

# NEUROSCIENCE (NSCI)

## **NSCI 323 Foundational Neuroscience Units: 3.00**

Fundamental properties of the nervous system. Emphasis placed on the properties of neurons that are fundamental to neuron-to-neuron communication, the formation of neural circuits, and the repair of the nervous system following injury. Tutorials introduce techniques and neurological problems that illustrate principles of neural function.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office.

**Learning Hours:** 120 (24 Lecture, 24 Group Learning, 36 Online Activity, 24 Off-Campus Activity, 12 Private Study)

**Requirements:** Prerequisite BIOL 339/3.0 or KNPE 125/3.0 or KNPE 225/3.0 or (PHGY 215/3.0 and PHGY 216/3.0) or PSYC 271/3.0.

**Offering Faculty:** Faculty of Health Sciences

### **Course Learning Outcomes:**

1. Recognize and describe essential knowledge required to navigate the field of neuroscience and further apply this knowledge into advanced molecular, cellular, systems, and behavioral neuroscience.
2. Identify, describe, and critique the most current ruling principles in neuroscience related to: How neurons develop, grow, migrate, and connect to form neuronal circuits and a functional mature nervous system.
3. Identify, describe, and critique the most current ruling principles in neuroscience related to: How neurons and neuronal circuits acquire, transmit, store, and retrieve information.
4. Identify, describe, and critique the most current ruling principles in neuroscience related to: How dysfunctional neuronal function results in developmental and functional diseases of the nervous system.

## **NSCI 324 Systems Neuroscience Units: 3.00**

Fundamental properties of the nervous system. Emphasis placed on the properties of neurons and neural circuits that underlie behaviour and cognitive functions within selected neural systems, such as sensory, motor, reward, and autonomic systems. Tutorials introduce techniques and neurological problems that illustrate principles of neural function.

**Requirements:** Prerequisite (PHGY 215/3.0 and PHGY 216/3.0) or PSYC 271/3.0 or NSCI 323/3.0 or PHGY 210/6.0 or PHGY 212/6.0 or PHGY 214/6.0.

**Offering Faculty:** Faculty of Health Sciences

## **NSCI 325 The Science of Psychedelics Units: 3.00**

An active learning-based course aimed at providing a thorough scientific perspective on psychedelics. Students will learn about the historical and cultural relevance of psychedelics, their mechanisms of action, and their current and predicted therapeutic use. Emphasis will be placed on rigorously verified knowledge surrounding psychedelic therapy. Course format encourages students to acquire and/or perfect essential learning competencies such as critical thinking, independent learning, problem-solving, communication and teamwork.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office.

**Learning Hours:** 120 (24 Lecture, 24 Group Learning, 36 Online Activity, 24 Off-Campus Activity, 12 Private Study)

**Requirements:** Prerequisite Level 3 or above.

**Offering Faculty:** Faculty of Health Sciences

### **Course Learning Outcomes:**

1. Appraise the demonstrated and proposed psychedelics therapy.
2. Assess the ratio risk and benefits of psychedelic therapy.
3. Compare the pharmacodynamic and pharmacokinetic properties of various psychedelics.
4. Contrast and compare the mechanisms of action of psychedelics and psychedelic-like drugs.
5. Recognize and appraise the historical and cultural uses/significance of psychedelics.

## **NSCI 401 Introduction to Theoretical Neuroscience Units: 3.00**

This course will provide an introduction to the main modelling approaches and theoretical concepts in Neuroscience. The computational anatomy of the brain and how it implements perception, learning, memory, decision making and motor control, among other topics, will be discussed.

RECOMMENDATION NSCI 323/3.0, NSCI 324/3.0, ANAT 312/3.0, PSYC 271/3.0.

**Requirements:** Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (BIOL 243; CHEE 209; COMM 162; ECON 250; GPYH 247; HSCI 190; KNPE 251; NURS 323; POLS 285; PSYC 202; SOCY 211; STAM 200; STAT 263; STAT 267; STAT 367).

**Offering Faculty:** Faculty of Health Sciences

**NSCI 403 Introduction to Neuroimaging Units: 3.00**

This course covers the theory and practice of modern neuroimaging methods. Topics include data acquisition, research study design, and analysis methods. Functional MRI is presented in the most depth, but computed tomography (CT), positron emission tomography (PET), and single photon emission computed tomography (SPECT), are also covered.

**Learning Hours:** 120 (36 Lecture, 84 Private Study)

**Requirements:** Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 323; NSCI 324; ANAT 312; PSYC 271; PSYC 370).

**Offering Faculty:** Faculty of Health Sciences

**NSCI 414 Progress in Neuroanatomy and Neuropharmacology Units: 3.00**

A contemporary and comprehensive assessment of the neurochemical anatomy and neuropharmacology of the mammalian and human nervous systems as they relate to development, function and disease. Topics will include dynamics of neurotransmitter interactions, neuronal drug receptor interactions and second messengers, neurotoxicity associated transmitters and neural growth factors.

NOTE BMCO students should contact the Department regarding prerequisites.

**Requirements:** Prerequisite A minimum grade of B- in (ANAT 312/3.0 or NSCI 323/3.0 or PHAR 340/3.0 or PHAR 370/3.0) and a minimum cumulative GPA of 2.50 or higher. Corequisite NSCI 324/3.0.

**Offering Faculty:** Faculty of Health Sciences

**NSCI 422 Cellular and Molecular Neuroscience Units: 3.00**

A course providing 1) the essentials in cellular and molecular neuroscience to pursue a graduate program and/or a career in neuroscience or related field, and 2) independent learning and communication skills applicable broadly. The course is divided into three segments: 1) neuronal integration, 2) synaptic plasticity, and 3) neuromodulation.

NOTE BMCO students should contact the Department regarding prerequisites.

**Learning Hours:** 119 (12 Lecture, 24 Seminar, 8 Group Learning, 6 Individual Instruction, 69 Private Study)

**Requirements:** Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and a minimum grade of B in NSCI 323.

**Offering Faculty:** Faculty of Health Sciences

**Course Learning Outcomes:**

1. To develop student's critical thinking skills
2. To encourage student's independent learning and problem-solving skills
3. To perfect oral and written communication skills
4. To learn and discuss current knowledge on 1-neuronal integration, 2-synaptic plasticity, 3-neuromodulation.

**NSCI 424 Neurodegeneration and Brain Health Units: 3.00**

This course focuses on the molecular basis of neurodegeneration in Alzheimer's disease and related neurodegenerative diseases. The course further covers the molecular basis of the systemic communication with the brain and the ability of circulatory blood factors to foster brain resilience and health. The course is designed to cover current research developments on the field. The course intends to advance critical thinking and has a focus to improve student's oral skills. Assessments include three presentations.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office.

**Learning Hours:** 120 (36 Lecture, 60 Group Learning, 24 Private Study)

**Requirements:** Prerequisite Level 4 or above and registration in a LISC Major or Specialization, or BHSc Program, and a cumulative GPA of 2.50, and (ANAT 312/3.0 or NSCI 323/3.0 or NSCI 324/3.0).

**Offering Faculty:** Faculty of Health Sciences

**Course Learning Outcomes:**

1. Understand and integrate the basic principles of neurodegeneration processes in Alzheimer's disease and related neurodegenerative diseases in order to communicate how they develop in the brain at a molecular, cellular, and behavioural level.
2. Understand and integrate, at the molecular level, neuroprotective processes stimulated by the systemic communication with the brain and how this communication may counteract neurodegeneration.
3. Critically analyze, and/or interpret scientific data in primary research reports and reviews in order to contextualize and communicate current knowledge in the field of neurodegeneration and brain health.
4. Learn to prepare effective slide deck presentations to use in the communication of the scientific basis of neurodegeneration and brain health.
5. Provide peer assessment, as well as thoughtful, logical questions and comments to the projects presented by peers.

**NSCI 429 Disorders of the Nervous System Units: 3.00**

A multi-disciplinary course exploring advanced concepts of clinical neuroscience. Topics include stroke, traumatic brain and cord injuries, neurodegenerative disorders, epilepsy, schizophrenia, depression, deep brain stimulation, pain and placebo effects, normal and abnormal aging, stem cells. Students will learn to critically evaluate scientific literature and present these concepts to classmates during student-led seminars. Restricted to fourth-year students. Enrollment is limited.

**Requirements:** Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 322; NSCI 323; NSCI 324; ANAT 312).

**Offering Faculty:** Faculty of Health Sciences

**NSCI 433 Cellular Elements of the Nervous System: Responses to Injury and Disease Units: 3.00**

Cellular dysfunction is a critical feature of neural injury and disease among humans. This course will examine the cellular elements of the mammalian central and peripheral nervous system, with an emphasis placed on understanding normal and abnormal cellular function in both humans and animal models.

NOTE Restricted to students registered in the 4th year.

**Learning Hours:** 114 (36 Lecture, 36 Laboratory, 42 Private Study)

**Requirements:** Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 323; NSCI 324), and one of (ANAT 309; ANAT 312).

**Offering Faculty:** Faculty of Health Sciences

**Course Learning Outcomes:**

1. Gain a greater understanding of the cellular organization of the mammalian nervous system.
2. Understand the cellular contributions to normal functioning both centrally and peripherally.
3. Understand how cells respond to injury or disease of the nervous system.

**NSCI 444 Controversies in Neuroscience Units: 3.00**

As insight regarding the human brain expands, so do related issues such as what constitutes personhood, what drives the criminal mind, intelligence-enhancing drugs and end-of-life issues. Lead by experts who deal daily with such concerns, we will focus weekly on a particular topic in neuroscience which impacts on society.

**Learning Hours:** 108 (12 Lecture, 24 Seminar, 72 Private Study)

**Requirements:** Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 322; NSCI 323; NSCI 324; ANAT 312).

**Offering Faculty:** Faculty of Health Sciences

**NSCI 483 Neurobiology of Learning and Memory Units: 3.00**

An exploration of brain systems underlying how we learn and remember, and how they become disordered. Online multimedia modules and study of cutting edge research articles reveal how modern techniques and ideas are driving neuroscience forward. Requires interviewing a person with a disorder in order to learn to advocate for them in society.

**Requirements:** Minimum 4th year (Level 4) standing and one of [(PHGY 215/3.0 and PHGY 216/3.0); PSYC 271/3.0; PHGY 214/6.0; PHGY 210/6.0]. For LISC and BCHM Honours students Level 4 and registration in a LISC or BCHM Major or Specialization Plan and a GPA of 2.5

**Offering Faculty:** Faculty of Health Sciences

**Course Learning Outcomes:**

1. Collaborate with others in order to effectively collect, analyze, and interpret scientific data.
2. Communicate an integrated understanding of the scientific basis and societal impact of neurological disorders of learning and memory to colleagues in order to advocate for vulnerable populations.
3. Critically evaluate primary research reports and reviews in order to contextualize and communicate current knowledge in the field of learning and memory.
4. Demonstrate skill in providing and responding to feedback in a professional manner.
5. Describe the basic principles of learning and memory processes in order to communicate how they are generated by the brain at a cellular, systems, and behavioural level.

**NSCI 491 Directed Special Laboratory Units: 3.00**

Laboratory course in a selected area of Neuroscience to be arranged in consultation with individual members of the Centre for Neuroscience Studies. Course involves experimental design, data collection and analysis (approximately 6 hours of laboratory work per week required) as well as a brief communication of the laboratory work. NOTE Students are limited to one NSCI 491/3.0 research project in Year 4.

NOTE Students whose research project requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

**Requirements:** Prerequisite Availability of a supervisor and permission of the course coordinator; level 4 in the LISC Specialization Plan, NSCI Sub-Plan.

**Offering Faculty:** Faculty of Health Sciences

**NSCI 499 Research Project in Neuroscience Units: 12.00**

An investigation into a selected area of neuroscience. The research project involves experimental design, data collection, and analysis, written report and oral presentation. Students will be required to attend seminars and tutorials on topics related to research. Limited enrolment.

NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

**Learning Hours:** 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

**Requirements:** Prerequisite Level 4 and registration in a LISC Specialization and a cumulative GPA of 2.50 or higher. Exclusion Maximum 12.0 units from: ANAT 499/12.0; ANAT 599/6.0; BCHM 421/6.0; BCHM 422/6.0; BCHM 594/3.0; BCHM 595/6.0; BCHM 596/12.0; CANC 499/12.0; DISC 591/3.0; DISC 592/3.0; DISC 593/3.0; DISC 594/3.0; DISC 598/6.0; DISC 599/6.0; EPID 499/12.0; EPID 595/6.0; HSCI 591/3.0; HSCI 592/3.0; HSCI 593/3.0; HSCI 594/3.0; HSCI 595/3.0; HSCI 598/6.0; HSCI 599/6.0; LISC 499/12.0\*; LISC 594/3.0; LISC 595/6.0; LISC 596/12.0; LISC 598/9.0; MICR 499/12.0; NSCI 499/12.0; PATH 499/12.0; PATH 595/6.0; PHAR 499/12.0; PHGY 499/12.0; REPD 499/12.0.

**Offering Faculty:** Faculty of Health Sciences