



UNIVERSITY OF CALGARY | FACULTY OF SCIENCE

CURRICULUM REVIEW REPORT

BSC NEUROSCIENCE

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Curriculum Review Team

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Overview and Context of the Program

The brain and nervous system are the most complex products of evolution and natural selection. Neuroscience is a branch of biology that seeks to understand how the brain and nervous system, and their various components, function to produce behaviour. Additionally, neuroscience seeks to understand, prevent and rectify brain disorders.

Neuroscience is a rapidly expanding branch of the life sciences dealing with the form, function, development and evolution, disease and repair of nervous systems. Central to this is the desire to understand the molecular and cellular foundations of the behavioural processes that allow animals and humans to respond to challenges encountered in daily life. Advancing our knowledge of these topics is essential to meeting the challenges of various nervous system disorders threatening health and wellness.

The BSc Neuroscience is a vibrant, interdisciplinary program providing experiential learning, small class sizes, and opportunities for direct mentorship. Students learn to think critically, synthesize concepts across scientific disciplines and master a variety of scientific techniques through research in laboratory and field course settings. The program attracts some of the best students that attend the University of Calgary, and has the highest minimal admission high school average of all programs at the university (usually 92%, but as high as 95% for 2017). By the end of their program, students will have enjoyed a strong research-intensive experience founded on the principles of inquiry and experiential learning.

The BSc Neuroscience program began in September of 2008 following approval by the provincial government after being ranked 1st of the University of Calgary's Education Performance Envelope applications. The program was the product of a grass-roots effort from the Faculty of Science (Biological Sciences), the Faculty of Social Science (Psychology, now in the Faculty of Arts), and Hotchkiss Brain Institute through the Faculty of Medicine (now the Cummings School of Medicine). It was designed as a small interdisciplinary program that would provide a comprehensive education in the neurosciences that ranges from single proteins and cells all the way to human behavior and disease. It was designed as a direct entry honours only program, where hands on research experience would be emphasized and encouraged, not only in a honours thesis, but also in courses and through summer research apprenticeships. Thus far the program has created over 300 summer research. These research experiences have already earned our students at least 96 authorships on at least 79 peer-reviewed scholarly publications. Of these, 24 of our students were 1st authors on publications.

We have graduated six classes of students so far. Of the 94 students to graduate from our program, 93% have earned the *First Class Honours* designation. About half of our graduates have attended or been accepted into Medical Schools, about 25% have moved on to graduate programs. Still others have gone into Nursing, Pharmacy, Clinical Psychology, Vet Med and Dentistry. Of those attending graduate schools, while many stay in Alberta and join the Leaders in Medicine program, others have left the proverbial nest to attend McGill, University of Montreal, University of Berlin, University of Lausanne.

Then president of the University of Calgary, Professor Harvey P Weingarten, was fully supportive and asked us to create "a world class undergraduate degree program without constraint".

"In order to become world leaders in Neuroscience research you must have an undergraduate degree program in Neuroscience". H P Weingarten 2007

Program Outcomes:

In 2015, the BSc Neuroscience program adopted the following outcomes. Those indicated in BOLD were singled out for this curriculum review:

Knowledge

- **Evaluate how cells interact to produce a functional nervous system.**
- **Interpret and integrate neuroscience phenomena at multiple levels of inquiry including molecular, cellular, network, systems, cognition and behaviour.**
- **Describe and explore the foundations of the dynamic and plastic nature of the nervous system and their application to development, experience, aging and interaction with the environment.**
- **Compare and contrast healthy and diseased states of the nervous system and analyze sources of resilience, dysfunction and recovery.**
- **Understand, analyze, and critique the process of knowledge generation and translation into novel applications.**
- **Identify key historical developments, recognize impact of research on society and vice versa, and debate issues of ethics in neuroscience.**

Skills

- Distill salient points from experimental outcomes.
- **Compare, contrast, and critically evaluate scientific findings***
- **Apply the scientific method to design and execute experiments***
- Execute technical skills common to neuroscience research
- Identify potential problems, and devise/implement solutions.
- Capacity to work effectively as a team member.
- **Generate written, graphical, and oral presentations of scientific information.**
- Convey information to scientific and non-scientific audiences.
- Evaluate personal performance and independently advance their knowledge and skills in the neurosciences
- Apply a discovery driven approach to creation and translation knowledge, integrating divergent and convergent ways of thinking.
- Demonstrate organization, time management, and a professional approach in learning.

* These two outcomes were combined for the curriculum review as: **Design experiments, apply neuroscience methods, and interpret findings.**

Commitments / Values

- Demonstrate understanding that people from other disciplines and backgrounds bring different skills, knowledge and tools to problem solving.
- Display ethical principles and a commitment to applying these principles in decision-making and Scientific practice.
- Demonstrate a commitment to sustainability and understand the impact of scientific practice on society and the environment.
- Contribute one's knowledge, skills and expertise to community and be responsive to their needs.

Guiding Questions

These are the critical questions that will guide the curriculum review. You will include the guiding questions asked by the Faculty as a whole as well as the 2-3 questions specific to your program. (faculty wide questions are included below)

Program Guiding Questions:

- Do you feel that students arriving in your class are either or Under-prepared (missing prerequisite knowledge)?
 - In what way? And what improvements can be made?
- Does this course address any of the following topics? If so to what extent (Introductory/Developing /Advanced)?
 - Evolution
 - Neuroanatomy
 - Writing
 - Group work
 - Data Analysis and interpretation
 - Application of core principles
 - Dissemination of scientific information in graphical format
 - Dissemination of scientific information in written format

Faculty-Wide Questions:

Based on the data from the National Survey of Student Engagement, the Faculty of Science is seeking additional information regarding High-Impact Educational Practices. High-Impact Practices (HIPs) share several traits: They generally demand considerable time and effort, facilitate learning outside of the classroom, require meaningful interactions between faculty and students, encourage collaboration with diverse others, and provide frequent and substantive feedback. Examples of HIPs include, but are not limited to:

- > Learning community or some other formal program where groups of students take two or more classes together
- > Courses that included a community-based project (service-learning)
- > Work with a faculty member on a research project
- > Internship, co-op, field experience, student teaching, or clinical placement
- > Study abroad
- > Culminating senior experience (capstone course, senior project or thesis, comprehensive exam, portfolio, etc.)

1. Are High Impact Practices being used regularly in this program?
2. If not, what is preventing these practices from being used?

Action Plan

Action Plan:

Recommendation	Action Item	Who is Responsible?	Due Date
Create a course in Neurophysiology and Neurochemistry (NEUR311)	<ul style="list-style-type: none"> • Design a course curriculum • Hire faculty to teach this new course • Calendar changes to add NEUR311 and delete BICE393 and CHEM351 	Academic Coordinators Associate Dean of Teaching & Learning	Design is complete, and the calendar change and implementation is contingent upon hiring a faculty member to teach the course
Enhance coverage of research methods and statistics	<ul style="list-style-type: none"> • Initiate discussion with Psychology about improving PSYC312 • Explore alternative courses such as SCIE301 • Explore option for a NEUR specific 300 level research methods and analysis course 	Academic Coordinators Associate Dean of Teaching & Learning	Summer 2020
Integrate Computer Science	<ul style="list-style-type: none"> • Submit a calendar change to require CPSC 217, 231 or DATA 211 	Academic Coordinator	Completed for 2018-19 calendar
Integrate Neuroanatomy into the program	<ul style="list-style-type: none"> • Design a lab component for NEUR201 • Submit a calendar change • Lobby the Faculty of Science for TA funding to support this lab component 	Academic coordinator Associate Dean of Teaching & Learning	Design is complete, and the calendar change and implementation is contingent upon approval of TA funding
Include Physics 223	<ul style="list-style-type: none"> • Submit Calendar change 	Academic Coordinators Associate Dean of Teaching & Learning	Completed for 2018-19 calendar
Changes to streamline program such as: <ul style="list-style-type: none"> • Delete ENGL2XX and ANTH201, 311 	<ul style="list-style-type: none"> • Explore modification to the program involving these courses 	Education Committee	Completed for 2018-19 calendar

Alignment with Faculty-Wide Questions

1. Are High Impact Practices being used regularly in this program?

The BSc Neuroscience Program was designed specifically to provide a High Impact Learning experience for our students. By its very nature, it creates a Learning community where all the students take the majority of their classes together, starting with the first NEUR course in first year, progressing to their field course between 1st and 2nd year, and culminating in all their senior courses in 3rd and 4th year being together as a group.

The program is an honours only course, so all students will work with a faculty member on a research project in their final year. Above and beyond this though, students are encouraged with financial support to work in neuroscience labs each summer of their degrees to broaden their research experience. We have created over 300 such summer research positions since the program began.

The BScNeuroscience program, in partnership with the Hotchkiss Brain Institute and The Rebecca Hotchkiss International Scholar Exchange, has created four study-abroad positions each year. Each summer we send two students who have completed their 3rd year to conduct a summer research project with a top scientist at the University of Oxford (ranked #1 in the world in 2017 by Times Higher Education). We also send 2 students to complete their final year at the Karolinska Institute (ranked #10 in the world in 2017 in the Times Higher Education's category for "Clinical, Pre-clinical & Health").

Given its small class size, cohort nature and commitment to experiential learning both in the classroom and in real research labs, the BSc Neuroscience program has become a model for inclusion of High Impact Practices at the University of Calgary