedback on their collaborative writing (evaluated and worth 25%) describing their Introduction and proposed Methods to be used for their project (evaluated and worth 25%). At the same time the course director will provide feedback on the performance of each team in terms of their progress toward meeting the learning outcomes specified in the project proposal as well as the core outcomes specified for the course. The format of this evaluation will vary from project to project, but the requirements of this evaluation will be specified in the original project proposal.

Students will also be assessed on their work in labs, lab meetings at York or in the community, modelling the importance of developing professionalism skills that are valuable to future careers in the field. While lab meetings and experiences may look different from project to project, all students will be assessed on citizenship (5% of their final grade) on how they contribute to the creation and ongoing support of a positive, collegial, research environment.

At the beginning of September, the neuroscience program coordinator will establish a date and format for the oral presentation of all Neuroscience Capstone projects. This presentation will normally consist of either a short public oral presentation of the project. Students will be also given an option of using a poster or video or other information sharing technologies to present their final projects. All of the faculty, staff, and students associated with the Neuroscience program will be invited to attend this presentation. This final presentation will be evaluated (20%) using a rubric adapted from the Oral communication value rubric proposed by AACU (American Academy of Colleges and Universities see *value@aacu.org*) evaluating skills such as reflection (e.g., uses concepts learned about neuroscience to draw further conclusions and links it to research, shows that they recognize and can critique the beliefs and assumptions they hold etc.); language (e.g., language supports the effectiveness of communication, is appropriate to the topic and audience, grammatical, clear, etc.); delivery (e.g., posture, gesture, eye contact, and vocal expressiveness shows confidence and authority. looks more often at the audience than at his/her speaking materials/notes, etc.); supporting material (e.g., explanations, examples, illustrations, statistics, analogies, and quotations from relevant authorities are appropriate); central message (e.g., compelling, precisely stated, appropriately repeated, memorable, and strongly supported, etc.).

At the end of the term, the supervisor will provide the student with a grade of the final paper (40%) and an overall evaluation of the degree to which the teams have met the agreed-upon expectations and the learning objectives.

Students will also submit to their supervisor an evaluation of their collaboration (peer-to-peer and self, evaluated at 5%) designed to provide students with an opportunity to critically reflect on their experience conducting a team-based project in the neuroscience program. A collaboration rubric will be created or adapted from the team based value rubric proposed by AACU (American Academy of Colleges and Universities see *value@aacu.org*) whereby students assess and critique their contributions and their peers contributions to the development of the project (e.g., role in researching and gathering information, ability to share and relay information, punctuality); responsibility in ensuring the project outcomes are fulfilled (e.g., fulfills team role &

duties, contributes to the development of the final paper); and ability to be a valuable team player (e.g., listens to others, expresses self to others, makes fair decisions).

Marking Scheme:

Precis and reading list: 5%
Mid-way draft evaluation: 25%
Oral presentation evaluation: 20%
Final report: 40%
Research Citizenship: 5%
Peer-to-peer and self-reflection: 5%

20. If the course is to be integrated (i.e., graduate/undergraduate), please list the additional evaluation requirements for graduate students.

n/a

21. If the proposed course is employs technology-enhanced forms of delivery (i.e., non "face-to-face", please identify how the integrity of learning evaluation will be maintained (will "on-site" examinations be required, etc.)

n/a

Other Resources:

13. Please provide a statement regarding the adequacy of physical resources (equipment, space, etc.). As well, please indicate if any other resources are required. Approval of a new course will be considered only if adequate resources are available to support the course.

No new physical resources are required in order to mount this course. A new hire in Neuroscience will be required to mount different sections of this course. In the interim Gary Turner has indicated interest in being a course director.

14. If there is a technology-enhanced component to the course, a statement is required from the Learning Technology Services indicating whether resources are adequate to support the course. Requests for statements can directed to Rob Finlayson (rfinlays@yorku.ca). Please note, it will take two weeks to get a statement of support.

Course Rationale:

- ***How will the course contribute to the educational objectives of the School/Department and of the Faculty?***

This course is the Capstone course for the Neuroscience program. It will contribute to the educational objectives of the Neuroscience program by giving the students an opportunity to engage in a valuable experience conducting research as a team either in a lab or in the community with industry or hospital partners. Successfully completing this course will contribute to the students' ability to achieve the following neuroscience program expectations:

- Integrate and apply theoretical perspectives and major findings across broad areas of neuroscience
- Demonstrate a detailed knowledge in one of the Specialized Neuroscience streams
- Relate neuroscience to other disciplines, and apply learning from those disciplines within neuroscience e.g., mathematics, computer science, physics, health sciences, sport and society
- Locate and retrieve scientific information, and to read and critique scientific articles, demonstrate scientific writing skills, and deliver oral presentations.
- Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods.
- Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions.
- Analyze and interpret pre-existing or novel data, including research findings, and communicate the findings in both oral and written formats to diverse audiences.
- Represent information in a quantitative format, to analyze and interpret quantitative information, including graphs and statistics.
- Demonstrate initiative, personal responsibility, and accountability in the laboratory and other settings.

- ***What is the relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content? If overlap exists, please indicate the nature and extent of consultation which has taken place. If the course is to be cross-listed, integrated or listed as a course credit exclusion with another course, approval is required from all the relevant Faculties/units.***

There already exists 4000 level thesis courses in Biology, Psychology and Kinesiology & Health Science, all of which operate in a similar manner. But not of all of which are in-depth, team based, in community research projects requiring a final written project, an oral presentation, and a peer-to-peer and self-evaluation. The expectation is that students will engage more fulsomely with a research question, engage in analysis, problem solving, writing, and oral communication that will culminate in contributing to the existing body of knowledge.

The Specialized Honours Neuroscience program aims to distinguish itself by a robust research-level Capstone experience, which this course fulfils.

- ***If applicable, please indicate the relationship of the proposed course to interdisciplinary programs; i.e. for which interdisciplinary program(s) will the course count for major/minor credit. As well, please indicate the nature and extent of consultation that has taken place with the relevant interdisciplinary program coordinator(s).***

n/a

- ***What is the expected enrolment in the course?***

Expected enrolment will be approximately 35 students/year.

Bibliography:

Please list the <u>required readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.).

Required reading from library holdings will vary based on the specific project(s) and specific focus of the neuroscience faculty member in a given year. In general, the existing electronic journal subscriptions should be sufficient for this course.

Please list any <u>suggested readings</u> for the course.

The reading list must contain complete bibliographical information (full name of author, title, year of publication, etc.)

This will vary depending on the project.

Please list any <u>online resources</u> for the course (please include complete bibliographical information as above).

For faculty members, there are some useful resources on the Teaching Commons website: http://teachingcommons.yorku.ca/resources-2/experiential-education/. As well as a faculty resource page at https://spark.library.yorku.ca/faculty-teaching-with-spark-guidelines-for-using-spark/ comprised of modules that support topics such as academic integrity, effective literature search strategies research, writing, etc.

AACU (American Academy of Colleges and see *value@aacu.org*) has developed and provided different rubrics for evaluating writing, critical thinking, team work, oral presentation skills, etc. that could easily be adapted for the evaluation needs of this course.

An excellent resource that exists for guiding students on writing are the SPARK (Student Paper and Academic Research Kit) modules found online at https://spark.library.yorku.ca/

Universities

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

n/a

Library Support Statement:

Proposals for new courses must include a **library support statement** from the Bibliographer responsible for the relevant discipline to indicate whether resources are adequate to support the course. To request a support statement, see the list of subject and liaison librarians at http://www.library.yorku.ca/web/about-us/contact-us/liaison-librarians/.

Consultation/Approval:

- The Faculty of Health Curriculum Committee will only consider new course proposals that have been approved by the unit responsible for offering the course.
- If the proposed course is to be cross-listed, integrated, listed as a course credit exclusion with another course, or listed as a major/minor course option in an interdisciplinary program, the proposal must be accompanied by a statement from the collaborating unit signaling agreement to the proposal.

Appendix D: Potential/example paths to completion

Path for BSc Spec. Hons. Psychology- Neuroscience

This is an example pathway for completion of the BSc. Specialized Honours degree in Psychology-Neuroscience. In this example pathway, we have made the assumption that the student will select the Behavioural and Cognitive Neuroscience stream as their chosen stream. Their alternative streams are Molecular and Cellular Neuroscience and Systems Neuroscience. We assume that this example student selected to complete a minimum of 6 credits in Molecular and Cellular Neuroscience and minimum of 6 credits in Systems Neuroscience. Please note, this is one of the many ways a student in BSc Spec. Hons. Psychology- Neuroscience could choose to complete the program.

The following legend explains the color coding:

White Background with Black Text	Neuroscience Core Credits
Green Background with Black Text	Prerequisite courses for Neuroscience core credits and Neuroscience streams
Purple Background with Black Text	Molecular and Cellular Neuroscience credits
Red Background with Black Text	Behavioural and Cognitive Neuroscience credits
Blue Background with Black Text	Systems Neuroscience credits

Year 1:

Course Code	Title	Credit	Status	Term
BIOL 1000	Biology I - Cells, Molecular Biology and Genetics	3	exists	F
BIOL 1001	Biology II - Evolution, Ecology, Biodiversity and Conservation Biology	3	exists	W
PSYC 1010	Introduction to Psychology	6	exists	F or W
MATH 1013 and Math 1014 or MATH 1505	Applied Calculus I & Applied Calculus II, or Mathematics for Life and Social Sciences	6	exists	F and W
CHEM 1000 & 1001	Chemical Structure & Chemical Dynamics	6	exists	F and W
	HH general education	6	exists	
NRSC 1001	Frontiers of Neuroscience	1	new	Full year
	Total Credits:	31		

Year 2:

Course Code	Title	Credit	Status	Term
NRSC 2000	Fundamental Molecular and Cellular Neuroscience	3	new	F
NRSC 2100	Systems, Behavioural, and Cognitive Neuroscience	3	new	W
NRSC 2200	Neuroscience Laboratory Techniques	3	new	W
PSYC 2021 or KINE 2050 or BIOL 2060	Statistics	3	exists	F or W
EECS 1520/1540/1570	Computer Use Fundamentals, or Computer Use for Natural Sciences, or Introduction to Computing for Psychology	3	exists	F or W
PSYC 2220	Sensation and Perception I	3	exists	F or W
PSYC 2240	Biological Basis of Perception	3	exists	F or W
PSYC 2030 or KINE 2049	Introduction to Research Methods or Research Methods in Kinesiology	3	exists	F
	HH General Education	6	exists	
	Total Credits:	30		

Year 3:

Course Code	Title	Credit	Status	Term
NRSC 3000	Molecular and Cellular Neurobiology	3	new	F
PSYC 3250	Neural Basis of Behaviour	3	exists	W
KINE 3650	Functional Neuroanatomy	3	exists	F
PSYC 3140	Abnormal Psychology	3	exists	W
PSYC 3265	Memory	3	exists	F or W

PSYC 3495	Neuroscience of Aging & Cognitive Health	3	exists	F
KINE 2011	Human Physiology I	3	exists	F
KINE 3012	Human Physiology II	3	exists	W
KINE 3020	Skilled performance in Motor Learning	3	exists	W
	Elective/upper level requirement	3	exists	
	Total Credits:	30		

Year 4:

Course Code	Title	Credit	Status	Term
NRSC 4000 or NRSC 4002	Neuroscience Capstone	6	new	Full Year
PSYC 4215	Neuroimaging of Cognition – fMRI methods	3	exists	F
KINE 4210	Disorders of Visual Cognition	3	exists	W
KINE 3670	Molecular and Cellular Neuroscience with Applications to Health	3	exists	F
KINE 4230	Neuronal Development for Activity and Health	3	exists	W
	Electives/upper level credits	12	exists	
	Total Credits:	30		

Path for BSc Spec. Hons. Kinesiology- Neuroscience

This is an example pathway for completion of the BSc. Specialized Honours degree in Kinesiology- Neuroscience. In this example pathway, we assume the student will select the Systems Neuroscience stream as their chosen stream. Their alternative streams are Molecular and Cellular Neuroscience and Behavioural and Cognitive Neuroscience. We assume in this example that this student selected to complete 3 credits in Molecular and Cellular Neuroscience and 9 credits in Behavioural and Cognitive Neuroscience. Please note, this is one of the many ways a student in BSc Spec. Hons. Kinesiology- Neuroscience could choose to complete the program.

The following legend explains the color coding:

White Background with Black Text	Neuroscience Core Credits
Green Background with Black Text	Prerequisite courses for Neuroscience core credits and Neuroscience streams
Purple Background with Black Text	Molecular and Cellular Neuroscience credits
Red Background with Black Text	Behavioural and Cognitive Neuroscience credits
Blue Background with Black Text	Systems Neuroscience credits

Year 1:

Course Code	Title	Credit	Status	Term
BIOL 1000	Biology I - Cells, Molecular Biology and Genetics	3	exists	F
BIOL 1001	Biology II - Evolution, Ecology, Biodiversity and Conservation Biology	3	exists	W
MATH 1013 & 1014, or 1505	Applied Calculus I & Applied Calculus II, or Mathematics for Life and Social Sciences	6	exists	F and W
KINE 1000	Sociocultural KINE	6	exists	
KINE 1020	Fitness and Health	6	exists	
PSYC 1010	Introduction to Psychology	6	exists	F or W
PKINS x 2*			exists	
NRSC 1001	Frontiers of Neuroscience	1	new	Full Year
	Total Credits:	31		

*Note the School of Kinesiology and Health Science is beginning the process of changing their program requirements, revising their zero credit PKINs to 3 credit Integrated Physical Activity for Life (IPAL) courses. These will have to be accommodated into this path (e.g., taken instead of the general education course in first year) once they are developed and implemented.

Year 2:

Course Code	Title	Credit	Status	Term
NRSC 2000	Fundamental Molecular and Cellular Neuroscience	3	new	F
NRSC 2100	Systems, Behavioural and Cognitive Neuroscience	3	new	W
NRSC 2200	Neuroscience Laboratory Techniques	3	new	W

PSYC 2021 or KINE 2050 or BIOL 2060	Statistics	3	exists	W
CHEM 1000	Chemical Structure	3	exists	F
CHEM 1001	Chemical Dynamics	3	exists	W
EECS 15XX	Computer Science Course	3	exists	F or W
KINE 2049	Research Methods in Kinesiology	3	exists	F
	General Education	6	exists	
	Total Credits:	30		

Year 3:

Course Code	Title	Credit	Status	Term
NRSC 3000	Molecular and Cellular Neurobiology	3	new	F
PSYC 3250	Neural Basis of Behaviour	3	exists	W
KINE 3650	Functional Neuroanatomy	3	exists	F
BIOL 2030	Animals	3	exists	F or W
BIOL 2020	Biochemistry	3	exists	F
BIOL 2021	Cell Biology	3	exists	W
PSYC 2240	Biological Basis of Behavior	3	exists	F
KINE 3020	Skilled Performance and Motor Learning	3	exists	W
	General Education	6	exists	
	Total Credits:	30		

Year 4:

Course Code	Title	Credit	Status	Term
NRSC 4000 or NRSC 4002	Neuroscience Capstone	6	new	Full Year
PSYC 2220	Sensation and Perception I	3	exists	F
BIOL 3060	Animal Physiology I	4	Exists	F
KINE 4500	Neural Control of Movement	3	exists	W
BIOL 4380	Systems Neuroscience	3	exists	W
KINE 4225	Principles of Neuro-motor Learning	3	exists	F
PSYC 3265	Cognition	3	exists	F
PSYC 3140	Abnormal Psychology	3	exists	F or W
BIOL 4310	Physiology of Circadian Timing	3	exists	W
	Total Credits:	31		

Example Pathway for Completion for a Student in the Faculty of Science
Path for BSc Spec. Hons. Biology- Neuroscience

This is an example pathway for completion of the BSc. Specialized Honours degree Biology-Neuroscience for a student in the Faculty of Science in Biology. In this example pathway, the student has selected the Molecular and Cellular Neuroscience stream as their chosen stream. Their alternate streams are Behavioural and Cognitive Neuroscience and Systems Neuroscience. We assume for this example that this student selected to complete 9 credits in Behavioural and Cognitive Neuroscience and 3 credits in Systems Neuroscience. Please note, this is one of the many ways a student in the Faculty of Science could complete the Neuroscience program.

The following legend explains the color coding:

White Background with Black Text	Neuroscience Core Credits
Green Background with Black Text	Prerequisite courses for Neuroscience core credits and Neuroscience streams
Purple Background with Black Text	Molecular and Cellular Neuroscience credits
Red Background with Black Text	Behavioural and Cognitive Neuroscience credits
Blue Background with Black Text	Systems Neuroscience credits

Year 1:

Course Code	Title	Credit	Status	Term
BIOL 1000	Biology I - Cells, Molecular Biology and Genetics	3	exists	F
BIOL 1001	Biology II - Evolution, Ecology, Biodiversity and Conservation Biology	3	exists	W

PSYC 1010	Introduction to Psychology	6	exists	F or W
MATH 1013 & 1014, or 1505	Applied Calculus I & Applied Calculus II, or Mathematics for Life and Social Sciences	6	exists	F and W
CHEM 1000	Chemical Structure	3	exists	F
CHEM 1001	Chemical Dynamics	3	exists	W
EECS 15XX	Computer science course	3	exists	F or W
NRSC 1001	Frontiers of Neuroscience	1	new	Full Year
	Non-science for general education	3	exists	
	Total Credits:	31		

Year 2:

Course Code	Title	Credit	Status	Term
NRSC 2000	Fundamental Molecular and Cellular Neuroscience	3	new	F
NRSC 2100	Systems, Behavioural and Cognitive Neuroscience	3	new	W
NRSC 2200	Neuroscience Laboratory Techniques	3	new	W
PSYC 2021 or KINE 2050 or BIOL 2060	Statistics	3	exists	F
KINE 2011	Human Physiology I	3	exists	F
KINE 3012	Human Physiology II	3	exists	W
BIOL 2020	Biochemistry	3	exists	F
BIOL 2021	Cell Biology	3	exists	W
BIOL 2030	Animals	3	exists	F or W
	Non-science for general education course	3	exists	
	Total Credits:	30		

Year 3:

Course Code	Title	Credit	Status	Term
NRSC 3000	Molecular and Cellular Neurobiology	3	new	F
PSYC 3250	Neural Basis of Behaviour	3	exists	W
KINE 3650	Functional Neuroanatomy	3	exists	F
KINE 3670	Molecular and Cellular Neuroscience with Applications to Health	3	exists	F
KINE 4230	Neuronal development for activity and health	3	exists	W
PSYC 2220	Sensation and Perception I	3	exists	W
BIOL 3060	Animal Physiology I	3	exists	F
PSYC 2240	Biological Basis of Behaviour	3	exists	F
	Non-science general education credits	6	exists	
	Total Credits:	30		

Year 4:

Course Code	Title	Credit	Status	Term
NRSC 4000 or NRSC 4002	Neuroscience Capstone	6	new	Full Year
KINE 4210	Disorders of Visual Cognition	3	exists	W
BIOL 4310	Physiology of circadian Timing	3	exists	W
BIOL 4370	Neurobiology	3	exists	F
PSYC 3265	Memory	3	exists	F or W
PSYC 3140	Abnormal Psychology	3	exists	F or W
	Electives	9	exists	
	Total Credits:	30		

Appendix E: Description of Courses*

*Not all of these are taken by all students as sometimes there is a choice e.g., 3 credits of EECS are required but there are many different EECS courses from which to choose. For information purposes, they are all listed here.

1000-level (listed are the 1000 level courses required for admission to the neuroscience program and contributing to the major)		
BIOL 1000 3.00	**Biology I - Cells, Molecular Biology and Genetics:** An introduction to major unifying concepts and fundamental principles of biology, including evolution and cell theory. Topics include cells, biological energetics, metabolism, cell division and genetics. Three lecture hours per week; three laboratory hours in alternate weeks.	Existing; offered in F, W and S1
BIOL 1001 3.00	**Biology II - Evolution, Ecology, Biodiversity and Conservation Biology:** A continuation of Biology I, exploring major unifying concepts and fundamental principles of biology, building on earlier concepts. Topics include mechanisms of evolution, ecology, a survey of biodiversity and conservation biology. Three lecture hours per week; three laboratory hours in alternate weeks.	Existing; offered in W and S2
CHEM 1000 3.00	**Chemical Structure:** Introduction to chemistry with emphasis on physical and electronic structure of matter, including gases, liquids and solids. Topics include behaviour of gases; thermochemistry; atomic structure and periodic table; chemical bonding and architecture; structure of liquids and solids; frontiers of chemistry. Two and one-half lecture hours per week, one tutorial hour per week, six three-hour laboratory sessions.	Existing; offered in F, W and SU
CHEM 1001 3.00	**Chemical Dynamics:** This course complements SC/CHEM 1000 3.00 - with emphasis on chemical change and equilibrium. Topics include chemical kinetics; chemical equilibrium; entropy and free energy as driving forces for chemical change; electrochemistry; frontiers in chemistry. Two and one-half lecture hours per week, one tutorial hour per week, six three-hour laboratory sessions.	Existing; offered in W and SU
EECS 1520 3.00	**Computer Use: Fundamentals**: An introduction to the use of computers focusing on concepts of computer technology and organization (hardware and software) and the use of applications such as spreadsheets and information retrieval tools for problem solving. Three lecture hours per week.	Existing; offered in F, W and SU
EECS 1530 3.00	**Computer Use: Programming**: Concepts of computer systems and technology - e.g. software engineering, algorithms, programming languages, theory of computation. Practical work focuses on problem solving using a high-level programming language. The course requires extensive laboratory work. Three lecture hours per week.	Existing, offered in W
EECS 1540 3.00	**Computer Use for the Natural Sciences**: Introduction to problem solving using computers - top down and modular design; implementation in a procedural programming language - control structures, data structures, subprograms; application to simple numerical methods, modelling and simulation in the sciences; use of library subprograms. Three lecture hours per week.	Existing, offered in W
EECS 1570 3.00	**Introduction to Computing for Psychology:** An introduction to computing concepts with applications to problems drawn from psychology, including concepts of computer programming in an integrated computing and visualization environment. Three lecture hours per week. Prerequisite: SC/MATH 1505 6.00	Existing; offered in W
MATH 1013 3.00	**Applied Calculus I:** Introduction to the theory and applications of both differential and integral calculus. Limits. Derivatives of algebraic and trigonometric functions. Riemann sums, definite integrals and the Fundamental Theorem of Calculus.	Existing; offered in F, W and S1

	Logarithms and exponentials, Extreme value problems, Related rates, Areas and Volumes. Three lecture hours per week.	
MATH 1014 3.00	**Applied Calculus II:** Calculus in Polar Coordinates. Techniques of Integration. Indeterminate Forms. Improper Integrals. Sequences, infinite series and power series. Approximations. Introduction to ordinary differential equations. Three lecture hours per week. Prerequisite: SC/MATH 1013 3.00	Existing, offered in F, W and S2
MATH 1505 6.00	**Mathematics for the Life and Social Sciences**: A presentation of the elements of single-variable differential and integral calculus, elementary linear algebra and introductory probability and statistics. This course is designed to provide a comprehensive mathematical background for students of the biological and social sciences. Emphasis is placed on basic mathematical skills and their applications. Prerequisite: 12U Advanced Functions (MHF4U) or equivalent, or SC/MATH 1510 6.00.	Existing, Y
PSYC 1010 6.00	**Introduction to Psychology:** A survey of psychology introducing basic terms, concepts and methods. Included are topics such as biological bases of behaviour, learning, perception, motivation, cognition, child development, personality, and abnormal and social psychology. Three lecture hours per week.	Existing; offered in Y, W and S
NRSC 1001 1.0	**Frontiers of Neuroscience:** An introduction to research directions within the field of neuroscience, and in particular of faculty members at York, including exposure to professionalism and ethics, and to facilities and organizations in the wider community	New
2000-level		
NRSC 2000 3.00	**Fundamental Molecular and Cellular Neuroscience:** An introductory survey of the key areas of neuroscience including a historic perspective, gross anatomy and histology of the nervous system, development of the nervous system, molecular and cellular neuroscience, and neurological disorders. Methodologies of research and experimentation in neuroscience will also be introduced. Three lecture hours per week. Prerequisites: SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; HH/PSYC 1010 6.00	New
NRSC 2100 3.00	**Systems, Behavioural and Cognitive Neuroscience:** This course is a core component of the Neuroscience degree program. In this course, students will explore the structure and function of the normal human brain. Topics include the organization of the central nervous system, the function and neural basis of sensory and movement systems, consciousness, language, thought and memory. Three lecture hours per week. Prerequisites: HH/SC/NRSC 2000 3.00	New
NRSC 2200 3.00	**Neuroscience Techniques:** Provides students with exposure to experimentation techniques and methodologies in the fields of systems and cognitive, cellular and molecular, and computational and theoretical neuroscience. These include EEG, fMRI, behavioural methods such as psychophysics and eye/body tracking, electrophysiology, patch and dynamic clamp, transgenic mouse technology, molecular imaging, neuronal coding and communication, neuronal networks, and brain-machine interfaces. Prerequisite: HH/SC/NRSC 2000 3.003.00. Corequisite: HH/SC/NRSC 2100 3.00	New
PSYC 2021 3.00 or KINE 2050 3.00 or BIOL 2060 3.00	**Three statistics options:** PSYC 2021: The fundamental concepts and application of descriptive statistics. An introduction to probability and inferential statistics, including hypothesis testing with the normal- and t-distributions.	Existing: PSYC 2021 F,W,SU;

	KINE 2050: An introduction to scientific method and the statistical analysis of experimental data. The conduct of simple experiments, techniques of naturalistic observation and the analysis of resulting data using fundamental concepts of descriptive and inferential statistics. BIOL 2060: Statistical problem solving for biologists. Basic theory for the analysis of parametric and non-parametric data. A project period is devoted to discussion and solving of statistical problems. Three hours per week.	KINE 2050 W; BIOL 2060 F,W
3000-level		
NRSC 3000 3.00	**Molecular and Cellular Neurobiology:** This course is a core component of the Neuroscience program. In this course students will explore the molecular, structural and cellular basis of complex brain functions focusing on perception, learning and memory. Students will learn about technological advances in areas of genome engineering, optogenetics, imaging and animal models used in the field. Examples of human neurological disease conditions will be discussed whenever appropriate to exemplify the consequences of sensory deficiencies in the nervous system. Three lecture hours per week. Prerequisites: HH/SC/NRSC 2000 3.00; HH/SC/NRSC 2100 3.00; HH/SC/NRSC 2200 3.00	New
PSYC 3250 3.00	**Neural Basis of Behaviour:** This course surveys issues concerning the development and localization of cerebral functions and examines experimental and clinical studies illustrating behavioural effects of brain damage. Three lecture hours per week. Prerequisite: AK/AS/HH/SC/PSYC 1010 6.00 or AK/HH/PSYC 2410 6.00, with a minimum grade of C; AK/AS/HH/SC/PSYC 2240 3.00 or AK/HH/PSYC 3145 3.00.	Existing; offered in F and W
KINE 3650 3.00	**Functional Neuroanatomy:** This course investigates the anatomy of the central nervous system, additionally discussing the clinical functional relevance of each area. Three lecture hours per week. Prerequisite: HH/KINE 2031 3.00 or SC/BIOL 4370 3.00 or HH/PSYC 3250 3.00.	Existing; offered in F
4000-level		
NRSC 4000 6.00	**Neuroscience Individual Research Project:** A Capstone neuroscience research project under the supervision of a neuroscience core/affiliated faculty member. An intensive research project engaged in a laboratory, or in the community, leading to the creation of an original piece of research, final written paper, as well as an oral presentation to the neuroscience community at York. Prerequisites: HH/SC/NRSC 2000 3.00; HH/SC/NRSC 2100 3.00; HH/SC/NRSC 2200 3.00; HH/SC/NRSC 3000 3.00; HH/SC/NRSC 3100 3.00; HH/PSYC 3250 3.00; HH/KINE 3650 300	New
NRSC 4002 6.00	**Neuroscience Team Research Project:** A team-based Capstone neuroscience research project under the supervision of a neuroscience core/affiliated faculty member engaged in a laboratory, or in the community, leading to the creation of an original piece of research, final written paper, as well as an oral presentation to the neuroscience community at York. Prerequisites: HH/SC/NRSC 2000 3.00; HH/SC/NRSC 2100 3.00; HH/SC/NRSC 2200 3.00; HH/SC/NRSC 3000 3.00; HH/SC/NRSC 3100 3.00; HH/PSYC 3250 3.00; HH/KINE 3650 300	New
Specialized Neuroscience: Molecular and Cellular Neuroscience		
KINE 3670 3.00	**Molecular and Cellular Neuroscience with Applications to Health:** The course covers the basic principles of molecular and cellular neuroscience. The course introduces students to the most basic fundamentals of neuroscience, which is the study of the functional properties of the nervous system and relationship between brain and disease. Topics covered range from neuronal	Existing; offered in F

	structure and function, communication at the synapse and neuromuscular junction, membrane receptors, synaptic transmission, neurotransmitters to the intra- and intercellular signaling systems within the sensory, motor and memory systems. This course provides the background for higher-level courses that deal with more specialized topics in neuroscience and the neurobiology of disease. Three lecture hours per week. Prerequisite: HH/KINE 3012 3.00.	
BIOL 4310 3.00	**Physiology of Circadian Timing**: This course examines the mechanism by which cells generate 24h (circadian) rhythms, how the numerous sites of these cells are coordinated by nerves and hormones and the critical roles of human circadian clocks in health and diseases. Three lecture hours per week. Prerequisites: SC/BIOL 2020 4.00 or SC/BIOL 2020 3.00; SC/BIOL 2021 4.00 or SC/BIOL 2021 3.00; SC/BIOL 3060 4.00.	Existing; offered in F
BIOL 4370 3.00	**Neurobiology:** An analysis of recent advances in neurobiology, particularly information processing and storage in nervous systems and the biochemical basis of learning, memory and behaviour. The neurobiology of addiction, diseases of the nervous system and regeneration are also discussed. Three lecture hours per week. Prerequisites: SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 3060 4.00.	Existing; offered in F
KINE 4230 3.00	**Neuronal development for activity and health:** Analyzes the cellular, molecular and physiological processes underlying neuronal and neuromuscular development in health and disease. Three lecture hours per week. Prerequisite: HH/KINE 3012 3.00.	Existing; offered in W
KINE 4505 3.00	**Neurophysiology of Movement in Health and Disease:** This course provides an overview of current neurophysiological concepts in motor control, with an emphasis on the neurophysiological principles underlying human movement disorders. Three lecture hours per week. Prerequisite: AS/HH/SC/KINE 3011 3.00 or AS/HH/SC/KINE 3020 3.00.	Existing; offered in F
Specialized Neuroscience: Behavioural and Cognitive Neuroscience		
PSYC 2220 3.00	**Sensation and Perception I**: A course in problems, experimental methods and research findings in sensation and perception. Vision and hearing are covered in some detail, including discussion of the structure and function of the eye and ear, and cortical areas responsible for processing visual and auditory information. Three lecture hours per week. Prerequisites: AK/AS/HH/SC/PSYC 1010 6.00 with a minimum grade of C.	Existing; offered in F and W
PSYC 2260 3.00	**Cognition**: A survey of higher-order cognitive processes in humans. Topics include attention, memory, problem solving, thinking and language. Prerequisite: AK/AS/HH/SC/PSYC 1010 6.00 or AK/HH/PSYC 2410 6.00, with a minimum grade of C. Course credit exclusions: AK/PSYC 3135 3.00 (prior to Summer 2002), GL/PSYC 3370 3.00.	Existing; offered in S1
PSYC 3140 3.00	**Abnormal Psychology**: A course on the nature, causes and treatment of a number of behaviour disorders. Topics include developmental disorders, anxiety problems, personality disorders, substance abuse, affective disorders, organic brain disorders and schizophrenia. Three lecture hours per week. Prerequisite: AK/AS/HH/SC/PSYC 1010 6.00 or AK/HH/PSYC 2410 6.00, with a minimum grade of C. Course	Existing; offered in F and W

	credit exclusions: AK/PSYC 3215 3.00 (prior to Summer 2002), GL/PSYC 3230 3.00.	
PSYC 3265 3.00	**Memory**: An examination of how humans encode, store and retrieve information from memory. Although the course focuses on data from laboratory studies and their theoretical interpretation, some consideration is given to applied aspects of human memory. Prerequisite: AK/AS/HH/SC/PSYC 1010 6.00 or AK/HH/PSYC 2410 6.00, with a minimum grade of C. Course credit exclusions: AK/PSYC 3130 3.00 (prior to Summer 2002), GL/PSYC 3390 3.00.	Existing; offered in F and W
PSYC 3270 3.00	**Sensation and Perception II:** A continuation of Sensation and Perception I. Senses such as balance, taste, smell and touch are considered, and there is more thorough discussion of the methods used to study sensory processing and perception. Prerequisites: AK/AS/HH/SC/PSYC 1010 6.00 with a minimum grade of C; AK/AS/HH/SC/PSYC 2220 3.00 or AK/HH/PSYC 3120 3.00.	Existing; offered in W
PSYC 3495 3.00	**Neuroscience of Aging & Cognitive Health:** This course investigates the neural basis of cognitive changes across the adult lifespan. Students will learn how the brain is altered in structure and function as people age and how these changes impact cognition. The course will examine the border between normal and abnormal aging and how neuroscience research is informing strategies to sustain cognitive health into older adulthood Prerequisite: HH/PSYC 1010 6.00 with a minimum grade of C; HH/PSYC 2240 3.00.	Existing; offered in W
PSYC 4080 6.00	**Neuropsychology of Abnormal Behaviour**: An examination of the genetic, physiological and anatomical bases of several types of abnormal behaviour. The social, public policy and ethical implications of a neuropsychological view of abnormal behaviour are discussed. Three lecture hours per week. Prerequisites: AK/AS/HH/SC/PSYC 1010 6.00 with a minimum grade of C; AK/AS/HH/SC/PSYC 2030 3.00 or AK/HH/PSYC 2530 3.00; one of AK/AS/HH/SC/PSYC 2021 3.00, AK/AS/HH/SC/PSYC 2020 6.00, AK/HH/PSYC 2510 3.00; AK/AS/HH/SC/PSYC 2240 3.00 or AK/HH/PSYC 3145 3.00; AK/HH/PSYC 3140 3.00 (after Winter 2002) or AS/SC/PSYC 3140 3.00 or AK/HH/PSYC 3215 3.00.	Existing; offered in Y
KINE 4210 3.00	**Disorders of Visual Cognition:** We rely heavily on vision to interact with the world. This course investigates the clinical disorders that are manifested with impairments in different stages of visual processing. Prerequisite: HH/KINE 3020 3.00 or SC/BIOL 4370 3.00 or HH/PSYC 3250 3.00.	Existing; offered in alternate years
PSYC 4260 3.00	**Seminar in Sensation and Perception:** This seminar course gives advanced, detailed coverage of topics in sensation and perception. Specific topics vary according to the instructor, and could include vision (e.g., shape perception, colour perception), hearing (e.g., auditory localization, speech perception), or vestibular perception (e.g., balance, the sense of movement). The course emphasizes reading and evaluating original scientific work, and readings include journal articles or research monographs. Special attention is paid to understanding the value and limitations of common experimental methods in perception research. Prerequisites: AK/AS/HH/SC/PSYC 1010 6.00 with a minimum grade of C; AK/AS/HH/SC/PSYC 2030 3.00 or AK/HH/PSYC 2530 3.00; one of AK/AS/HH/SC/PSYC 2021 3.00, AK/AS/HH/SC/PSYC 2020 6.00, AK/HH/PSYC 2510 3.00; AK/AS/HH/SC/PSYC 2220 3.00 or AK/HH/PSYC 3120 3.00.	Existing; offered in W

PSYC 4270 3.00	**Seminar in Memory and Cognition:** An examination of a number of issues in memory and cognition. The course focuses on areas of current interest and may include topics such as pattern recognition, perception of art, memory retrieval, connectionist models, problem solving, thinking, concept formation, categorization and artificial intelligence. Prerequisites: AK/AS/HH/SC/PSYC 1010 6.00 with a minimum grade of C; AK/AS/HH/SC/PSYC 2030 3.00 or AK/HH/PSYC 2530 3.00; one of AK/AS/HH/SC/PSYC 2021 3.00, AK/AS/HH/SC/PSYC 2020 6.00, AK/HH/PSYC 2510 3.00; one of AK/HH/PSYC 3130 3.00, AK/HH/PSYC 3135 3.00, AK/HH/PSYC 3260 3.00 (after Winter 2002), AS/SC/PSYC 3260 3.00, AK/AS/HH/SC/PSYC 3265 3.00.	Existing; offered in F & W
PSYC 4360 3.00	**Visuospatial Memory and Goal-Directed Action:** The course examines how the brain represents, updates, and transforms spatial information from the senses, primarily vision, into goal-directed movements of the eyes, head, and hand. Classes consist of a combination of lectures followed by journal article discussions and / or formal seminar presentations by students. Prerequisites: Students must have at least one introductory neuroscience or animal physiology course HH/PSYC 2240 3.00, SC/BIOL 3060 3.00, HH/KINE 3650 3.00.	Existing; offered in W
Specialized Neuroscience: Systems Neuroscience		
KINE 3020 3.00	**Skilled Performance and Motor Learning:** An introduction to the analysis and development of skilled performance. Two lecture hours and two laboratory hours per week. Prerequisites: AS/HH/SC/KINE 2050 3.00; AS/SC/PSYC 1010 6.00.	Existing; offered in F
BIOL 4380 3.00	**Systems Neuroscience:** This course investigates the neural basis of visual and auditory perception, echolocation, smell, short- and long-term memory, and motor control. Emphasis is on understanding how neural interactions analyze sensory information and control complex behaviour. Three lecture hours per week. Prerequisite: SC/BIOL 3060 4.00.	Existing; offered in W
PSYC 4215 3.00	**Neuroimaging of Cognition - fMRI Methods**: This course offers fundamental knowledge on neuroimaging of cognition using fMRI, including practical aspects of experimental design and analytical approaches. The course provides the necessary theoretical perspectives of fMRI experiments and provides extensive “hands-on” experience in fMRI analysis. The course is integrated with a graduate level course.	New
KINE 4225 3.00	**Principles of Neuro-motor Learning:** This course covers concepts of how the brain learns and controls voluntary movement, particular those of the upper limbs. Prerequisite: HH/KINE 2050 3.00, HH/KINE 3020 3.00	Existing; offered in W
KINE 4240 3.00	**Applied Human Factors:** This course discusses human factors, e.g. sensory, perceptual, motor and cognitive systems, and how they feature in machines, systems design, procedures and skills, with an emphasis on physical activities and sport. Prerequisite: HH/KINE 3020 3.00 or SC/BIOL 4370 3.00 or HH/PSYC 3250 3.00.	Existing; offered in alternate years
KINE 4500 3.00	**Neural Control of Movement:** This neuroscience course reviews fundamental concepts of movement control, with an emphasis on the brain mechanisms underlying motor behaviour. Topics include walking, looking, reaching, posture and complex skill coordination. Movement control concepts will be used to understand the neural basis of symptoms associated with motor disorders such as Parkinson's disease, ataxia, Lou Gehrig's disease, muscular dystrophy, and stroke. Prerequisite: AS/HH/SC/KINE 3020 3.00 or permission of the course director.	Existing; offered in alternate years.
PSYC 4380 3.00	**Seminar in Neuroscience: Rhythms of the Brain:** Explores the temporal dynamics of brain activity, from ultradian and circadian cycles to the high-frequency neural oscillations associated with attention and memory. Topics addressed	Existing; offered in W

	include: sleep rhythms, hippocampal rhythms, central pattern generators, neocortical oscillations and memory consolidation. Prerequisite: AK/AS/HH/SC/PSYC 1010 6.00, AK/AS/HH/SC/PSYC 2021 3.00, AK/AS/HH/SC/PSYC 2030 3.00, AK/AS/HH/SC/PSYC 2240 3.00, AK/AS/HH/SC/PSYC 3250 3.00.	

Appendix F: Calendar Copy

Specialized Honours BSc Program in Neuroscience (120 Credits)

Faculty of Health and Faculty of Science are described separately next

Faculty of Health:

Residency requirement: a minimum of 30 course credits and at least half (50 per cent) of the course credits required in each undergraduate degree program major/minor must be taken at York University.

Continuation requirement: students must attain a cumulative grade point average of 6.00 (B) on 30 credits to continue in the program.

Graduation requirement: all graduates must complete a total of at least 120 credits with a minimum overall cumulative grade point average of 6.00 (B).

General education requirement: a minimum of 12 credits as follows:

- six credits at the 1000 level in approved Faculty of Health general education or humanities categories approved by the Faculty of Liberal Arts & Professional Studies
- six credits at the 1000 level in approved Faculty of Health general education or social science categories approved by the Faculty of Liberal Arts & Professional Studies

Note 1: it is required that students complete the general education requirements above within their first 60 credits.

Note 2: students may complete a maximum of 30 credits in general education, any additional credits not being used to fulfill general education may count toward electives.

Note 3: general education requirements are satisfied by taking approved humanities or social science categories courses and Faculty of Health general education courses. For further information please visit http://health.info.yorku.ca/current-student-information/general-education-requirements/.

Basic science requirement: a minimum of 15 credits as follows:

- six credits in mathematics selected from:
  - SC/MATH 1505 6.00 or
  - SC/MATH 1013 3.00 and
  - SC/MATH 1014 3.00
- three credits selected from:
  - LE/EECS 1520 3.00
  - LE/EECS 1540 3.00
  - LE/EECS 1570 3.00
- 6 credits
  - SC/CHEM 1000 3.00
  - SC/CHEM 1001 3.00

Major credits: students must complete a minimum of 64 credits in neuroscience major.

- SC/BIOL 1000 3.00
- SC/BIOL 1001 3.00
- HH/PSYC 1010 6.00
- NRSC 1001 1.00
- NRSC 2000 3.00
- NRSC 2100 3.00
- NRSC 2200 3.00
- HH/PSYC 2021 3.00 or HH/KINE 2050 3.00
- NRSC 3000 3.00
- HH/PSYC 3250 3.00
- HH/KINE 3650 3.00
- NRSC 4000 6.00 or NRSC 4002 6.00

- 12 credits selected from the list of courses in the chosen specialized stream
- 12 credits selected from the list of courses below to satisfy breadth requirement in the alternative specialized stream.

    - Molecular and Cellular Neuroscience Stream
        - HH/KINE 3670 3.00
        - SC/BIOL 4310 3.00
        - SC/BIOL 4370 3.00
        - HH/KINE 4230 3.00
        - HH/KINE 4505 3.00
    - Behavioural and Cognitive Neuroscience Stream
        - HH/PSYC 2220 3.00
        - HH/PSYC 2260 3.0
        - HH/PSYC 3140 3.00
        - HH/PSYC 3265 3.00
        - HH/PSYC 3270 3.00
        - HH/PSYC 3495 3.00
        - HH/PSYC 4080 6.00
        - HH/KINE 4210 3.00
        - HH/PSYC 4260 3.00
        - HH/PSYC 4270 3.00
        - HH/PSYC 4360 3.00
    - Systems Neuroscience Stream
        - HH/KINE 3020 3.00
        - SC/BIOL 4380 3.00
        - HH/PSYC 4215 3.00
        - HH/KINE 4225 3.00
        - HH/KINE 4240 3.00
        - HH/KINE 4500 3.00
        - HH/PSYC 4380 3.00

Upper-level credits: a minimum of 42 credits at the 3000 level or 4000 level, including 18 credits at the 3000 or 4000 level in the major with 12 credits at the 4000 level.

Required science credits outside the major: A minimum of nine credits in science disciplines outside the major, of which three credits must be at the 2000-level or above. Students in the major will be deemed to have fulfilled required science credits outside the major by completing at least 12 credits in the alternative streams.

Electives: additional elective credits as required for an overall total of at least 120 credits. Elective credits may be used to fulfill science and upper-level credits.

Faculty of Science:

Residency requirement: a minimum of 30 course credits and at least half (50 per cent) of the course credits required in each undergraduate degree program major/minor must be taken at York University.

Continuation requirement: students must attain a cumulative grade point average of 6.00 (B) on 30 credits to continue in the program.

Graduation requirement: all graduates must complete the home Faculty requirements, a total of at least 120 credits with a minimum overall cumulative grade point average of 6.00 (B).

General education requirement: a minimum of 12 credits from two different areas of study, including at least three credits from each area, subject to restrictions from the Faculty of Science. For the purpose of this regulation “different area” means offered by a different academic unit such as divisions, departments or Faculties.

For further information please visit: http://science.yorku.ca/current-students/my-degree/program-requirements/general-education/

Basic science requirement: a minimum of 15 credits as follows:

- six credits in mathematics selected from:
  - SC/MATH 1505 6.00 or
  - SC/MATH 1013 3.00 and
  - SC/MATH 1014 3.00
- three credits selected from:
  - LE/EECS 1520 3.00
  - LE/EECS 1540 3.00
  - LE/EECS 1570 3.00
- 6 credits
  - SC/CHEM 1000 3.00
  - SC/CHEM 1001 3.00

Major credits: students must complete a minimum of 64 credits in neuroscience major.

- SC/BIOL 1000 3.00
- SC/BIOL 1001 3.00
- HH/PSYC 1010 6.00
- NRSC 1001 1.00
- NRSC 2000 3.00
- NRSC 2100 3.00
- NRSC 2200 3.00
- HH/BIOL 2060 3.00
- NRSC 3000 3.00
- HH/PSYC 3250 3.00
- HH/KINE 3650 3.00
- NRSC 4000/4002 6.00
- 12 credits selected from the list of courses in the chosen specialized stream
- 12 credits selected from the list of courses below to satisfy breadth requirement in the alternative specialized stream.

  - Molecular and Cellular Neuroscience Stream
    - HH/KINE 3670 3.00
    - SC/BIOL 4310 3.00
    - SC/BIOL 4370 3.00
    - HH/KINE 4230 3.00
    - HH/KINE 4505 3.00
  - Behavioural and Cognitive Neuroscience Stream
    - HH/PSYC 2220 3.00
    - HH/PSYC 2260 3.0
    - HH/PSYC 3140 3.00
    - HH/PSYC 3265 3.00
    - HH/PSYC 3270 3.00
    - HH/PSYC 3495 3.00
    - HH/PSYC 4080 6.00
    - HH/KINE 4210 3.00
    - HH/PSYC 4260 3.00
    - HH/PSYC 4270 3.00
    - HH/PSYC 4360 3.00
  - Systems Neuroscience Stream
    - HH/KINE 3020 3.00
    - SC/BIOL 4380 3.00
    - HH/PSYC 4215 3.00
    - HH/KINE 4225 3.00
    - HH/KINE 4240 3.00
    - HH/KINE 4500 3.00
    - HH/PSYC 4380 3.00

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

Students in the major will be deemed to have fulfilled required science credits outside the major by completing at least 12 credits in the alternate streams.

Upper-level credits: a minimum of 42 credits at the 3000 level or 4000 level, including 18 credits at the 3000 or 4000 level in the major with 12 credits at the 4000 level.

Additional Elective Credits: additional elective credits as required for an overall total of at least 120 credits. Elective credits may be used to fulfill science and upper-level credits.

Appendix G: Assessment of Student Achievement in NRSC courses

Below is documentation of the methods and criteria for assessing student achievement. Using each program learning outcomes as a guide, key assessments from the core neuroscience courses are presented to showcase the way students' achievement will be measured.

Methods and Criteria for Assessing Student Achievement

Program Learning Outcome	***Assessment Methodologies***
1. Integrate and apply theoretical perspectives and major findings across broad areas of neuroscience, i.e., cellular and molecular, behavioural/cognitive, and systems.	• Engage in major findings in broad areas of neuroscience through attendance at up to 10 talks by researchers (or research groups), and/or representatives of other groups associated with Neuroscience such as research ethics in NRSC 1001 • Integrating content knowledge in Neuroscience on topics such as, histology of Neuroscience, aging and senescence in the brain in two written exams in NRSC 2000 • Responding to case studies/simulations, such as famous cases of brain abnormalities as part the in-class case studies/simulations exercises in NRSC 2100 • Students integrate and apply key concepts in systems, behaviours and cognitive Neuroscience through three written exams with multiple choice, matching and short answer questions where in NRSC 2100 • Demonstrate knowledge of detailed understanding of Neuroscience through team reflection presentation about one experimental technique in Neuroscience NRSC 2200 • Students identify, describe and explain their knowledge of molecular and cellular basis of perception and cognition in three non-cumulative equally weighted written exams and one final exam. Exams will be comprised of multiple-choice and matching/short answer questions where in NRSC 3000. • Defend a chosen argument or stance based on collected evidence (e.g., data, literature, etc.) in Neuroscience as part of Capstone project requirements including initial project proposal and final report in NRSC 4000/4002.
2. Demonstrate knowledge of, and recognize the relationships between, the structure and function of molecules and tissues involved in neurobiological systems at all levels: molecular, cellular, and organismal.	• Interview of two different Neuroscientists and write critical reflection in NRSC 1001 • Demonstrate content knowledge in molecular and cellular neuroscience and molecular and cellular basis of neurological disorders in two exams in NRSC 2000. • Responding to case studies/simulations, such as famous cases of brain abnormalities as part the in-class case studies/simulations exercises in NRSC 2100 • Demonstrate knowledge of key concepts in systems, behaviours and cognitive Neuroscience through three written exams with multiple choice, matching and short answer questions in NRSC 2100 • Critique the purpose and process of neuroscience experimental techniques through reviewing and critiquing five articles in the online Journal Club in NRSC 2200 • Students identify, describe and explain their knowledge of molecular and cellular basis of perception and cognition through three non-cumulative equally weighted written exams and one final exam. Exams will be comprised of multiple-choice and matching/short answer questions. • Demonstrate knowledge and recognize relationships in Neurobiological systems through Capstone project

	development including initial project proposal and final report in NRSC 4000/4002.
3. Demonstrate a detailed knowledge in one of the Specialized Neuroscience streams.	• Demonstrate detailed knowledge in a specific topic in Neuroscience as part of Capstone project development including initial project proposal and final report in NRSC 4000/4002. • Term paper in KINE 4505
4. Locate and retrieve scientific information, and to read, critique, and evaluate scientific articles, demonstrate scientific writing skills, and deliver oral presentations.	• Analysis of journal articles in Journal Critique assignment in NRSC 2000 • Oral presentation based on literature in Neuroscience in NRSC 2200 • Locate, retrieve and critique five articles in the online Journal Club in NRSC 2200 • Locate, retrieve and critique literature and data to defend a chosen argument based on the collected evidence for initial project proposal and final report in NRSC 4000/4002.
5. Perform basic laboratory techniques used in neuroscience research and understand and apply principles of laboratory safety.	• Implement and perform Neuroscience research to complete laboratory/clinical project or team-based project for initial project proposal and final report in NRSC 4000 or NRSC 4002
6. Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods.	• Critical reflection on the purpose of research in Neuroscience and the current context of how research is conducted in the field in NRSC 1001 • One-minute paper on experimental research methods presented in talk in NRSC 1001 • Describe the techniques by which we can measure brain functions as part the in-class case studies/simulations exercises in NRSC 2100 • Oral reflection presentation about one experimental technique in Neuroscience in NRSC 2200 • Completion of four of five graphs based on data provided using different techniques in NRSC 2200 • Critique the purpose and process of neuroscience experimental techniques through reviewing and critiquing five articles in the online Journal Club in NRSC 2200 • Critique published decisions in experimental research in Neuroscience in team work critical reflection activity in NRSC 3000. • Draft explaining research methods in Neuroscience in initial project draft in NRSC 4000/4002.
7. Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions.	• Investigate a variety of research questions through participating in four of five graphical analysis in NRSC 2200 • Developing testable research questions based on in-depth knowledge of neuroscience and apply the research methods through Capstone project including initial project proposal and final report in NRSC 4000/4002
8. Represent information in a quantitative format, to analyze and interpret quantitative information, including graphs and statistics.	• Completion of four of five graphs based on data provided using different techniques in NRSC 2200 • Represent, analyze and interpret research findings in Capstone project in final written report in NRSC 4000/4002.
9. Analyze and interpret pre-existing or novel data, including research findings, to develop lines of argument, propose solutions, and	• Consider information presented in talks and communicate this through a one-minute paper in NRSC 1001

communicate the findings in both oral and written formats to diverse audiences.	• Analysis of journal articles in Journal Critique assignment in NRSC 2000 • Analysis of data and research findings in-class case studies/simulations on systems, behavioural and cognitive Neuroscience exercises in NRSC 2100 • Apply appropriate data analysis techniques in analyzing experimental data in five journal critiques on research methods in Neuroscience in NRSC 2200 • Represent, analyze, interpret and explain research data orally through public presentation of Capstone project in NRSC 4000/4002 • Represent, analyze and interpret research data in Capstone project in final written report in NRSC 4000/4002.
10. Relate neuroscience to other disciplines, and apply learning from those disciplines within neuroscience e.g., mathematics, computer science, physics, health sciences, sport and society	• Critical reflection on the purpose of research in Neuroscience and the current context of how research is conducted in the field in NRSC 1001 • Analysis of media articles that draw on molecular and cellular Neuroscience and relate them the questions “What”, “So What” and “Now What” in Medical Article reflection activity-NRSC 2000 • Analysis of case studies/simulations that offer ‘real-life’ examples of the complex structure and function of the human brain through in-class case studies/simulations in NRSC 2100 • Relating Neuroscience through other disciplines through reviewing articles, some of which may be suggested by guest lectures as part of five journal critiques in NRSC 2200. • Analysis of real-world topic related to the nervous system with a focus on sensory processing in critical reflection activity in NRSC 3000.
11. Work effectively and collaboratively in teams.	• Working in groups to critically reflect and write about media articles in Neuroscience in Media Article reflection activity in NRSC 2000 • Choice of team reflection presentation on one Neuroscience technique in NRSC 2200 • Complete peer to peer and self-evaluation of collaborating of choose the team presentation in NRSC 2200 • Team critical reflection activity in NRSC 3000 • Complete peer to peer and self-evaluation of collaborating on the team presentation in NRSC 3000 • Work effectively with supervisor, lab mates, team mates during Capstone project and in developing initial proposal, final report and public presentation in NRSC 4000/4002.
12. Demonstrate initiative, personal responsibility, and accountability in the laboratory and class setting.	• Interview of two different Neuroscientists and write a critical reflection in NRSC 1001 • Demonstrate personal responsibility and accountability while working in groups to critically reflect and write about media articles in Neuroscience in Media Article reflection activity in NRSC 2000 • Participation in data workshops in NRSC 2200 • Self-evaluation in NRSC 2200 • Peer to peer evaluation of collaborating on team presentation in NRSC 2200 • Display professionalism in public presentation in NRSC 4000/4002
13. Demonstrate academic integrity, social responsibility, and respect	• Interview of two different Neuroscientists in NRSC 1001

for diversity and different points of view.	• Demonstrate respect for diversity and different points of view when working in groups to critically reflect and write about media articles in Neuroscience in Media Article reflection activity in NRSC 2000 • Demonstrate academic integrity, respect for diversity and different points of view while working effectively with others in NRSC 4000/4002

Detailed Assessment Criteria for Determining Student Achievement

Assessment	Course	Assessment Criteria
Critical Reflection	NRSC 1001	see for definitions of critical reflection http://health.yorku.ca/experiential-education/faculty/#squelch-taas-tab-content-1-6 • 0 assigned for below benchmark, 1 for reaching benchmark, 3 assigned for mastery
Critical Reflection	NRSC 4000	• reflect on their experience in the neuroscience program and to outline how and what they have learned about neuroscience research, the field in general, and themselves. • critique their own thoughts, attitudes, and actions related to neuroscience research, and describe how/why they have changed or stayed the same as a result of their research experience. • asked to identify at least one attitude/action that they think they could apply, do better, or do differently (it can apply to any aspect of their professional or academic life) as a result of what they have learned about neuroscience.
	NRSC 4002	• reflect on their experience conducting a team-based project in the neuroscience program. A collaboration rubric will be created or adapted from the team based value rubric proposed by AACU (American Academy of Colleges and Universities see *value@aacu.org*) whereby students assess and critique their contributions and their peers contributions to the development of the project (e.g., role in researching and gathering information, ability to share and relay information, punctuality); responsibility in ensuring the project outcomes are fulfilled (e.g., fulfills team role & duties, contributes to the development of the final paper); and ability to be a valuable team player (e.g., listens to others, expresses self to others, makes fair decisions).
One-minute paper	NRSC 1001	• Student are expected to answer the questions: “What was the most important concept they learned from the guest speaker?” and/or “What would they like to learn more about?”
Reflection Activity on Media Article	NRSC 2000	• Students are expected to write about one media article elaborating on reflection questions such as “What” (e.g., what neuroscience issue is being addressed?), “So What” (e.g., how does this information relate to your neuroscience content?),

		and “Now what” (e.g., What would they like to learn more about pertaining to this topic?).
Journal Article Critique Assignment	NRSC 2000	• Students are expected to analyze a research article, critically reflect on the research processes, and discuss their emerging understanding of the purpose and process of at least two of these methodologies
In-class case study/simulation exercises	NRSC 2100	• Students will be assessed on the engagement with/participation in the exercises (e.g. they must be present in class and complete the exercise) as well as their reflective responses. Responses will be assessed both on accuracy (against the course material) as well as their ability to make critical connections between core course concepts. • Students will be asked to write a critical reflection based on a provided case study e.g., addressing the questions “what?” (e.g., what did they learn about the structure/function covered, what neuroimaging techniques were used to measure the structure/function), “so what” (how does this information contribute to our knowledge in the field of neuroscience), and “what now” (what more would they like to know about this topic or what further research needs to be engaged in to expand on this topic).
Choice of Individual or Team reflection presentation about one of the laboratories	NRSC 2200	• In teams of 5, students will present a critical reflection about an experimental technique in a 15-minute presentation to the class. • They will describe: What (what did they learn about the lab), so what (what key course concepts does this technique help them to understand, what usefulness and limitations are associated with the technique), and what now (if you could engage in a research project using this technique would you do?) • Students will complete a peer-to-peer and self-evaluation on their contribution to and participation in the team-based presentation.
Critical reflection activity	NRSC 3000	• Students will be asked to work in teams (in class or online) to write a critical reflection on a journal article and/or media posting related to the nervous system with a focus on sensory processing, learning and memory • . They will be asked to address the questions: “what?” (e.g., what did they learn about the sensory process covered, what technologies were used to investigate the sensory system), “so what” (e.g., how does this information contribute to our knowledge in the field of neuroscience, does and/or how does the technologies used to investigate the sensory system further our understanding of this system), and “what now” (e.g., what more would they like to know about this topic or what further research needs to be engaged in to expand on this topic, are there other technologies that could better investigate the sensory system in this context).

Mid-way draft evaluation	NRSC 4000/4002	• Students will be asked to create an initial project proposal. No later than 4 months after beginning the project (approximately January 15th) the students will submit to their supervisor a draft of the Introduction and Methods of the project, • Students will receive feedback on their performance, and progress toward meeting the learning outcomes in their proposal and the course.
Oral presentation evaluation	NRSC 4000/4002	• Students will present their Capstone project. • This final presentation will be evaluated (approximately 20%) using a rubric adapted from the Oral communication value rubric proposed by AACU (American Academy of Colleges and Universities see *value@aacu.org*) evaluating skills such as reflection (e.g., uses concepts learned about neuroscience to draw further conclusions and links it to research, shows that they recognize and can critique the beliefs and assumptions they hold etc.); language (e.g., language supports the effectiveness of communication, is appropriate to the topic and audience, grammatical, clear, etc.); delivery (e.g., posture, gesture, eye contact, and vocal expressiveness shows confidence and authority. looks more often at the audience than at his/her speaking materials/notes, etc.); supporting material (e.g., explanations, examples, illustrations, statistics, analogies, and quotations from relevant authorities are appropriate); central message (e.g., compelling, precisely stated, appropriately repeated, memorable, and strongly supported, etc.).
Research citizenship		• Students will be assessed on their work in labs, lab meetings at York or in the community, modelling the importance of developing professionalism skills that are valuable to future careers in the field. While lab meetings and experiences may look different from project to project, all students will be assessed on how they contribute to the creation and ongoing support of a positive, collegial, research environment.

Appendix H: Confirmed and Potential Neuroscience Faculty members

The neuroscience faculty are comprised of two types: core vs. affiliated.

1. Core Faculty would sit on a governing board and help determine the direction of the Program. They would have a negotiated (with their home department) fraction of their teaching duties devoted to the Neuroscience Program. They would also be able to supervise Capstone course projects in the Neuroscience Program. Someone from the core could serve as the Neuroscience Program coordinator.

2. Affiliated Faculty would occasionally teach courses in the Neuroscience Program. They would also be able to supervise Capstone course projects in the Neuroscience Program.

Confirmed core neuroscience faculty:

Christopher Bergevin (Physics and Astronomy)
Steven Conner (Biology)
Dorota Crawford (Kinesiology)
Doug Crawford (Psychology) Canada Research Chair
Joseph DeSouza (Psychology)
Logan Donaldson (Biology)
Mazyar Fallah (Kinesiology)
Ebrahim Ghafar-Zadeh (Computer Science and Engineering)
Vinod Goel (Psychology)
Laurence Harris (Psychology)
Denise Henriques (Kinesiology)
Shayna Rosenbaum (Psychology)
Lauren Sergio (Kinesiology)
Jennifer Steeves (Psychology)
Dale Stevens (Psychology)
Christine Till (Psychology)
Gary Turner (Psychology)
Niko Troje (Biology)
Georg Zoidl (Biology/Psychology) Canada Research Chair

Confirmed affiliated faculty

Ellen Bialystok (Psychology) Distinguished Research Professor
James Elder (Computer Science and Engineering)
Erez Freud (Psychology)
Mazen Hamadeh (Kinesiology)
Walter Heinrichs (Psychology)
Susan Murtha (Psychology)
Norm Park (Psychology)

Potential core faculty (not confirmed, new hires)

Robert Allison (Computer Science and Engineering)
Richard Murray (Psychology)
Thanujeni Pathman (Psychology)
Frances Wilkinson (Psychology, Emeritus)
Hugh Wilson (Biology, Emeritus)

Potential affiliated faculty (not confirmed)

Scott Adler (Psychology)
Ingo Fruend (Psychology)
William Gage (Kinesiology)
Jorg Grigull (Mathematics and Statistics)
Terrance Kubiseki (Biology)
Pouya Rezai (Engineering)
Nicko Troje (CRC Tier 1 in Visual Science (VISTA) - (Biology)
Derek Wilson (Chemistry)
Laurie Wilcox (Psychology)
Madgalene Wojtowicz (Psychology)
Joel Zylberberg (CRC Tier 2 Visual Science (VISTA) - (Physics and Astronomy)

Appendix I: see separate attached Excel spreadsheet.

Note to populate this spreadsheet the proposed Neuroscience Program Level Objectives (PLOs) were mapped to the University Undergraduate Degree level expectations (UDLE) for a BSc degree. Then all the course outlines proposed to be a part of the new degree were reviewed for their learning outcomes and these were mapped to the PLOs. If a course outline did not indicate learning outcomes per se, but there was information provided about teaching objectives these were reviewed and mapped based on our best estimate, and/or the Course Instructors who taught the courses were asked for feedback on the mapping to ensure appropriate alignment of course objectives with PLO's.

After this first iteration, gaps were found and therefore modifications were made to the proposal adding in additional neuroscience program level objectives and a redesigning of the proposed new neuroscience courses to ensure that at least one if not more courses in the core had learning outcomes that mapped to the PLO's, and UDLE's. The final product of this exercise is shown in the Excel spreadsheet.

Appendix I: Undergraduate Degree Level Expectations (UDLE) mapped against Program Learning Objectives (PLO) and each course in the program (Yellow = KINE courses, Grey = PSYC courses, White = BIOL and other Science courses, green = new neuroscience courses, blue represents a course taken in either BIOL, KINE, PSYC.)

Neuroscience degree requirements		Basic Science									Core Neuroscience												Specialization: Molecular and					Specialization: Behavioural and Cognitive Neuroscience											Specialization: Systems Neuroscience						
Six OCAV defined undergraduate degree level expectations (i.e., what students will need to demonstrate when degree is granted)	**Defined 13 objectives/outcomes of attaining Neuroscience degree (X marks which courses map to the outcome/objective)**	**CHEM 1000 3.00**	**CHEM 1001 3.00**	**EECS1520**	**EECS 1530**	**EECS1540**	**EECS 1570**	**MATH 1013 3.00**	**MATH 1014 3.00**	**MATH 1505 6.00**	**BIOL 1000 3.00**	**BIOL 1001 3.00**	**PSYC 1010 6.00**	**PSYC 2021 or KINE 2050 or BIOL 2060 3.00**	**NRSC 1001 1.0**	**NRSC 2000 3.00**	**NRSC 2100 3.00**	**NRSC 2200 3.00**	**NRSC 3000 3.00**	**PSYC 3250 3.00**	**KINE 3650 3.00**	**NRSC 4000/4002 6.00**	**KINE 3670 3.00**	**BIOL 4310 3.00**	**BIOL 4370 3.00**	**KINE 4230 3.00**	**KINE 4505 3.00**	**PSYC 2220 3.00**	**PSYC 2260 3.0**	**PSYC 3140 3.00**	**PSYC 3265 3.00**	**PSYC 3270 3.00**	**PSYC 3495 3.00**	**PSYC 4080 6.00**	**KINE 4210 3.00**	**PSYC 4260 3.00**	**PSYC 4270 3.00**	**PSYC 4360 3.00**	**KINE 3020 3.00**	**BIOL 4380 3.00**	**KINE 4225 3.00**	**KINE 4240 3.00**	**KINE 4500 3.00**	**PSYC 4215 3.00**	**PSYC 4380 3.00**
1) Depth and Breadth of Knowledge.																																													
a) Developed knowledge and critical understanding of the key concepts, methodologies, current advances, theoretical approaches and assumptions in a discipline overall, as well as in a specialized area of a discipline;	1. Integrate and apply theoretical perspectives and major findings across broad areas of neuroscience 3. Demonstrate a detailed knowledge in one of the Specialized Neuroscience streams														X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	x
b) Developed understanding of many of the major fields in a discipline, including, where appropriate, from an interdisciplinary perspective, and how the fields may intersect with fields in related disciplines;	2. Demonstrate knowledge of, and recognize the relationships between, the structure and function of molecules and tissues involved in neurobiological systems at all levels: molecular, cellular, and organismal. 10. Relate neuroscience to other disciplines, and apply learning from those disciplines within neuroscience e.g., mathematics, computer science, physics, health sciences, sport and society	X	X	X	X	X	X	X	X	x	X	X	X		X	X	X	X	X	X	X	X	X			X	X	X	X	x	X		X	X	X	X	X		X		X	X	X	X	
c) Developed ability to: gather, review, evaluate and interpret information; and compare the merits of alternate hypotheses or creative options, relevant to one or more of the major fields in a discipline;	4. Locate and retrieve scientific information, and to read and critique scientific articles, demonstrate scientific writing skills, and deliver oral presentations.		X															x		X		x		x	X		X						X	X		X	X		X	x	X	X	X	X	
d) Developed, detailed knowledge of and experience in research in an area of the discipline;	5. Perform basic laboratory techniques used in neuroscience research and understand and apply principles of laboratory safety. 6. Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods.										X	X				X		X	X		X				x		X	X				X	X	X	X	X	X		X		X	X	X	X	
e) Developed critical thinking and analytical skills inside and outside the discipline; and	10. Relate neuroscience to other disciplines and apply learning from those disciplines within neuroscience. E.g. mathematics, computer science, physics , health sciences, sport and society	X				X	X	X		X	X	X			X	X		X	X	X	X	X			X		X						X	X			X		X	X	X		X		
f) Ability to apply learning from one or more areas outside the discipline.	10. Relate neuroscience to other disciplines and apply learning from those disciplines within neuroscience. E.g. mathematics, computer science, physics , health sciences, sport and society															X		X	X	X				X	X				X	X	X		X	X		X	X		X				X		

2) Knowledge of Methodologies. An understanding of methods of enquiry or creative activity, or both, in their primary area of study that enables the student to:																																																	
a) evaluate the appropriateness of different approaches to solving problems using well established ideas and;	5. Perform basic laboratory techniques used in neuroscience research and understand and apply principles of laboratory safety. 6. Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods	X	X									X	X						X	X			X					X			X			X	X				X				X		X			X	
b) devise and sustain arguments or solve problems using these methods; and	7. Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions.																						X				x				X				X				X				x		X			X	
c) describe and comment upon particular aspects of current research or equivalent advanced scholarship	6. Describe the diverse experimental research methods used in the broad areas of neuroscience and defend the use of these methods. 9. Analyze and interpret pre-existing or novel data, including research findings, and communicate the findings in both oral and written formats to diverse audiences.														X	X			X				X			X	X	X				X					X		X				x		X			X	
3) Application of Knowledge	1. Integrate and apply theoretical perspectives and major findings across broad areas of neuroscience, i.e., cellular and molecular, behavioural/cognitive, and systems																X	X	X	X	X	X	X				x	X			X	X	X		X	X	X	X	X	X				X	X	X		x	
The ability to review, present and critically evaluate qualitative and quantitative information to: a) develop lines of argument;										X			X										X						X			X	X			X	X		X	X				X			X		

b) make sound judgments in accordance with the major theories, concepts and methods of the subject(s) of study;	7. Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions.																					X						X			X				X	X		X	X					X			X	
c) apply underlying concepts, principles, and techniques of analysis, both within and outside the discipline;	10. Relate neuroscience to other disciplines and apply learning from those disciplines within neuroscience. E.g. mathematics, computer science, physics , health sciences, sport and society										X	X			X	X		X	X						X		X	X		X				X	X			X	X			X		X		X	X	
d) where appropriate use this knowledge in the creative process; and	7. Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions																	X				X																		X								X	
The ability to use a range of established techniques to: i) initiate and undertake critical evaluation of arguments, assumptions, abstract concepts and information; and	4. Locate and retrieve scientific information, and to read, critique, evaluate scientific articles, demonstrate scientific writing skills and deliver oral presentations. 9. Analyze and interpret pre-existing or novel data, including research findings, to develop lines of argument, propose solutions, and communicate the findings in both oral and written formats to diverse audiences.														x				X		X		x						X			X	X			X	X		X	X			X	X	X		X	X	
ii) propose solutions;																																																			
iii) frame appropriate questions for the purpose of solving a problem;	7. Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions																	X				X													X		X				X		X			X	
iv) solve a problem or create a new work;	7. Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions																	X				X															X				X		X			X	

v) make critical use of scholarly reviews and primary sources.	4. Locate and retrieve scientific information, and to read and critique and evaluate scientific articles, demonstrate scientific writing skills and deliver oral presentations. 7. Develop testable research questions based upon their in-depth knowledge in one or more of the broad areas of neuroscience and apply research methods, experimental designs, and analysis techniques used to investigate such scientific questions																		X	X	X		X			X			X			X	X			X	X		X	X				X	X		X	X	
4) Communication Skills																																																	
The ability to communicate information, arguments, and analyses accurately and reliably, orally and in writing to a range of audiences.	4.Locate and retrieve scientific information, and to read, critique and evaluate scientific articles, demonstrate scientific writing skills, and deliver oral presentations. 8. Represent information in a quantitative format, to analyze and interpret quantitative information, including graphs and statistics. 9.Analyze and interpret preexisting or novel data, including research findings, to develop lines of argument, propose solutions, and communicate the findings in both oral and written formats to diverse audiences.	X	X	X	X	X	X	X	X	X		X	X		X	X	X		X		X		X			X	X		X			X	X			X	X		X	X			X	X	X		X	X	
5) Awareness of limits of knowledge																																																	
An understanding of the limits to their own knowledge and ability, and an appreciation of the uncertainty, ambiguity and limits to knowledge and how this might influence analyses and interpretations.																					X	X	X									X	X			X	X	X	X	X			X		X			X	
6) Autonomy and Professional Capacity. Qualities and transferable skills necessary for further study, employment, community involvement and other activities requiring:				X	X		X																X																										
a) the exercise of initiative, personal responsibility and accountability in both personal and group contexts;	Demonstrate initiative, personal responsibility, and accountability in the laboratory and class settng.	X	X											X					X				X																X	X					X			X	
b) working effectively with others;	Work effectively and collaboratively in teams.											X	X	X			X		X				X																X	X			X					X	
c) decision-making in complex contexts;																	X						X																X						X				
d) ability to manage their own learning in changing circumstances, both within and outside the discipline and to select an appropriate program of further study; and																	X				X		X									X	X			X	X		X	X			X						
e) behaviour consistent with academic integrity and social responsibility.	Demonstrate academic integrity, social responsibility, and respect for diversity and different points of view.	X	X									X	X	X			X		X				X																										

Appendix J: Supporting Documents

- Deans of the Faculties of Health and Science (Paul McDonald, and EJ Janse van Rensburg)
- University Librarian (Joy Kirchner)
- University Registrar (Lucy Bellissimo)
- Relevant programs (Chairs)
    - Kinesiology & Health Science (Angelo Belcastro)
    - Psychology (Joel Goldberg)
    - Biology (Robert Tsushima)
- Vice-President Academic and Provost (Lisa Phillips)

Plus, we have attached a letter of support from Learning Technology Services from Rob Finlayson for the new course proposals.

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February 27, 2019

Academic Standards, Curriculum
and Pedagogy Committee (ASCP)

Re: Letter of Support – Neuroscience Program

I am delighted to provide my enthusiastic support for the proposed new undergraduate program in neuroscience to be jointly offered by the Faculty of Health and the Faculty of Science. This is an outstanding example of how two faculties can come together to create an innovative, high-quality interdisciplinary program.

The neuroscience program is expected to enroll approximately 70 students annually, until the enrolment peaks at a steady state of 240 students over all years. Some of these students may have otherwise enrolled in one of the host units, but the majority are expected to be students who would not have come to York.

The program is distinctive in various ways. First, it is a hybrid between a traditional first and second entry program. This enables students to develop an affiliation with the neuroscience program as well as one of the three host academic units. Given that the program is expected to be highly demanding, it ensures that students who find the program too difficult can continue unabated in the program of their host unit. The program utilizes an efficient and unique blend of existing courses from each of the three host units, as well as a handful of new offers specifically designed to enhance the student experience in neuroscience. The program clearly integrates research into its curriculum. I have no doubt that the three host units have the necessary expertise and commitment to deliver an outstanding academic program which attracts students of the highest quality. Additional resource demand for the program are remarkably modest thanks to the utilization of mostly existing courses and faculty, and by sharing the administrative tasks across multiple units.

After undertaking a careful analysis, we project that the net new enrolments will produce enough revenue to hire the additional faculty and staff required to deliver the program. I am pleased to confirm that together with the Faculty of Science, the Faculty of Health is fully prepared to support this program with the necessary resources and infrastructure. We also commit to the principle of fairness in managing, and paying for this program, with respect to our respective partners.

Sincerely,

Paul McDonald, PhD, FRSPH, FCAHS
Dean, Faculty of Health

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February 8th, 2019

Academic Standards, Curriculum
and Pedagogy Committee (ASCP)

Re: Letter of Support – Neuroscience Program

I am writing to express support for the proposed new Neuroscience Program to be jointly offered by the Faculty of Health and the Faculty of Science. This has resulted from a collaboration between our two Faculties in the true spirit of interdisciplinary excellence.

The Neuroscience program is expected to enroll about 70 students annually, maturing at about 240 students over all years. It comprises many existing courses, but it also proposes to add seven new courses specific to the program. Accordingly, we recognize that attendant with such a new program, there will be costs associated with administration, infrastructure, and teaching. I confirm that the Faculty of Science, working with the Faculty of Health is prepared to support this program with the necessary funds for personnel and infrastructure, and also to be mindful of the needs of the program as we consider our Faculty complement plans from year-to-year. We also confirm that the Faculty of Science will continue to respect the principles of fairness in managing, and paying for this program, with respect to our respective partners.

Sincerely,

EJ Janse van Rensburg
Interim Dean, Faculty of Science

TENTANDA VIA

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Memorandum

To: Susan Murtha, Associate Dean, Learning, Teaching, Academic Programs, Faculty of Health

From: Joy Kirchner, Dean of Libraries

Date: October 25, 2018

Subject: Library Support for BSc Specialized Honours in Neuroscience

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As the attached memo attests, York University Libraries are well-situated to support the proposed new undergraduate program in neuroscience. The Libraries have extensive collections to support teaching, learning, and research in this area due to existing curricular and research strengths in neuroscience at York University. Further, there is broad librarian expertise at York to support faculty and students within this program.

The Libraries are engaged in extensive restructuring at the moment, with the aim of continuing to provide the excellent collections and instructional and consultation expertise it has provided in the past, but to also better leverage library expertise and infrastructure to better support emerging needs around resource accessibility, open educational resources, and data management, to name a few. You will be hearing more about this over the coming months.

We look forward to our continued work with the Faculty of Health and with the Faculty of Science over the coming years and are excited to fully support this new program.

TENTANDA VIA

Statement of Library Support for the New Proposed Neuroscience Program

York University Libraries

October 2018

Submitted by: Ilo-Katryn Maimets, Rajiv Nariani,
Amy Poon

INTRODUCTION

This statement of library support for the proposed ***Bachelor of Science Specialized Honours Degree in Neuroscience*** has been prepared in accordance with the guidelines outlined in the Quality Assurance Framework as set out by the Ontario Universities Council on Quality Assurance. It describes the level of support currently provided by York University Libraries for the Neuroscience program proposed to be offered in the Faculty of Health (FoH) on the Keele campus. The Libraries support FoH programs including undergraduate through to the PhD level in related Health Sciences and Science programs through collections, instructional services, research assistance, access to knowledge resources, supporting research dissemination and providing adaptive services.

The proposed Neuroscience program will "provide students with an undergraduate path into graduate studies, leading to research-oriented careers in academia or industry. As such, and as outlined below, this program is aimed at high-achieving students. Students will graduate with a broad and advanced understanding of cellular and molecular, cognitive and behavioural, and systems neuroscience. Given their breadth and depth of knowledge and skills, graduates will also be prepared for other employment opportunities in life sciences professions and industry that are afforded by the rapid expansion of technological and entrepreneurial endeavors in neuroscience."

COLLECTIONS

General Description of the Collection

The current graduate diploma program in Neuroscience has been well supported since 2007 and draws strength from the collective knowledge of faculty members in the Department of Biology in the Faculty of Science and from the School of Kinesiology & Health Science and the Department of Psychology in the Faculty of Health at York University.

The Libraries' collections support the research and teaching needs of the faculty as well as the graduate students enrolled in these programs and courses offered in Psychology, Kinesiology & Health Sciences and Biology.

In the recent years there has been a growing focus on research in cognitive neuroscience, neuropsychology, and vision science. YUL continues to support these subject areas ranging from the introductory to the advanced, and the collection accommodates these diverse interests and supports the strong neuroscience component of these courses associated with the proposed *Bachelor of Science Specialized Honours Degree in Neuroscience*. The collection comprises a variety of formats: print, online and microform, consisting of monographs, journals, government publications, index databases and other reference sources.

Formats

The Libraries' collection comprises print, electronic, audio-visual, and microform resources in the form of monographs, journals, reference materials, films, videos, DVDs, government documents and statistics. Digital/electronic resources can be accessed from all libraries and off-campus through the York Libraries' web site.

Location of Resources

A large portion of the print collection in the areas of Biology and Kinesiology is concentrated in the Steacie Science and Engineering Library and includes resources in systems neuroscience, neuroanatomy, neurobiology, stress physiology, neurophysiology, and neuroendocrinology. In addition, the Science Library has strong holdings related to vision sciences, visual perception, vision-motor control, neural networks, and psychophysics. We also collect research level resources in cellular and molecular biology and immunobiology.

The Psychology and Behavioral Sciences print collection is housed in Scott Library, and includes resources covering learning, emotion and motivation, sleep disorders, cognitive sciences, psychophysics, perception, and some areas of health psychology. In addition, some supporting collections such as government documents and the microform collection are also housed at Scott Library.

Print Books

Monographs are purchased through the *Gobi Approval Plan* although other sources of new titles are also used. Searches are also conducted in ***WorldCat*** to locate titles of relevance and interest.

York University Libraries have been collecting reference material and handbooks in all areas of neurosciences including vision sciences and signal processing. Significant reference sources include the *Handbook of developmental cognitive neuroscience* (2014), *Encyclopedia of behavioral neuroscience* (2010), *Encyclopedia of neuroscience* (2008), *Handbook of neurochemistry and molecular neurobiology* (complete series), *Neurobiology of Disease* (2007), and *Signal processing for neuroscientists* (2007), *Oxford handbook of traumatic stress disorders* (2012), *Encyclopedia of Stress* (2007) and the *Encyclopedia of health and behavior* (2004). The Libraries have copies of the book *Principles of Neural Science* (5th Ed.). The Libraries remain been committed to meeting faculty and students needs and have print and/or online access to most of the journals mentioned in the assigned reading list.

Journals

Given the interdisciplinary nature of the program, the journal collections in neuroscience, cognitive science, neurobiology, psychology, biology, and health science are especially important since currency is emphasised. Subscriptions are maintained for all significant periodicals, and back runs are acquired if available. Whenever possible, electronic journal format is preferred over print. York University Libraries are moving towards providing a complete range of resources to students' desktops. As electronic subscriptions are added to the collection, print versions are cancelled once ongoing access to the electronic archives has been ensured.

The demand for periodicals, particularly online journals is increasingly fulfilled through our involvement and memberships in consortia such as the Canadian Research Knowledge Network (CRKN) and the Ontario Council of University Libraries (OCUL). Many journals are also available from publishers such as the *Elsevier, Karger, BioOne, and National Library of Medicine* and from aggregators such as *Synergy-Blackwell, PsycARTICLES* (APA), *CogNet* (MIT) and *Proquest*. Open access journals from *Directory of Open Access Journals (DOAJ),* and *Public Library of Science (PLoS)* are also listed in the library catalogue. Individual titles are added on request by faculty.

Electronic Resources

New E-journals and databases

York University Libraries subscribe to full text electronic journals viz. *Nature Reviews NeuroScience* and *Nature Reviews Genetics*. Additional journals the library subscribes to include *Nature Neuroscience*, *Journal of Cognitive Neuroscience*, and *The Journal of Neuroscience*.

All of the journals and books mentioned in required and recommended readings are available in print and/or electronic format at York University Libraries. In addition, the library subscribes to high impact journals in biology, kinesiology and health sciences, psychology & cognitive sciences, and all aspects of neuroscience.

The main journal indexes and databases of relevance to this area include *Biological Abstracts, Compendex and Inspec, Elsevier Biobase, Medline (Ovid/Pubmed), Mental Measurements Yearbook, Primal Pictures, PsycARTICLES, PsycINFO, Scholars Portal, Scopus, and Web of Science.*

Electronic Books

YUL subscribes to *MIT CogNet*, an online location for the brain and cognitive science community's scientific research and interchange, which provides access to a comprehensive platform of resources from several fields, such as artificial intelligence, linguistics, neuroscience, psychology, philosophy and education.

Another significant collection of electronic books is *PsycBOOKS* which contains full text versions of thousands of scholarly titles published by the *American Psychological Association*. These electronic books are in a broad range of areas in psychology. An electronic version of the 8 volume Kazdin *Encyclopedia of Psychology* is also included in this product and is available through the eresources Quick Search box via the Libraries' homepage at www.library.yorku.ca

The Libraries also subscribe to numerous electronic books in neurosciences, psychology and biology through other content providers on a variety of platforms.

The Biochemisty, Biology, Kinesiology, Neuroscience, Psychology and other Health and Science Research Guides list all the important online resources (subscribed and free) for neuroscience and are available from:

http://researchguides.library.yorku.ca/biochemistry
http://researchguides.library.yorku.ca/biology
http://researchguides.library.yorku.ca/kinesiology
http://researchguides.library.yorku.ca/neuroscience
http://researchguides.library.yorku.ca/psychology

Theses & Dissertations

Should faculty and students require access to theses and dissertations, this is made primarily available through *ProQuest Dissertations and Theses* database which provides full-text access to North American and European dissertations. International theses can be located through the *Networked Digital Library of Theses and Dissertations* (NDLTD) and other portals. Links to several additional sources of dissertations are available through the Neuroscience Research guide under the Advanced Research tab. Theses that are not available in full-text can be requested through the Interlibrary loan system called RACER (Rapid Access to Collections by Electronic Requesting).

Access to Collections

The library home page at http://www.library.yorku.ca is the central starting point for accessing the range of resources and services York University Libraries have to offer. Electronic resources are linked from the Libraries' home page and from the catalogue and can be accessed from workstations within the Libraries or from off-site computers. An excellent collection of online indexes and e-journals, as well as access to the Libraries' catalogue is available for users around the clock. Facilities for printing, scanning and photocopying are available in the Libraries as options for saving to disk or sending as e-mail.

Scholars Portal is a suite of services and products offered through a partnership of Ontario College and University Libraries (OCUL). Originally a database of e-journals, Scholars Portal has evolved beyond full text electronic journal content to include numerous indexes and abstracts (now called *Scholars Portal Search*) with seamless linking from initial search to final results via the ***Find It @York*** feature. This feature enhances the speed and effectiveness of research by linking individual records to electronic full text. Following a search in a database such as *Biological Abstracts*, the search results now provide a link from each citation to the York Library catalogue. Clicking on the ***Find it @ York*** brings up a menu of viewing and downloading options available for the citation. These can include links to one or more versions of the electronic text when it is available, or links to abstracts or the table of contents for journal issues when full text is not available. An additional link to the York library catalogue determines whether the article is available in print, and finally a link to *RACER* permits ordering of articles not held at York.

Purchase requests

Collection development is an ongoing process and the Libraries are committed to developing library resources that are in alignment with the University's curricular and research activities. Students and faculty members are encouraged to suggest additional books and resources for library purchases. Please forward any requests for purchase by using the form at: https://www.library.yorku.ca/web/suggestion-for-purchase-form/

Interlibrary Loans/Resource Sharing and Off- Campus Resources

Students and faculty are not restricted to using only resources that are available at York. All students, both graduate and undergraduate, and faculty have access to the collections of other university libraries through the interlibrary loan system called *RACER* (Rapid Access to Collections by Electronic Requesting). Students and faculty may borrow monographs and request articles not available at York through *RACER,* free of charge. Articles are delivered to the requestor's e-mail.

Intercampus Borrowing

Because some of the collections extend over two campuses and since all students need easy access to materials, the Libraries provide an intercampus borrowing system at no charge. Students can submit a request online to have library materials delivered from one campus to the other by the following business day. Students can also use a free shuttle service to travel between campuses.

SUPPORTING TEACHING, LEARNING & RESEARCH SERVICES

Research Dissemination through Open Access Initiatives

York University Libraries have been generous in supporting the Open Access (OA) movement and encourage submissions to OA journals. York University Libraries have directed a part of their collections funds to support faculty and graduate students' publishing endeavours by paying the Article Processing Charges for select OA publishers. Some of the supported publishers include *BioMed Central*, *Hindawi*, *Public Library of Science (PLoS), BioOne*, and *Open Medicine*.

Faculty are invited to deposit their papers for publication in YorkSpace, York's institutional digital repository. The non-exclusive archiving of research in York's digital repository lends an institutional presence and increases York University's scholarly profile while protecting faculty/author rights and preserving the work for future use. For more information about Scholarly and Open Access Publishing, please see https://www.library.yorku.ca/web/research/.

Undergraduate students have an opportunity each year to present a poster on their original research at the York Undergraduate Research Fair. Now in its 8th year, this Fair provides a real-life opportunity for promising undergraduate students to take their research conducted within the framework of a credit course and written up as a research paper and turn it into a poster that makes their research accessible to the public. Pre-fair workshops are held for students on designing posters in their disciplines, organizing poster content, and presenting to an audience.

Abstracts of all accepted submissions as well as the complete work of award winners will be published in a student-led journal.

Specialized Liaison Librarians

Library support is provided primarily at the Steacie Science & Engineering Library, Bronfman Business Library, and Scott Library. Liaison librarians assist students and faculty with literature research, provide in-class workshops, develop research guides and help to manage and organize the research literature using citation management programs. Science students and faculty can get reference help during reference hours in person, via e-mail, by telephone, and through the Ask Chat Reference Service accessed from the Ask & Services tab on the library home page. In addition, the libraries provide research help by email, phone and in person.

Managing Research Results

The Libraries support faculty and students using *Mendeley* or *Zotero*, both web-based citation management programs, to store and format citations to books, journal articles and other scholarly resources.

Scholarly Publishing Services

York University Libraries provide an electronic journal hosting service for York-affiliated journals. This service is called *York Digital Journals* (YDJ) and uses *Open Journal Systems* (OJS), an open source software platform. The Digital Scholarship Infrastructure Department is happy to work with York community members to create new journals or migrate existing journals to an online environment. The Libraries provide training and troubleshooting help with the OJS software, as well as advice to ensure maximum exposure.

YorkSpace is York University's digital library of research outputs. It is a platform that enables York community members to post, organize and preserve their research online in an institutional context. It showcases the scholarship of the York University community through the use of a special standards-based software platform that collects usage statistics and promotes visibility on the web. The Faculty of Health has a growing number of research papers stored in *YorkSpace* that subsequently can be discovered using Google.

STUDENT LEARNING and ACADEMIC SUCCESS

The Student Learning and Academic Success Department of the Libraries advances a cohesive and coordinated approach to develop students' information and other academic literacies throughout academic programs at York. Student-centred learning requires learners to find, evaluate, interpret and apply information to solve problems and construct new meanings and is an essential component of students' education. The Libraries' information literacy programming empowers learners to use information critically to learn and to create new knowledge, cultivating academic, professional and personal success.

York University Libraries has a very active information literacy program supporting undergraduate and graduate students and faculty. Informed by information literacy scholarship,

we strive to embed and integrate information literacy principles and learning outcomes into curricular and co-curricular programs. Information literacy programming is most successful when developed through a progressive incremental building of skills that are strategically embedded at critical junctures throughout the program. Learned in the context of the discipline with its own distinctive research practices and scholarly culture, this coherent and scaffolded learning experience ensures students graduate with the skills and knowledge to be successful in their academic pursuits and in their future careers.

Information Literacy Support for Students

Information Literacy is an essential component of students' education. Without the skills to find, retrieve, evaluate and use information, students cannot participate fully in a university environment or in their disciplinary culture. Critical engagement with information is an integral component of scholarly discourse and fundamental when involving students in teaching and learning.

Increasingly, programs at York University are developing curriculum-integrated approaches to information literacy (IL). This is a process whereby IL instruction and principles are embedded throughout an entire degree program by a progressive incremental building of IL skills. More students are reached as IL instruction is embedded strategically at critical junctures throughout the program, making it accessible to all students through a scaffolded approach.

The benefits of this are that library research skills (and information literacy) are learned in the context of the discipline with its own research practices and scholarly culture. This kind of coherent and graduated learning experience has been shown to improve retention and ensure that we graduate students who have the tools and knowledge to remain current and knowledgeable in their fields by easily following and incorporating developments and changes as they arise. This is more meaningful in that it prepares students for challenges they will actually face in their programs and their future careers.

If this were implemented in Neuroscience, the assigned librarian will be available to work with faculty members and curriculum committees to:

- articulate learning objectives related to information literacy,
- decipher how they might be mapped strategically into programs or courses, and
- co-design and implement assignments that hone and assess discipline-specific IL skills.

As an example, some of the core courses that might be considered for IL integration are those that are newly proposed for the program:

NRSC 1001 1.00 *Frontiers of Neuroscience*

IL instruction could include: (1) articulating research questions; (2) Using Web of Science and SCOPUS to identify key researchers in areas of neuroscience; (3) developing keyword search strategies and applying them to each database recognizing that each has its own syntax and features; (4) evaluating search results for use, recognizing that every genre has associated audiences and purposes; (5) managing and saving search results and references using

bibliographic management software such as Mendeley; (6) using information and citing one's sources using citation styles specific to the Health Literature.

NRSC 2000 3.00 *Fundamental Molecular and Cellular Neuroscience*

IL instruction could include: (1) introduction to the tools of neuroanatomy; (2) learning to use Medline and its advanced features such as the MeSH thesaurus, subheadings, and limits in the context of course assignments for searching the Biomedical literature; (3) how to search for neuroscience media articles; (4) evaluate sources for accuracy and relevance

NRSC 2100 3.00 *Systems, behavioral and cognitive neuroscience*

IL instruction could include: (1) introduction to the tools of neuroanatomy; (2) searching PsycINFO

Information literacy is particularly important for graduating students who are proficient in navigating the health information landscape. For this program which will be graduating students who are likely to continue in graduate and professional programs, equipping them with the skills required for academic success will give them an edge in these competitive markets.

CONCLUSION

Library support for the *Bachelor of Science Specialized Honours Degree in Neuroscience* is extensive and covers all aspects from collections, through access, to user assistance. This support stems from collaborations between the Libraries and faculty members and the student community. In reviewing the descriptions of the courses and programs that are offered in neuroscience, it is evident that the collections are well equipped to support the courses in this program. Collection development in the library is ongoing, and is based on a commitment to developing library resources that are in alignment with the University's curricular and research activities. Access to resources has been a focus of the libraries for a number of years, and has led to increases in collaborative initiatives such as RACER for interlibrary loans and document delivery, and Scholars Portal for a collaborative information gateway of software and resources, to name a few. Developments in these areas are also ongoing with a focus on improving desktop access for faculty and students. Finally, the library is committed to providing instructional and reference support to assist students and faculty with information needs that arise in the contexts of teaching, learning and research. York University Libraries look forward to maintaining these important working relationships so that the Libraries have the resources in place to support the Faculty of Health's plans for growth and diversification, as new courses and programs are introduced, and new faculty are appointed.

In summary, we contend that York University Libraries are well positioned to support the Bachelor of Science Specialized Honours Degree in Neuroscience, Faculty of Health at York University.

Sincerely,

Ilo-Katryn Maimets (Health and Science Librarian)
Rajiv Nariani (Health and Science Librarian)
Amy Poon (Health and Science Librarian)
Steacie Science and Engineering Library

Appendix 1: York University Libraries Annual Statistics 2016-17

CIRCULATION	2014/2015	2015/2016	2016/2017
Scott			
Circulation Services	60, 572	65,512	60,000
Reserves	29,823	27,532	16,931
Self Check	109,078	89,268	74,178
Total	**138,901**	**182,312**	**151,109**
Sound and Moving Image Library			
Circulation	22,468	17,523	14,691
Reserves	217	250	132
Total	**22,685**	**17,773**	**14,823**
Archives & Special Collections	3,337	2,828	2,815
Map Library			
Circulation	227	326	351
Reserves	223	116	147
GIS	325	1,451	591
Total	**775**	**1,893**	**1,089**
Bronfman			
Circulation	4,130	4,573	4,762
Reserves	5,681	5,128	4,067
Total	**9,811**	**9,701**	**8,829**
Frost			
Circulation	17,622	17,534	17,630
Reserves	1,990	1,906	1,709
Total	**19,448**	**19,440**	**19,339**
Steacie			
Circulation	9,662	6,991	7,335
Reserves	20,169	17,719	11,816
Self check	8,031	6,268	5,074
Total	**34,565**	**30,978**	**24,225**
Total Circulation	**268,029**	**212,274**	**187,427**
Total Reserves	**58,103**	**52,651**	**34,802**
Total Item Circulation	**326,132**	**264,925**	**222,229**
Renewals	299,835	236,535	206,389
Total Transactions	**625,967**	**501,460**	**428,618**
Nellie Rowell Langford Library	988	1058	919
Education Resource Centre	11,656	704	1013

USE OF ERESOURCES	2013/2014	2015/2016	2016/2017
Number of successful fulltext article re	3,469,115	3,258,533	3,658,345
Number of database searches	21,373,886	27,317,313	20,697,352

LAPTOP LENDING	2014/2015	2015/2016	2016/2017
Scott	1,251	3,866	4,971
Bronfman	182	286	676
Frost	478	494	895
Steacie	148	893	1,372
Total	**2,059**	**5,539**	**7,914**

Appendix 1: York University Libraries Annual Statistics 2016-17

ITEMS SHELVED	2014/2015	2015/2016	2016/2017
Scott			
Circulation	365,085	361,225	312,315
Government Documents	4,131	2,225	1,430
Microtext	13,839	11,669	12,610
Reference	530	595	150
Reserves	1,511	2,705	680
Map Library	2,320	2,354	2,354
Archives & Special Collections	6,026	2,828	2,815
Bronfman	14,441	13,974	14,480
Frost	32,337	28,285	24,709
Steacie	23,188	22,166	19,748
Total	**463,408**	**448,026**	**391,291**

COLLECTION GROWTH	As of 30-Apr-15	As of 30-Apr-16	As of 30-Apr-17
Print Volumes	2,714,182	2,398,271	2,417,989
Microform Units	4,271,143	4,359,357	4,232,805
Journal Titles/Other Subscriptions	3,765	3,860	3,579
Digital Journal Titles	43,514	43,514	44,830
Digital Monograph Titles	774,904	802,311	1,289,510
Media			
Maps	139,779	139,849	140,044
Aerial Photographs	5,051	5,051	5,051
GIS Data titles	701	703	707
Sound Recordings	50,130	51,768	52,287
Videocassettes	8,688	8057	8069
Films	2679	2,679	2,679
DVDs	24,524	25,328	23,374
Manuscripts and Archives			
Manuscripts (Linear metres)	4,683	4,795	4,858
University Records (Linear metres)	965	1,016	1,143
Photographs (Linear metres)	399	401	401
Moving Image Archives (Linear metres)	89,087	89,102	89,138
Born Digital Archives	214.6	4,386	4,578
Titles Catalogued	**84,577**	**114,869**	**53,405**

DIGITAL COLLECTIONS @ York	2014/2015	2015/2016	2016/2017
Digital Items Created	13,897	18,647	8,316*
Total Digital Items	105,591	124,238	132,554

*changes in metadata required before uploading of scanned items. Large upload expected in 2017-18.

Appendix 1: York University Libraries Annual Statistics 2016-17

RESOURCE SHARING		2014/2015	2015/2016	2016/2017
ILL, Interfilm	**Total Lending**	8,156	8,016	7,764
ILL, Interfilm	**Total Borrowing**	4,504	4,077	3,613

REFERENCE SERVICES	2014/2015	2015/2016	2016/2017
Scott			
Information Desk			
Reference	8,422	11,603	12,089
Other	10,240	3,877	9,792
Total Transactions	18,662	15,480	21,881
Scott Reference			
Reference	6,634	6,783	6,225
Other	1,526	946	2,774
Total Transactions	8,160	7,729	8,999
Sound and Moving Image			
Reference	83	N/A	555
Other	719	N/A	633
Total Transactions	802	N/A	1,188
Map Library			
Reference	379	553	587
Other	1,008	686	784
Total Transactions	1,387	1,239	1,371
Archives & Special Collections			
New Users	67	35	49
Returning users	253	127	213
Total Users	320	162	262
Bronfman			
Reference	4,855	7,316	5,894
Other	10,975	4,301	3,270
Total Transactions	15,830	11,617	9,164
Steacie			
Reference	2,947	5,083	4,161
Other	7,928	6,710	6,568
Total Transactions	10,875	11,793	10,729
Frost			
Reference	1,509	3,145	3,925
Other	2,485	1,110	3,314
Total Transactions	3,994	4,255	7,239
Total Reference	**25,149**	**34,645**	**33,698**
All Transactions	**60,030**	**52,275**	**60,833**
Virtual Reference	**2,742**	**2,602**	**1,950**

Appendix 1: York University Libraries Annual Statistics 2016-17

LIBRARY INSTRUCTION	2013/2014		2015/2016		2016/2017	
	Classes	Participants	Classes	Participants	Classes	Participants
Archives	28	590	19	125	33	547
Bronfman	101	4,287	92	4,512	116	5,594
Frost	79	1,699	77	1,848	50	1,113
Maps	22	1,108	22	624	18	469
Scott	310	11,306	290	10,872	251	10,699
Steacie	104	4,145	128	3,423	99	4,266
Total	**644**	**23,135**	**628**	**21,404**	**567**	**22,688**

LIBRARY ACCESSIBILITY SERVICES	2014/2015	2015/2016	2016/2017
Total Texts Provided	1,730	2571	2887

STUDY SEATS	2014/2015	2015/2016	2016/2017
Scott	2,108	2,108	**2,108**
Bronfman	321	321	**321**
Frost	247	247	**247**
Steacie	337	337	**337**
Total	**3,013**	**3,013**	**3,013**

Turnstile Count	2014/2015	2015/2016	2016/2017
Scott	2,262,666	2,209,087	2,136,478
Bronfman	292,726	275,211	287,526
Frost	83,737	89,261	82,821
Steacie	128,472	289,398	276,109
Total	**2,767,601**	**2,862,957**	**2,782,934**

OPERATING BUDGET	2014/2015	2015/2016	2016/2017
Salaries	$ 11,426,013	$ 11,564,144	$ 11,711,207
Part Time Assistance	$ 875,189	$ 715,435	$ 734,578
Benefits	$ 2,684,614	$ 2,747,151	$ 3,115,743
Subtotal	**$ 14,985,816**	**$ 15,026,730**	**$ 15,561,528**
Collections	$ 9,989,296	$ 11,684,041	$ 11,746,068
Binding	$ 46,527	$ 56,107	$ 46,650
Subtotal	**$ 10,035,823**	**$ 11,740,148**	**$ 11,792,718**
General operating	$ 1,869,197	$ 1,850,577	$ 1,772,805
Total Expenses	$ 26,854,658	$ 28,617,454	$ 29,127,051
Recovery	-$ 790,731	-$ 806,852	-$ 644,437
Total Expenses less recovery	**$ 26,063,928**	**$ 27,810,602**	**$ 28,482,614**
Gifts in Kind	$ 704,842	$ 358,900	$ 1,825,253

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DIVISION OF STUDENTS

Office of the University Registrar

Lucy Bellissimo
Interim University Registrar

Bennett Centre for Student Services
4700 KEELE ST.
TORONTO ON
CANADA M3J 1P3
T 416 736 2100
roinfo@yorku.ca

April 23, 2019

To: Academic Standards, Curriculum and Pedagogy Committee

RE: Proposed B.Sc. Sp. Hons. Neuroscience

The proposal for the establishment of a Specialized Honours, Bachelor of Science program in Neuroscience by the Faculty of Science and the Faculty of Health has been reviewed by the Office of the University Registrar.

The requested subject rubric of "NRSC" used in the proposal is available for use of the program and courses in either faculty and the transcript titles as proposed are also technically feasible within our systems and processes.

We look forward to collaborating with both Faculties to work through the implementation details in support of their requirements for curriculum management, admission and progression.

Sincerely,

Lucy Bellissimo, M.Ed.
Interim University Registrar
York University

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SCHOOL OF KINESIOLOGY AND HEALTH SCIENCE

Office of the Chair

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Tel 416 736 5403
Fax 416 736 5774

March 14th, 2019

Academic Standards, Curriculum
and Pedagogy Committee (ASCP)

Re: Letter of Support – Neuroscience Program (NS)

The School of Kinesiology and Health Science is pleased to provide support for the proposed new undergraduate program in neuroscience to be jointly offered by the Faculty of Health and the Faculty of Science.

As one of the partners in delivering the NS program, we are proud to be associated with a unique program that brings together both the brain and mind aspects of NS, which most other programs fail to do. As well, the NS program's interdisciplinary approach, which focuses on integrating content across disciplines to provide positive student learning experiences, aligns very well with our School's approach to post-secondary education. The benefit of this approach will be to provide students the opportunity within the NS program to develop an affiliation with one of the three host academic Schools/Departments. This will be accomplished by the NS program utilizing a blend of existing courses across the three host academic units; and together with selected new course offerings enhance the student's theoretical and practical/research experiences in NS.

After reviewing our current and projected enrolments, course registrations and faculty and staff complement, there is little doubt that with some modest new investments in complement and space that the School of Kinesiology and Health Science, and the two other host units will have the necessary expertise and commitment to deliver an outstanding academic NS program. Moreover, we are committed to supporting the NS program by providing access to existing courses identified in the program proposal and by sharing the administrative tasks with our respective partners.

In summary, the School confirms support in implementation and delivering the neuroscience program.

Thank you for your attention and consideration in this matter,
Regards

Angelo N. Belcastro, Ph.D.
Professor and Chair

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March 11, 2019

TO: Academic Standards, Curriculum and Pedagogy Committee

RE: Proposed BSc Specialized Honours Degree in Neuroscience

We are writing to express our overall endorsement of the most recent version of the proposal for a new BSc Specialized Honours Degree in Neuroscience at York (dated March 2019). In particular, we would like to note that Associate Dean Susan Murtha has diligently consulted with the Department of Psychology by meeting formally with our Undergraduate Studies Committee (USC) and also engaging in extensive, less formal in-person consultation and email correspondence with a number of faculty members over a span of several months.

Internal to our academic unit, feedback from Psychology faculty members at large, as well as from those faculty members affiliated with the Brain, Behaviour and Cognition Area was solicited. This input, combined with that of the USC, and an environmental scan we conducted of neuroscience undergraduate programs in Ontario, led to the development of a Feedback Report where we detailed our interests and concerns with respect to the October 22nd version of the Proposal (submitted to Dr. Murtha on January 9, 2019). On February 13, 2019, Dr. Murtha provided a written response to the Feedback Report indicating measures taken to address the majority of our concerns.

On January 10, 2019, Dr. Murtha along with colleagues in the Faculties of Health and Science held a large 'Stakeholder Meeting' with representatives from all of the participating Units to discuss a number of key issues such as supervision for the 'Capstone Experience' course.

In relation to the March 2019 version of the neuroscience proposal: We are in strong support of the proposed 'Three Pathways' program model that would enable Psychology students to obtain a Psychology degree while pursuing the Neuroscience curriculum, and also benefit from the infrastructural and student supports available to all Psychology undergraduate students. We also strongly endorse the nomenclature of 'Faculty of Health, B.Sc. Spec. Hons Neuroscience - Psychology.' Lastly, we agree that this new program requires a dedicated administrative assistant who possesses an intricate knowledge of the program and its curriculum and who could guide academic advisors in supporting student progress through the neuroscience program (or successful transitions to and from it).

There is one remaining curriculum issue that we are hopeful can be negotiated such that neither the Psychology degree nor the Neuroscience degree aspects are compromised. Specifically, we note that it would not be possible to fully adhere to the Psychology Spec. Hons. course requirements while fulfilling the NRSC curriculum (including NRSC required courses) as articulated in the current version of the proposal. Thus, in order to uphold the integrity of the Psychology Spec. Hons. component of the proposed B.Sc. Spec. Hons

Neuroscience - Psychology degree, consideration needs to be given to how we may be able to fulfill the Psychology Spec. Hons. requirements (within the neuroscience curriculum) *or* create justifiable grounds to grant an exemption for specific courses for Psychology students pursuing the Neuroscience program.

Specifically we are referring to:

At the 2000 level:

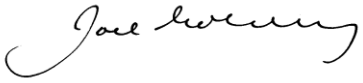
PSYC 2010 3.0 *Writing in Psychology*
PSYC 2022 3.0 *Statistics in Psychology II* (or equivalent)

At the 3000 level:

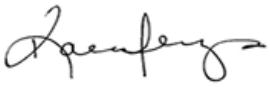
PSYC 3010 3.0 *Intermediate Research Methods*
PSYC 3031 3.0 *Intermediate Statistics Laboratory*
PSYC 3125 3.0 *History of Psychology*
PSYC 3000 3.0 *Professionalism and Communication in Psychology*

In general, we wish to convey our strong support for the overall direction of the current version of the neuroscience proposal. By the same token, we wish to document that these curricular details would still need to be ironed out where Psychology is concerned, moving forward. Please contact us if you require further information.

Sincerely,



Joel Goldberg, PhD, C.Psych
Chair & Associate Professor, Department of Psychology



Karen Fergus, PhD, C.Psych
Undergraduate Program Director, Associate Professor
Department of Psychology

YORK
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March 11, 2019

Prof. Alexander Mills
Associate Dean Students
Faculty of Science
York University

Robert G. Tsushima, PhD
Chair & Associate Professor

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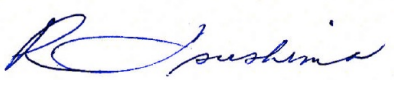
Dear Alex,

I enthusiastically support the proposed new undergraduate program in Neuroscience; a joint venture between the Faculties of Science and Health. This program is truly interdisciplinary and multidisciplinary in its scope, which will involve the Departments of Biology and Psychology and the School of Kinesiology and Health Sciences. The field of neuroscience has a wide appeal to high school students, and the new program will add a much-needed undergraduate program at York. The Department of Biology currently has 3 exceptional neuroscience faculty, all of whom are Canada Research Chairs, who will contribute to the teaching and research training of the students. Other Biology faculty will have the opportunity to participate in the program.

I have participated in some of the dialogue and meetings during the development of the Neuroscience program. I commend the working group on the finalized program format, which acknowledges the feedback and concerns from Science and Health colleagues. The working group has addressed the complexities and challenges of administering a multi-Faculty academic program. The final curriculum will provide students with a breadth of learning opportunities through the different neuroscience streams ranging from molecular and cellular neuroscience, cognition and behaviour, and systems neuroscience. Moreover, students will have the opportunity to engage in comprehensive and experiential learning experiences.

I wish to congratulate you and Prof. Susan Murtha, and all those involved, for the tireless work in developing this program. The Biology department will be a strong advocate for the Neuroscience program, which I envision will be a showpiece at York.

Sincerely,



Robert G. Tsushima, PhD

Office of the Provost and Vice-President Academic

YORK
UNIVERSITÉ
UNIVERSITY

Memorandum

To: Chair, Senate ASCP
Chair, Senate APPRC

From: Lisa Philipps, Provost and Vice-President Academic

Date: April 16, 2019

Subject: Proposal for Neuroscience Program

I have reviewed the proposal for a new interdisciplinary undergraduate program (Specialized Honours BSc) in Neuroscience to be jointly offered by the Faculty of Health and the Faculty of Science, as well as the letters of support from each of the Deans and from Department Chairs. I am pleased to offer my full support for the proposal at this stage in the approval process.

This proposed program, spanning the curricula of two Faculties and three units, provides an excellent example of collaborative program development, which is called for in the University Academic Plan. It is also a natural extension of York's offerings given that we are building a critical mass of neuroscience researchers including those involved in the VISTA (Vision Science to Application) project. This proposed undergraduate degree has been designed to take full advantage of this expertise by introducing students to a range of neuroscience faculty and laboratories at York through new courses, experiential learning opportunities, and a final capstone research project.

The strength of this proposal derives in large part from excellent planning practices adopted by the Faculties of Health and Science which can serve as an exemplar for the development of other collaborative, interdisciplinary curricula. These included:

- a detailed environmental scan as well as student surveys to analyze need and demand for the program and to differentiate it clearly from those at other institutions;
- careful mapping of student pathways through a single, unified program that can be entered via three different units depending on the student's orientation and educational goals;
- Inclusion of a select group of new, purpose-built courses designed to create an undergraduate neuroscience community, to ensure student readiness for advanced study in the area, and to enhance opportunities for essential skills and knowledge acquisition through the incorporation of hands-on research and community based activities;
- Articulation of emerging labour market needs and diverse career paths open to graduates of the program, as well as tailored research-intensive pathways for those who wish to pursue graduate study;
- Establishment of a clear and explicit governance mechanism (the tri-partite Neuroscience Committee) charged with the smooth planning and delivery of the program across two Faculties and three Departments; and
- Agreement to adhere to principles of equity and fairness in sharing costs and administrative responsibilities for the program, as well as revenues, and if necessary to adjust the outcomes of the SHARP budget model if the normal application of its default principles does not achieve this objective.

Growth in the broad fields of science and health is a key element of York's strategic goals and academic plans to become an increasingly comprehensive and research intensive University. Our existing undergraduate degrees in Biology, Kinesiology and Psychology are already among York's most highly subscribed programs. Adding this specialized and growing area of study will attract additional highly qualified students to York, and will help us to continue building the excellence and capacity of our neuroscience graduate programs, post-doctoral researchers and faculty.

I am persuaded that the resource demands to launch this program will be modest given the reliance on existing courses and faculty, as well as the sharing of administrative costs across multiple units. I anticipate requests for additional faculty complement as the program grows, subject to budgetary approval. I applaud the commitment of both Faculties to program innovation, and to efficient management and collegial governance of the partnership.

I look forward to discussion of the proposal and, in particular, to the report of the review team following its review of the materials and a site visit.

Cc: Vice-Provost Academic A. Pitt
Dean P. McDonald
Dean EJ Janse van Rensburg

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October 22, 2018

Dear Professor Murtha,

University Information Technology (UIT) is committed to the support of eLearning for the academic community and supports many technologies that underpin those efforts, include Moodle as York's primary learning management system. Within Moodle, a wide array of tools are made available to support pedagogical needs for information delivery, communications between course participants, assessment, collaboration and others. Additionally, within UIT Learning Technology Services (LTS) provides primary support to courses and instructors within the Faculty of Health.

With these supports in place I'm happy to confirm UIT support for the following course proposals:
Frontiers of Neuroscience
Fundamental Molecular and Cellular Neuroscience
Systems, Behavioral and Cognitive Neuroscience
Neuroscience Techniques
Molecular and Cellular Basis of Perception and Cognition
Neuroscience Capstone Experience

Support for many of course requirements which require technology can be found within the Moodle LMS, including delivery of course content (with videos and simulations), assignment submission, discussion, reflection and assessment activities, peer review, and knowledge construction through Wikis. These and other activities to support student-to-student and student-to-course instructor interaction are all within the scope of the support UIT provides as are support for lecture capture and timely feedback with iClicker..

I wish you well on your proposal for this exciting and engaging set of courses.

Sincerely,

Rob Finlayson

Manager, Learning Technology Services
University Information Technology