

# Neuroscience

This section presents the requirements for programs in:

- Neuroscience and Mental Health B.Sc. Honours
- Neuroscience and Mental Health B.Sc. Major
- Neuroscience and Mental Health B.Sc.
- Neuroscience B.Sc. Combined Honours
- Minor in Neuroscience and Mental Health

## Program Requirements

### Course Categories for B.Sc. Programs

The program descriptions for B.Sc. Combined Honours Neuroscience make use of the course categories defined for all B.Sc. programs (see Academic Regulations for the Bachelor of Science Degree):

- Science Faculty Electives
- Science Continuation Courses
- Free Electives

## Neuroscience and Mental Health B.Sc. Honours (20.0 credits)

### A. Credits Included in the Major (10.5 credits)

<b>1. 5.5 credits in:</b>	<b>5.5</b>
NEUR 1202 [0.5] Neuroscience of Mental Health and Psychiatric Disease	
NEUR 1203 [0.5] Neuroscience of Mental Health and Neurological Disease	
NEUR 2001 [0.5] Introduction to Research Methods in Neuroscience	
NEUR 2002 [0.5] Introduction to Statistics in Neuroscience	
NEUR 2201 [0.5] Cellular and Molecular Neuroscience	
NEUR 2202 [0.5] Neurodevelopment and Plasticity	
NEUR 3001 [0.5] Data Analysis in Neuroscience I	
NEUR 3002 [0.5] Data Analysis in Neuroscience II	
NEUR 3204 [0.5] Neuropharmacology	
NEUR 3206 [0.5] Sensory and Motor Neuroscience	
NEUR 3207 [0.5] Systems Neuroscience	
<b>2. 1.0 credit in:</b>	<b>1.0</b>
BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
<b>3. 1.5 credit from:</b>	<b>1.5</b>
NEUR 3301 [0.5] Genetics of Mental Health	
NEUR 3303 [0.5] The Neuroscience of Consciousness	
NEUR 3304 [0.5] Hormones and Behaviour	
NEUR 3401 [0.5] Environmental Toxins and Mental Health	
NEUR 3402 [0.5] Impact of Lifestyle and Social Interactions on Mental Health	
NEUR 3403 [0.5] Stress and Mental Health	
NEUR 3501 [0.5] Neurodegeneration and Aging	
NEUR 3502 [0.5] Neurodevelopmental Determinants of Mental Health	
<b>4. 0.5 credit from:</b>	<b>0.5</b>

NEUR 4301 [0.5] Neurobiology of Energy Homeostasis	
NEUR 4302 [0.5] Sex and the Brain	
NEUR 4303 [0.5] Indigenous Health & Mental Health	
NEUR 4305 [0.5] Immune-Brain Interactions	
NEUR 4306 [0.5] The Neural Basis of Addiction	
NEUR 4600 [0.5] Advanced Lab in Neuroanatomy	
<b>5. 0.5 credit from:</b>	<b>0.5</b>
NEUR 4200 [0.5] Seminar on Current Advances in Neuroscience	
NEUR 4202 [0.5] Seminar on Current Research in Neuroscience and Psychiatric Disease	
NEUR 4203 [0.5] Seminar on Current Research in Neuroscience and Clinical Neurology	
<b>6. 1.0 credit from:</b>	<b>1.0</b>
NEUR 4905 [1.0] Honours Workshop	
NEUR 4907 [1.0] Honours Essay and Research Proposal	
NEUR 4908 [1.0] Honours Research Thesis	
<b>8. 0.5 credit in Advanced Science Faculty Electives</b>	<b>0.5</b>
<b>B. Credits Not Included in the Major CGPA (9.5 credits)</b>	
<b>8. 2.0 credits in:</b>	<b>2.0</b>
CHEM 1001 [0.5] General Chemistry I	
CHEM 1002 [0.5] General Chemistry II	
PHYS 1007 [0.5] Elementary University Physics I	
PHYS 1008 [0.5] Elementary University Physics II	
<b>9. 0.5 credit from:</b>	<b>0.5</b>
MATH 1007 [0.5] Elementary Calculus I	
MATH 1107 [0.5] Linear Algebra I	
<b>10. 1.0 credit in:</b>	<b>1.0</b>
BIOL 2201 [0.5] Cell Biology and Biochemistry or BIOL 2200 [0.5] Cellular Biochemistry	
BIOL 2107 [0.5] Fundamentals of Genetics	
<b>11. 1.0 credit in Science Continuation Courses</b>	<b>1.0</b>
<b>12. 2.0 credits in approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)</b>	<b>2.0</b>
<b>13. 3.0 credits in free electives.</b>	<b>3.0</b>
<b>Total Credits</b>	<b>20.0</b>

## Neuroscience and Mental Health B.Sc. Major (20.0 credits)

### A. Credits Included in the Major CGPA (10.5 credits)

<b>1. 5.5 credits in:</b>	<b>5.5</b>
NEUR 1202 [0.5] Neuroscience of Mental Health and Psychiatric Disease	
NEUR 1203 [0.5] Neuroscience of Mental Health and Neurological Disease	
NEUR 2001 [0.5] Introduction to Research Methods in Neuroscience	
NEUR 2002 [0.5] Introduction to Statistics in Neuroscience	
NEUR 2201 [0.5] Cellular and Molecular Neuroscience	
NEUR 2202 [0.5] Neurodevelopment and Plasticity	
NEUR 3001 [0.5] Data Analysis in Neuroscience I	
NEUR 3002 [0.5] Data Analysis in Neuroscience II	

NEUR 3204 [0.5]	Neuropharmacology	
NEUR 3206 [0.5]	Sensory and Motor Neuroscience	
NEUR 3207 [0.5]	Systems Neuroscience	
<b>2. 1.0 credit in:</b>		<b>1.0</b>
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
<b>3. 1.5 credit from:</b>		<b>1.5</b>
NEUR 3301 [0.5]	Genetics of Mental Health	
NEUR 3303 [0.5]	The Neuroscience of Consciousness	
NEUR 3304 [0.5]	Hormones and Behaviour	
NEUR 3401 [0.5]	Environmental Toxins and Mental Health	
NEUR 3402 [0.5]	Impact of Lifestyle and Social Interactions on Mental Health	
NEUR 3403 [0.5]	Stress and Mental Health	
NEUR 3501 [0.5]	Neurodegeneration and Aging	
NEUR 3502 [0.5]	Neurodevelopmental Determinants of Mental Health	
<b>4. 1.0 credit from:</b>		<b>1.0</b>
NEUR 4301 [0.5]	Neurobiology of Energy Homeostasis	
NEUR 4302 [0.5]	Sex and the Brain	
NEUR 4303 [0.5]	Indigenous Health & Mental Health	
NEUR 4305 [0.5]	Immune-Brain Interactions	
NEUR 4306 [0.5]	The Neural Basis of Addiction	
NEUR 4600 [0.5]	Advanced Lab in Neuroanatomy	
<b>5. 1.0 credit from:</b>		<b>1.0</b>
NEUR 4200 [0.5]	Seminar on Current Advances in Neuroscience	
NEUR 4202 [0.5]	Seminar on Current Research in Neuroscience and Psychiatric Disease	
NEUR 4203 [0.5]	Seminar on Current Research in Neuroscience and Clinical Neurology	
<b>6. 0.5 credit in Advanced Science Faculty Electives</b>		<b>0.5</b>
<b>B. Credits Not Included in the Major CGPA (9.5 credits)</b>		
<b>7. 2.0 credits in:</b>		<b>2.0</b>
CHEM 1001 [0.5]	General Chemistry I	
CHEM 1002 [0.5]	General Chemistry II	
PHYS 1007 [0.5]	Elementary University Physics I	
PHYS 1008 [0.5]	Elementary University Physics II	
<b>8. 0.5 credit from:</b>		<b>0.5</b>
MATH 1007 [0.5]	Elementary Calculus I	
MATH 1107 [0.5]	Linear Algebra I	
<b>9. 1.0 credit in:</b>		<b>1.0</b>
BIOL 2201 [0.5]	Cell Biology and Biochemistry or BIOL 2200 [0.5] Cellular Biochemistry	
BIOL 2107 [0.5]	Fundamentals of Genetics	
<b>10. 1.0 credit in Science Continuation courses (not in NEUR)</b>		<b>1.0</b>
<b>11. 2.0 credits in approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)</b>		<b>2.0</b>
<b>12. 3.0 credits in free electives</b>		<b>3.0</b>
<b>Total Credits</b>		<b>20.0</b>

## Neuroscience and Mental Health B.Sc. (15.0 credits)

### A. Credits Included in the Major CGPA (7.0 credits)

<b>1. 4.5 credits in:</b>		<b>4.5</b>
NEUR 1202 [0.5]	Neuroscience of Mental Health and Psychiatric Disease	
NEUR 1203 [0.5]	Neuroscience of Mental Health and Neurological Disease	
NEUR 2001 [0.5]	Introduction to Research Methods in Neuroscience	
NEUR 2002 [0.5]	Introduction to Statistics in Neuroscience	
NEUR 2201 [0.5]	Cellular and Molecular Neuroscience	
NEUR 2202 [0.5]	Neurodevelopment and Plasticity	
NEUR 3204 [0.5]	Neuropharmacology	
NEUR 3206 [0.5]	Sensory and Motor Neuroscience	
NEUR 3207 [0.5]	Systems Neuroscience	
<b>2. 1.0 credit in:</b>		<b>1.0</b>
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
<b>3. 1.5 credit from:</b>		<b>1.5</b>
NEUR 3301 [0.5]	Genetics of Mental Health	
NEUR 3303 [0.5]	The Neuroscience of Consciousness	
NEUR 3304 [0.5]	Hormones and Behaviour	
NEUR 3401 [0.5]	Environmental Toxins and Mental Health	
NEUR 3402 [0.5]	Impact of Lifestyle and Social Interactions on Mental Health	
NEUR 3403 [0.5]	Stress and Mental Health	
NEUR 3501 [0.5]	Neurodegeneration and Aging	
NEUR 3502 [0.5]	Neurodevelopmental Determinants of Mental Health	
<b>B. Credits Not Included in the Major CGPA (8.0 credits)</b>		
<b>4. 2.0 credits in:</b>		<b>2.0</b>
CHEM 1001 [0.5]	General Chemistry I	
CHEM 1002 [0.5]	General Chemistry II	
PHYS 1007 [0.5]	Elementary University Physics I	
PHYS 1008 [0.5]	Elementary University Physics II	
<b>5. 0.5 credit from:</b>		<b>0.5</b>
MATH 1007 [0.5]	Elementary Calculus I	
MATH 1107 [0.5]	Linear Algebra I	
<b>6. 1.0 credit in:</b>		<b>1.0</b>
BIOL 2201 [0.5]	Cell Biology and Biochemistry	
BIOL 2107 [0.5]	Fundamentals of Genetics	
<b>7. 1.0 credit in Science Continuation courses (not in NEUR)</b>		<b>1.0</b>
<b>8. 2.0 credits in approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)</b>		<b>2.0</b>
<b>9. 1.5 credit in free electives</b>		<b>1.5</b>
<b>Total Credits</b>		<b>15.0</b>

## Neuroscience B.Sc. Combined Honours (20.0 credits)

### A. Credits Included in the Major CGPA (14.5 credits)

<b>1. 5.5 credits in:</b>		<b>5.5</b>
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NEUR 1202 [0.5]	Neuroscience of Mental Health and Psychiatric Disease	
NEUR 1203 [0.5]	Neuroscience of Mental Health and Neurological Disease	
NEUR 2001 [0.5]	Introduction to Research Methods in Neuroscience	
NEUR 2002 [0.5]	Introduction to Statistics in Neuroscience	
NEUR 2201 [0.5]	Cellular and Molecular Neuroscience	
NEUR 2202 [0.5]	Neurodevelopment and Plasticity	
NEUR 3001 [0.5]	Data Analysis in Neuroscience I	
NEUR 3002 [0.5]	Data Analysis in Neuroscience II	
NEUR 3204 [0.5]	Neuropharmacology	
NEUR 3206 [0.5]	Sensory and Motor Neuroscience	
NEUR 3207 [0.5]	Systems Neuroscience	
<b>2. 3.0 credits in:</b>		<b>3.0</b>
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2104 [0.5]	Introductory Genetics	
BIOL 2200 [0.5]	Cellular Biochemistry	
BIOL 3305 [0.5]	Human and Comparative Physiology	
<b>3. 1.5 credits in BIOL or BIOC at the 3000 level or above</b>		<b>1.5</b>
<b>4. 1.0 credit from:</b>		<b>1.0</b>
NEUR 3301 [0.5]	Genetics of Mental Health	
NEUR 3303 [0.5]	The Neuroscience of Consciousness	
NEUR 3304 [0.5]	Hormones and Behaviour	
NEUR 3401 [0.5]	Environmental Toxins and Mental Health	
NEUR 3402 [0.5]	Impact of Lifestyle and Social Interactions on Mental Health	
NEUR 3403 [0.5]	Stress and Mental Health	
NEUR 3501 [0.5]	Neurodegeneration and Aging	
NEUR 3502 [0.5]	Neurodevelopmental Determinants of Mental Health	
NEUR 4301 [0.5]	Neurobiology of Energy Homeostasis	
NEUR 4302 [0.5]	Sex and the Brain	
NEUR 4303 [0.5]	Indigenous Health & Mental Health	
NEUR 4305 [0.5]	Immune-Brain Interactions	
NEUR 4306 [0.5]	The Neural Basis of Addiction	
NEUR 4600 [0.5]	Advanced Lab in Neuroanatomy	
<b>5. 2.0 credits from:</b>		<b>2.0</b>
BIOC 4007 [0.5]	Membrane Biochemistry	
BIOL 2600 [0.5]	Ecology	
BIOL 2301 [0.5]	Biotechnology I	
BIOL 2303 [0.5]	Microbiology	
BIOL 3307 [0.5]	Advanced Human Anatomy and Physiology	
BIOL 3605 [0.5]	Field Course I	
BIOL 3609 [0.5]	Evolutionary Concepts	
BIOL 3802 [0.5]	Animal Behaviour	
BIOL 3804 [0.5]	Social Evolution	
BIOL 4306 [0.5]	Animal Neurophysiology	
BIOL 4317 [0.5]	Neuroethology: The Neural Basis of Animal Behaviour	
BIOL 4802 [0.5]	Advanced Animal Behaviour	
CHEM 2204 [0.5]	Organic Chemistry II	
<b>6. 0.5 credit from:</b>		<b>0.5</b>
NEUR 4200 [0.5]	Seminar on Current Advances in Neuroscience	
NEUR 4202 [0.5]	Seminar on Current Research in Neuroscience and Psychiatric Disease	
NEUR 4203 [0.5]	Seminar on Current Research in Neuroscience and Clinical Neurology	
<b>7. 1.0 credit in neurophysiology, animal behaviour, neuropsychology or a related topic from:</b>		<b>1.0</b>
NEUR 4905 [1.0]	Honours Workshop	
NEUR 4907 [1.0]	Honours Essay and Research Proposal	
NEUR 4908 [1.0]	Honours Research Thesis	
BIOL 4905 [1.0]	Honours Workshop	
BIOL 4907 [1.0]	Honours Essay and Research Proposal	
BIOL 4908 [1.0]	Honours Research Thesis	
<b>B. Credits not included in the Major CGPA (5.5 credits)</b>		
<b>8. 1.0 credit in:</b>		<b>1.0</b>
MATH 1007 [0.5]	Elementary Calculus I	
MATH 1107 [0.5]	Linear Algebra I	
<b>9. 1.5 credits in:</b>		<b>1.5</b>
CHEM 1001 [0.5]	General Chemistry I	
& CHEM 1002 [0.5]	General Chemistry II	
CHEM 2203 [0.5]	Organic Chemistry I	
<b>10. 1.0 credit in:</b>		<b>1.0</b>
PHYS 1007 [0.5]	Elementary University Physics I	
& PHYS 1008 [0.5]	Elementary University Physics II	
<b>11. 2.0 credits in approved courses outside of the faculties of Science and Engineering and Design (may include NSCI 1000)</b>		<b>2.0</b>
<b>Total Credits</b>		<b>20.0</b>
<b>Minor in Neuroscience and Mental Health (4.0 credits)</b>		
The Minor in Neuroscience is available to students registered in degree programs other than those offered by the Department of Neuroscience.		
<b>Requirements:</b>		
<b>1. 2.0 credits in:</b>		<b>2.0</b>
NEUR 1202 [0.5]	Neuroscience of Mental Health and Psychiatric Disease	
NEUR 1203 [0.5]	Neuroscience of Mental Health and Neurological Disease	
NEUR 2201 [0.5]	Cellular and Molecular Neuroscience	
NEUR 2202 [0.5]	Neurodevelopment and Plasticity	
<b>2. 2.0 credits from:</b>		<b>2.0</b>
NEUR 3204 [0.5]	Neuropharmacology	
NEUR 3301 [0.5]	Genetics of Mental Health	
NEUR 3303 [0.5]	The Neuroscience of Consciousness	
NEUR 3304 [0.5]	Hormones and Behaviour	
NEUR 3401 [0.5]	Environmental Toxins and Mental Health	

NEUR 3402 [0.5]	Impact of Lifestyle and Social Interactions on Mental Health
NEUR 3403 [0.5]	Stress and Mental Health
NEUR 3501 [0.5]	Neurodegeneration and Aging
NEUR 3502 [0.5]	Neurodevelopmental Determinants of Mental Health
NEUR 4301 [0.5]	Neurobiology of Energy Homeostasis
NEUR 4302 [0.5]	Sex and the Brain
NEUR 4303 [0.5]	Indigenous Health & Mental Health
NEUR 4306 [0.5]	The Neural Basis of Addiction
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Total Credits	4.0

Students enrolled in the Neuroscience and Mental Health programs should consult with the Department of Neuroscience when planning their program or selecting courses. Those enrolled in the Neuroscience Combined Honours program should consult with either the Department of Biology or the Department of Neuroscience.

### B.Sc. Regulations

The regulations presented in this section apply to all Bachelor of Science programs. In addition to the requirements presented here, students must satisfy the University regulations common to all undergraduate students including the process of Academic Performance Evaluation (see the *Academic Regulations of the University* section of this Calendar).

#### Breadth Requirement for the B.Sc.

Students in Bachelor of Science Honours, Major, or General programs must present the following credits at graduation:

- 2.0 credits in Science Continuation courses not in the major discipline; **students completing a double major are considered to have completed this requirement providing they have 2.0 credits in science continuation courses in each of the two majors**
- 2.0 credits in courses outside of the faculties of Science and Engineering and Design (but may include NSCI 1000)

In most cases, the requirements for individual B.Sc. programs, as stated in this Calendar, contain these requirements, explicitly or implicitly.

Students admitted to B.Sc. programs by transfer from another institution must present at graduation (whether taken at Carleton or elsewhere):

- 2.0 credits in courses outside of the faculties of Science and Engineering and Design (but may include NSCI 1000) if, on transfer, the student received credit for fewer than 10.0 credits.
- 1.0 credit in courses outside of the faculties of Science and Engineering and Design (but may include NSCI 1000) if, on transfer, the student received credit for 10.0 or more credits.

#### Declared and Undeclared Students

Students who are registered in a program within the degree are called Declared students. Most students

designate a program of study when they first apply for admission and so begin their studies as Declared students. Students may also choose to begin their studies within the B.Sc. degree without being registered in a program. These students are referred to as Undeclared students. The recommended course pattern for Undeclared students is provided in the Undeclared entry of the Programs section of this Calendar. Undeclared students normally must apply to enter a program before beginning their second year of study. The Science Student Success Centre (SSSC) provides Undeclared students guidance to the appropriate support services in making this decision.

#### Change of Program within the B.Sc. Degree

Students may transfer to a program within the B.Sc. degree if upon entry to the new program they would be in good academic standing.

Other applications for change of program will be considered on their merits; students may be accepted in the new program in *Good Standing* or on *Academic Warning*.

Applications to declare or change their program within the B.Sc. Degree must be made online through Carleton Central by completing a Change of Program Elements (COPE) application form within the published deadlines. Acceptance into a program or into a program element or option is subject to any enrolment, and/or specific program, program element or option requirements as published in the relevant Calendar entry.

#### Minors, Concentrations and Specializations

Students may add a minor, concentration or specialization by completing a Change of Program Elements (COPE) application form online through Carleton Central. Acceptance into a minor, concentration or specialization requires that the student be in *Good Standing* and is subject to any specific requirements of the intended Minor, Concentration or Specialization as published in the relevant Calendar entry.

#### Experimental Science Requirement

Students in B.Sc. Honours, Major, or General degree programs must present at graduation at least two full credits of experimental science chosen from two different departments or institutes from the list below:

##### Approved Experimental Science Courses

Biochemistry	
BIOC 2200 [0.5]	Cellular Biochemistry
BIOC 4001 [0.5]	Methods in Biochemistry
BIOC 4201 [0.5]	Advanced Cell Culture and Tissue Engineering
Biology	
BIOL 1103 [0.5]	Foundations of Biology I
BIOL 1104 [0.5]	Foundations of Biology II
BIOL 2001 [0.5]	Animals: Form and Function
BIOL 2002 [0.5]	Plants: Form and Function
BIOL 2104 [0.5]	Introductory Genetics
BIOL 2200 [0.5]	Cellular Biochemistry
BIOL 2600 [0.5]	Ecology

**Chemistry**

CHEM 1001 [0.5]	General Chemistry I
CHEM 1002 [0.5]	General Chemistry II
CHEM 1005 [0.5]	Elementary Chemistry I
CHEM 1006 [0.5]	Elementary Chemistry II
CHEM 2103 [0.5]	Physical Chemistry I
CHEM 2203 [0.5]	Organic Chemistry I
CHEM 2204 [0.5]	Organic Chemistry II
CHEM 2302 [0.5]	Analytical Chemistry I
CHEM 2303 [0.5]	Analytical Chemistry II
CHEM 2800 [0.5]	Foundations for Environmental Chemistry

**Earth Sciences**

ERTH 1006 [0.5]	Exploring Planet Earth
ERTH 1009 [0.5]	The Earth System Through Time
ERTH 2102 [0.5]	Mineralogy to Petrology
ERTH 2404 [0.5]	Engineering Geoscience
ERTH 2802 [0.5]	Field Geology I
ERTH 3111 [0.5]	Vertebrate Evolution: Mammals, Reptiles, and Birds
ERTH 3112 [0.5]	Vertebrate Evolution: Fish and Amphibians
ERTH 3204 [0.5]	Mineral Deposits
ERTH 3205 [0.5]	Physical Hydrogeology
ERTH 3806 [0.5]	Structural Geology

**Food Sciences**

FOOD 3001 [0.5]	Food Chemistry
FOOD 3002 [0.5]	Food Analysis
FOOD 3005 [0.5]	Food Microbiology

**Geography**

GEOG 1010 [0.5]	Global Environmental Systems
GEOG 3108 [0.5]	Soil Properties

**Neuroscience**

NEUR 3206 [0.5]	Sensory and Motor Neuroscience
NEUR 3207 [0.5]	Systems Neuroscience
NEUR 4600 [0.5]	Advanced Lab in Neuroanatomy

**Physics**

PHYS 1001 [0.5]	Foundations of Physics I
PHYS 1002 [0.5]	Foundations of Physics II
PHYS 1003 [0.5]	Introductory Mechanics and Thermodynamics
PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion
PHYS 1007 [0.5]	Elementary University Physics I
PHYS 1008 [0.5]	Elementary University Physics II
PHYS 2202 [0.5]	Wave Motion and Optics
PHYS 2604 [0.5]	Modern Physics I
PHYS 3007 [0.5]	Third Year Physics Laboratory: Selected Experiments and Seminars
PHYS 3606 [0.5]	Modern Physics II
PHYS 3608 [0.5]	Modern Applied Physics

**Course Categories for B.Sc. Programs****Science Geography Courses**

GEOG 1010 [0.5]	Global Environmental Systems
GEOG 2006 [0.5]	Introduction to Quantitative Research

GEOG 2013 [0.5]	Weather and Water
GEOG 2014 [0.5]	The Earth's Surface
GEOG 3003 [0.5]	Quantitative Geography
GEOG 3010 [0.5]	Field Methods in Physical Geography
GEOG 3102 [0.5]	Geomorphology
GEOG 3103 [0.5]	Watershed Hydrology
GEOG 3104 [0.5]	Principles of Biogeography
GEOG 3105 [0.5]	Climate and Atmospheric Change
GEOG 3106 [0.5]	Aquatic Science and Management
GEOG 3108 [0.5]	Soil Properties
GEOG 4000 [0.5]	Field Studies
GEOG 4005 [0.5]	Directed Studies in Geography
GEOG 4013 [0.5]	Cold Region Hydrology
GEOG 4017 [0.5]	Global Biogeochemical Cycles
GEOG 4101 [0.5]	Two Million Years of Environmental Change
GEOG 4103 [0.5]	Water Resources Engineering
GEOG 4104 [0.5]	Microclimatology
GEOG 4108 [0.5]	Permafrost

**Science Psychology Courses**

PSYC 2001 [0.5]	Introduction to Research Methods in Psychology
PSYC 2002 [0.5]	Introduction to Statistics in Psychology
PSYC 2700 [0.5]	Introduction to Cognitive Psychology
PSYC 3000 [1.0]	Design and Analysis in Psychological Research
PSYC 3506 [0.5]	Cognitive Development
PSYC 3700 [1.0]	Cognition (Honours Seminar)
PSYC 3702 [0.5]	Perception
PSYC 2307 [0.5]	Human Neuropsychology I
PSYC 3307 [0.5]	Human Neuropsychology II

**Science Continuation Courses**

A course at the 2000 level or above may be used as a Science Continuation credit in a B.Sc. program if it is not in the student's major discipline, and is chosen from the following:

BIOC (Biochemistry)

BIOL (Biology)

CHEM (Chemistry)

COMP (Computer Science) A maximum of two half-credits at the 1000-level in COMP, excluding COMP 1001 may be used as Science Continuation credits.

ERTH (Earth Sciences), except EARTH 2415 which may be used only as a free elective for any B.Sc. program. Students in Earth Sciences programs may use EARTH 2401, EARTH 2402, and EARTH 2403 only as free electives.

Engineering. Students wishing to register in Engineering courses must obtain the permission of the Faculty of Engineering and Design.

ENSC (Environmental Science)

FOOD (Food Science and Nutrition)

GEOM (Geomatics)

HLTH (Health Sciences)

MATH (Mathematics)

NEUR (Neuroscience)

PHYS (Physics), except PHYS 2903

Science Geography Courses (see list above)

Science Psychology Courses (see list above)

STAT (Statistics)

TSES (Technology, Society, Environment) except TSES 2305. Biology General, Major, and Honours students may use these courses only as free electives. Integrated Science and Environmental Science students may include these courses in their programs but may not count them as part of the Science Sequence.

### Science Faculty Electives

Science Faculty Electives are courses at the 1000-4000 level chosen from:

BIOC (Biochemistry)

BIOL (Biology) Biology & Biochemistry students may use BIOL 1010 and BIOL 2005 only as free electives

CHEM (Chemistry) except CHEM 1003, CHEM 1004 and CHEM 1007

COMP (Computer Science) except COMP 1001

ERTH (Earth Sciences) except ERTH 1010, ERTH 1011 and ERTH 2415. Earth Sciences students may use ERTH 2401, ERTH 2402, and ERTH 2403 only as free electives.

Engineering

ENSC 2001

FOOD (Food Science and Nutrition)

GEOM (Geomatics)

HLTH (Health Science)

MATH (Mathematics)

NEUR (Neuroscience)

PHYS (Physics) except PHYS 1901, PHYS 1902, PHYS 1905, PHYS 2903

Science Geography (see list above)

Science Psychology (see list above)

STAT (Statistics)

TSES (Technology, Society, Environment) Biology General, Major and Honours students may use these courses only as free electives.

### Advanced Science Faculty Electives

Advanced Science Faculty Electives are courses at the 2000-4000 level chosen from the Science Faculty Electives list above.

### Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)

All courses offered by the Faculty of Arts and Social Sciences, the Faculty of Public Affairs, and the Sprott School of Business are approved as Arts or Social Sciences courses EXCEPT FOR: All Science Geography courses (see list above), all Geomatics (GEOM) courses, all Science Psychology courses (see list above). NSCI 1000 may be used as an Approved Course Outside the Faculties of Science and Engineering and Design.

### Free Electives

Any course is allowable as a Free Elective providing it is not prohibited (see below). Students are expected to comply with prerequisite requirements and enrolment restrictions for all courses as published in this Calendar.

### Courses Allowable Only as Free Electives in any B.Sc. Program

CHEM 1003 [0.5] The Chemistry of Food, Health and Drugs

CHEM 1004 [0.5] Drugs and the Human Body

CHEM 1007 [0.5] Chemistry of Art and Artifacts

ERTH 1010 [0.5] Our Dynamic Planet Earth

ERTH 1011 [0.5] Evolution of the Earth

ERTH 2415 [0.5] Natural Disasters

ISCI 1001 [0.5] Introduction to the Environment

ISCI 2000 [0.5] Natural Laws

ISCI 2002 [0.5] Human Impacts on the Environment

MATH 0107 [0.5] Algebra and Geometry

PHYS 1901 [0.5] Planetary Astronomy

PHYS 1902 [0.5] From our Star to the Cosmos

PHYS 1905 [0.5] Physics Behind Everyday Life

PHYS 2903 [0.5] Physics Towards the Future

### Prohibited Courses

The following courses are not acceptable for credit in any B.Sc. program:

COMP 1001 [0.5] Introduction to Computational Thinking for Arts and Social Science Students

MATH 0005 [0.5] Precalculus: Functions and Graphs

MATH 0006 [0.5] Precalculus: Trigonometric Functions and Complex Numbers

MATH 1009 [0.5] Calculus: with Applications to Business

MATH 1119 [0.5] Linear Algebra: with Applications to Business

MATH 1401 [0.5] Elementary Mathematics for Economics I

MATH 1402 [0.5] Elementary Mathematics for Economics II

### Co-operative Education

For more information about how to apply for the Co-op program and how the Co-op program works please visit the Co-op website.

All students participating in the Co-op program are governed by the Undergraduate Co-operative Education Policy.

### Undergraduate Co-operative Education Policy

#### Admission Requirements

Students can apply to co-op in one of two ways; directly from high school or after beginning a degree program at Carleton.

If a student is admitted to co-op from high school, their grades will be reviewed two terms to one year prior to their first work term to ensure they continue to meet the academic requirements after their 1st or 2nd year of study. The time at which evaluation takes place depends on the program of study. Students will automatically be notified via their Carleton email account if they are permitted to continue.

Students not admitted to Carleton University with the co-op option on their degree can apply for admission via

the co-operative education program website. To view application deadlines, visit [carleton.ca/co-op](http://carleton.ca/co-op).

Admission to the co-op option is based on the completion of 5.0 or more credits at Carleton University, the CGPA requirement for the students' academic program as well as any course prerequisites. The articulated CGPA for each program is the normal standard for assessment. Please see the specific degree program sections for the unique admission and continuation requirements for each academic program.

### **English Language Proficiency**

Students admitted to Carleton based on CAEL, IELTS or TOEFL assessments and who are required to take an ESL course must take and pass the Oral Proficiency in Communicative Settings (OPECS) Test. The test must be taken before being permitted to register in COOP 1000. Admission to the co-op program can be confirmed with a minimum score of 4+.

### **Participation Requirements**

#### **COOP 1000**

Once a student has been given admission or continuation confirmation to the co-op option s/he must complete and pass COOP 1000 (a mandatory online 0.0 credit course). Students will have access to this course a minimum of two terms prior to their first work term and will be notified when to register.

#### **Communication with the Co-op Office**

Students must maintain contact with the co-op office during their job search and while on a work term. All email communication will be conducted via the students' Carleton email account.

#### **Employment**

Although every effort is made to ensure a sufficient number of job postings for all students enrolled in the co-op option of their degree program, no guarantee of employment can be made. Carleton's co-op program operates a competitive job search process and is dependent upon current market conditions. Academic performance, skills, motivation, maturity, attitude and potential will determine whether a student is offered a job. It is the student's responsibility to actively conduct a job search in addition to participation in the job search process operated by the co-op office. Once a student accepts a co-op job offer (verbally or written), his/her job search will end and access to co-op jobs will be removed for that term. Students that do not successfully obtain a co-op work term are expected to continue with their academic studies. The summer term is the exception to this rule. Students should also note that hiring priority is given to Canadian citizens for co-op positions in the Federal Government of Canada.

#### **Registering in Co-op Courses**

Students will be registered in a Co-op Work Term course while at work. The number of Co-op Work Term courses that a student is registered in is dependent upon the number of four-month work terms that a student accepts.

While on a co-op work term students may take a maximum of 0.5 credit throughout each four-month co-op work term.

Courses must be scheduled outside of regular working hours.

Students must be registered as full-time before they begin their co-op job search (2.0 credits). All co-op work terms must be completed before the beginning of the final academic term. Students may not finish their degree on a co-op work term.

### **Work Term Assessment and Evaluation**

To obtain a Satisfactory grade for the co-op work term students must have:

1. A satisfactory work term evaluation by the co-op employer;
2. A satisfactory grade on the work term report.

Students must submit a work term report at the completion of each four-month work term. Reports are due on the 16th of April, August, and December and students are notified of due dates through their Carleton email account.

Workplace performance will be assessed by the workplace supervisor. Should a student receive an unsatisfactory rating from their co-op employer, an investigation by the co-op program manager will be undertaken. An unsatisfactory employer evaluation does not preclude a student from achieving an overall satisfactory rating for the work term.

### **Graduation with the Co-op Designation**

In order to graduate with the co-op designation, students must satisfy all requirements for their degree program in addition to the requirements according to each co-op program (i.e. successful completion of three or four work terms).

Note: Participation in the co-op option will add up to one additional year for a student to complete their degree program.

### **Voluntary Withdrawal from the Co-op Option**

Students may withdraw from the co-op option of their degree program during a study term ONLY. Students at work may not withdraw from the work term or the co-op option until s/he has completed the requirements of the work term.

Students are eligible to continue in their regular academic program provided that they meet the academic standards required for continuation.

### **Involuntary or Required Withdrawal from the Co-op Option**

Students may be required to withdraw from the co-op option of their degree program for one or any of the following reasons:

1. Failure to achieve a grade of SAT in COOP 1000
2. Failure to pay all co-op related fees
3. Failure to actively participate in the job search process
4. Failure to attend all interviews for positions to which the student has applied
5. Declining more than one job offer during the job search process

6. Continuing a job search after accepting a co-op position
7. Dismissal from a work term by the co-op employer
8. Leaving a work term without approval by the Co-op manager
9. Receipt of an unsatisfactory work term evaluation
10. Submission of an unsatisfactory work term report

### Standing and Appeals

The Co-op and Career Services office administers the regulations and procedures that are applicable to all co-op program options. All instances of a student's failure during a work term or other issues directly related to their participation in the co-op option will be reported to the academic department.

Any decision made by the Co-op and Career Services office can be appealed via the normal appeal process within the University.

### International Students

All International Students are required to possess a Co-op Work Permit issued by Immigration, Refugees and Citizenship Canada before they can begin working. It is illegal to work in Canada without the proper authorization. Students will be provided with a letter of support to accompany their application. Students must submit their application for their permit before being permitted to view and apply for jobs on the Co-op Services database. Confirmation of a position will not be approved until a student can confirm they have received their permit. Students are advised to discuss the application process and requirements with the International Student Services Office.

### B.Sc. Honours Neuroscience, Neuroscience and Mental Health: Co-op Admission and Continuation Requirements

- Maintain full-time status in each study term (2.0 credits);
- Be eligible to work in Canada (for off-campus work)
- Have successfully completed COOP 1000 [0.0]

In addition to the following:

1. Completion of 5.0 or more credits at Carleton University;
2. Registered as a full-time student in the Bachelor of Science Honours degree program;
3. Obtained and maintained a major CGPA of 8.0 or higher and an overall CGPA of 6.50 or higher

B.Sc. Honours Neuroscience and Neuroscience and Mental Health students must successfully complete three (3) work terms to obtain the co-op designation.

**Work Term Course:** NEUR 3999

**Work-Study Pattern:**

Year 1		Year 2		Year 3		Year 4		Year 5	
Term	Pattern	Term	Pattern	Term	Pattern	Term	Pattern	Term	Pattern
Fall	S	Fall	S	Fall	S	Fall	*W/S	Fall	S
Winter	S	Winter	S	Winter	S	Winter	*W/S	Winter	S
Summer	**O/W	Summer	*W	Summer	O/W	Summer	O/W		

### Legend

**S:** Study

**W:** Work

**O:** Optional

\* indicates recommended work study pattern

\*\* student finds own employer for this work-term.

### Admissions Information

Admission Requirements are for the 2020-21 year only, and are based on the Ontario High School System. Holding the minimum admission requirements only establishes eligibility for consideration. The cut-off averages for admission may be considerably higher than the minimum. See also the **General Admission and Procedures** section of this Calendar. An overall average of at least 70% is normally required to be considered for admission. Some programs may also require specific course prerequisites and prerequisite averages and/or supplementary admission portfolios. Higher averages are required for admission to programs for which the demand for places by qualified applicants exceeds the number of places available. The overall average required for admission is determined each year on a program by program basis. Consult [admissions.carleton.ca](http://admissions.carleton.ca) for further details.

Note: Courses listed as *recommended* are not mandatory for admission. Students who do not follow the recommendations will not be disadvantaged in the admission process.

### Degrees

- B.Sc. (Honours)
- B.Sc. (General)
- B.Sc. (Major)

### Admission Requirements

#### Honours Program

#### First Year

The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. For most programs including Biochemistry, Bioinformatics, Biotechnology, Chemistry, Combined Honours in Biology and Physics, Chemistry and Physics, Computational Biochemistry, Food Science, Nanoscience, Neuroscience, Neuroscience and Mental Health, and Psychology, the six 4U or M courses must include Advanced Functions and two of Biology, Chemistry, Earth and Space Sciences or Physics. (Calculus and Vectors is strongly recommended).

#### Specific Honours Admission Requirements

For the Honours programs in Earth Sciences, Environmental Science, Geomatics, Interdisciplinary Science and Practice, and Physical Geography, Calculus and Vectors may be substituted for Advanced Functions.

For the Honours programs in Physics and Applied Physics and for double Honours in Mathematics and Physics, Calculus and Vectors is required in addition to Advanced Functions and one of 4U Physics Chemistry, Biology, or Earth and Space Sciences. For all programs in Physics, 4U Physics is strongly recommended.



For the Combined Honours program in Chemistry and Computer Science, 4U Chemistry and Calculus and Vectors are strongly recommended.

For Honours in Psychology, a 4U course in English is recommended.

For Honours in Environmental Science, a 4U course in Biology and Chemistry is recommended.

### **Advanced Standing**

For entry to an Honours program after the completion of 5.0 included credits, a student must have a major CGPA of 5.50 or higher, an overall CGPA of 4.50 or higher and the recommendation of the Honours department or committee. A student beginning the final 10.0 credits towards an Honours degree must present a major CGPA of 6.00 or higher, an overall CGPA of 5.00 or higher and the recommendation of the Honours department or committee. A student beginning the final 5.0 credits towards an Honours degree must present a major CGPA of 6.50 or higher and an overall CGPA of 5.00 or higher, as calculated for graduation. Advanced standing will be granted for studies undertaken elsewhere when these are recognized as the equivalent of subjects offered at Carleton University.

### **Major Program**

#### **General Program**

##### **First Year**

The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. The six 4U or M courses must include Advanced Functions and two of Calculus and Vectors, Biology, Chemistry, Earth and Space Science or Physics (Calculus and Vectors is strongly recommended). For the B.Sc. Major in Physics. 4U Physics is strongly recommended. Equivalent courses may be substituted between the old and new Ontario mathematics curriculum.

##### **Advanced Standing**

For entry to a General or Major program after the completion of 5.0 included credits, a student must have a major and core CGPA of 3.50 or higher and an overall CGPA of 3.50 or higher. A student beginning the final 5.0 credits towards a General or Major degree must present a major and core CGPA of 4.00 or higher and an overall CGPA of 4.00 or higher, as calculated for graduation. Advanced standing will be granted for studies undertaken elsewhere when these are recognized as the equivalent of subjects offered at Carleton University.

### **Co-op Option**

#### **Direct Admission to the First Year of the Co-op Option**

Applicants must:

1. meet the required overall admission cut-off average and prerequisite course average. These averages may be higher than the stated minimum requirements;
2. be registered as a full-time student in the Bachelor of Science Honours program;
3. be eligible to work in Canada (for off-campus work placements).

Note that meeting the above requirements only establishes eligibility for admission to the program. The prevailing job market may limit enrolment in the co-op option.

Note: continuation requirements for students previously admitted to the co-op option and admission requirements for the co-op option after beginning the program are described in the Co-operative Education Regulations section of this Calendar.

### **Neuroscience (NEUR) Courses**

#### **NEUR 1202 [0.5 credit]**

##### **Neuroscience of Mental Health and Psychiatric Disease**

Clinical symptoms of psychiatric disease, including biological, developmental, experiential and environmental factors that contribute to disease. Topics may include depressive disorders, schizophrenia, autism, ADHD, anorexia, narcolepsy, substance abuse, and personality disorders.

Precludes additional credit for NEUR 1201 (no longer offered).

Lecture three hours a week.

#### **NEUR 1203 [0.5 credit]**

##### **Neuroscience of Mental Health and Neurological Disease**

Clinical symptoms of neurological disease, including biological, developmental, experiential and environmental factors that contribute to disease. Topics may include stroke, multiple sclerosis, migraine, seizure disorder, Parkinson's disease, ALS, chronic pain, Alzheimer's disease and concussion.

Lectures three hours a week.

#### **NEUR 2001 [0.5 credit]**

##### **Introduction to Research Methods in Neuroscience**

A general introduction to research methodologies employed within neuroscience. Topics covered include research designs and techniques, basic descriptive statistics, and how to interpret and report research findings.

Precludes additional credit for PSYC 2000 and PSYC 2001.

Prerequisite(s): second-year standing.

Lecture three hours a week, online labs/tutorials.

#### **NEUR 2002 [0.5 credit]**

##### **Introduction to Statistics in Neuroscience**

A general introduction to statistical techniques employed within contemporary neuroscience. Topics covered include basic data analysis using descriptive and inferential statistics (t-tests, ANOVA, correlation, chi-square). Precludes additional credit for ENST 2006, GEOG 2006, PSYC 2002.

Prerequisite(s): PSYC 2001 or NEUR 2001.

Lectures three hours a week, online labs/tutorials.

**NEUR 2003 [0.5 credit]****Introduction to Techniques in Neuroscience**

Introduction to common techniques used in neuroscience research. Brain imaging, animal behaviour, electrophysiology, immunohistochemistry and microscopy, genomics, transgenics, cell culture, and DSM-IV-based clinical assessment.

Prerequisite(s): one of PSYC 1001, NEUR 1201, NEUR 1202 or NEUR 1203.

Lectures three hours a week.

**NEUR 2004 [0.5 credit]****Fundamentals of Scientific Writing in Neuroscience**

Introduction to various forms of scientific writing appropriate to neuroscience, with a focus in fundamental skills in scientific writing.

Includes: Experiential Learning Activity

Prerequisite(s): second-year standing in a Neuroscience program and one of NEUR 1201, NEUR 1202 or NEUR 1203.

Lectures and workshops three hours a week.

**NEUR 2201 [0.5 credit]****Cellular and Molecular Neuroscience**

Core principles in cellular and molecular neuroscience, including signal transmission along and between neurons, ion channels and transporters, intracellular signaling pathways, and regulation of gene expression.

Precludes additional credit for PSYC 3200 (no longer offered) and NEUR 3200 (no longer offered).

Prerequisite(s): Either NEUR 1201 and NEUR 1203, or NEUR 1202 and NEUR 1203, or both BIOL 1103 and BIOL 1104.

Lectures three hours a week, online labs.

**NEUR 2202 [0.5 credit]****Neurodevelopment and Plasticity**

Core principles in nervous system development from embryogenesis to plasticity in the adult brain. Topics include neural induction, neurogenesis, apoptosis, neuronal migration and axon growth, synaptogenesis and synaptic pruning both under normal conditions and in psychopathology.

Precludes additional credit for PSYC 3200 (no longer offered) and NEUR 3200 (no longer offered).

Prerequisite(s): NEUR2201.

Lectures three hours a week, online labs.

**NEUR 2801 [0.5 credit]****Neuroscience and Creativity**

Abnormal brain function associated with mental illness or substance abuse has been commonly depicted in or been the inspiration for important cultural works including movies, music, paintings and literature. The neurobiological basis of creativity in individuals with and without mental illness.

Prerequisite(s): one of PSYC 1001, NEUR 1201, NEUR 1202 or NEUR 1203.

Lectures and seminars three hours a week.

**NEUR 3001 [0.5 credit]****Data Analysis in Neuroscience I**

Introducing software for analyzing neuroscience data. Drawing graphs, correlations, regression, with a focus on the appropriate use of statistical methods and interpretation of results.

Includes: Experiential Learning Activity

Prerequisite(s): PSYC 2001 and PSYC 2002, or NEUR 2001 and NEUR 2002.

Lectures three hours a week, online labs/workshops.

**NEUR 3002 [0.5 credit]****Data Analysis in Neuroscience II**

Use of software for analyzing neuroscience data. Various forms of ANOVA, and an introduction to nonparametric statistical tests; the appropriate use of statistical methods and interpretation of results.

Includes: Experiential Learning Activity

Prerequisite(s): NEUR 3001.

Lectures three hours a week, online labs/workshops.

**NEUR 3203 [0.5 credit]****Field Course in Animal Behaviour**

Offered in the Department of Biology as BIOL 3605. Only those modules dealing with animal behaviour topics may be offered for Neuroscience credit.

Includes: Experiential Learning Activity

Also listed as BIOL 3605.

Precludes additional credit for PSYC 3203.

Prerequisite(s): permission of the department.

**NEUR 3204 [0.5 credit]****Neuropharmacology**

Introduction to synaptic mechanisms and the arrangements of the transmitter-specific brain systems, followed by a discussion of neuro-pharmacological bases of normal and abnormal behaviour and of the behavioural effects of various classes of psychoactive drugs such as stimulants, tranquilizers, opiates.

Precludes additional credit for PSYC 3204 (no longer offered).

Prerequisite(s): NEUR 2200 or NEUR 2201.

Lectures and seminars three hours a week.

**NEUR 3206 [0.5 credit]****Sensory and Motor Neuroscience**

Exploration of major topics in sensory processing and motor control, with a focus on underlying mechanisms and neurobiological principles. Topics include all sensory systems (such as vision, somatosensation and audition) plus motor system components including lower and upper motor neurons, basal ganglia, and cerebellum.

Includes: Experiential Learning Activity

Precludes additional credit for PSYC 3200 (no longer offered), NEUR 3200 (no longer offered), PSYC 3202 (no longer offered) and NEUR 3202 (no longer offered).

Prerequisite(s): NEUR 1201 or both NEUR 1202 and NEUR 1203, and either NEUR 2200 or both NEUR 2201 and NEUR 2202.

Lectures three hours a week, laboratory three hours a week.

**NEUR 3207 [0.5 credit]****Systems Neuroscience**

Neural systems underlying complex behaviours including emotion, motivation, and sleep, and the role of association cortices in brain function.

Includes: Experiential Learning Activity

Precludes additional credit for NEUR 3200 (no longer offered) and PSYC 3200 (no longer offered).

Prerequisite(s): NEUR 1201 or both NEUR 1202 and NEUR 1203, and either NEUR 2200 or both NEUR 2201 and NEUR 2202.

Lectures three hours a week, laboratory three hours a week.

**NEUR 3301 [0.5 credit]****Genetics of Mental Health**

Most common mental health diseases have a genetic component. By focusing on specific diseases, this course will discuss how disease susceptibility genes are identified, and describe the genetic, genomic and epigenetic mechanisms through which DNA alterations can predispose to disease.

Prerequisite(s): BIOL 2104 or BIOL 2107, and NEUR 2200 or NEUR 2201.

Lectures three hours a week.

**NEUR 3303 [0.5 credit]****The Neuroscience of Consciousness**

Consciousness remains one of the least understood aspects of the nervous system. This course explores neural mechanisms underlying consciousness, changes in consciousness associated with sleep, coma, vegetative states, drugs, and other stimuli, and considers the evolutionary basis of consciousness, and its relationship with awareness.

Prerequisite(s): NEUR 2200 or NEUR 2202.

Lectures three hours a week.

**NEUR 3304 [0.5 credit]****Hormones and Behaviour**

The effects of hormones throughout life at all levels of the nervous system. The role of hormones in mediating behaviours that are both basic (feeding, reproduction and social interactions) and complex (motivation, emotion, learning and memory).

Prerequisite(s): NEUR 2200 or both NEUR 2201 and NEUR 2202.

Lectures three hours a week.

**NEUR 3401 [0.5 credit]****Environmental Toxins and Mental Health**

Exposure to environmental toxins from the air, water or food can interfere with neuronal function, alter neurodevelopment, and damage the brain. This course will explore associations between toxins and diseases such as Parkinson's disease, multiple sclerosis and depression, focusing on mechanisms underlying development of pathology.

Prerequisite(s): NEUR 2200 or both NEUR 2201 and NEUR 2202.

Lectures three hours a week.

**NEUR 3402 [0.5 credit]****Impact of Lifestyle and Social Interactions on Mental Health**

Healthy lifestyle choices and positive social interactions can reduce the incidence of pathological conditions such as depression, obesity, cardiovascular disease and impaired immunity. This course focuses on psychosocial and neurobiological mechanisms that underlie the relationship between lifestyle, social interactions and health.

Prerequisite(s): NEUR 2200 or both NEUR 2201 and NEUR 2202.

Lectures three hours a week.

**NEUR 3403 [0.5 credit]****Stress and Mental Health**

Stressful events can have profound repercussions on physical and psychological well-being. This course examines the psychosocial and biological processes by which stressors predispose to both physical (immune-related disorders, diabetes, heart disease) and psychological (acute stress disorder, posttraumatic stress disorder, depression, anxiety) pathologies.

Prerequisite(s): NEUR 2200 or both NEUR 2201 and NEUR 2202.

Lectures three hours a week.

**NEUR 3501 [0.5 credit]****Neurodegeneration and Aging**

Neurodegeneration is particularly acute in the aging population, and is characteristic of diseases such as Alzheimer's, Parkinson's, multiple sclerosis and Huntington's disease. This course will explore mechanisms underlying neurodegeneration, plus recent advances aimed at the restoration of nervous tissue, potentially curing these pathologies.

Prerequisite(s): NEUR 2200 or both NEUR 2201 and NEUR 2202.

Lectures three hours a week.

**NEUR 3502 [0.5 credit]****Neurodevelopmental Determinants of Mental Health**

Development of the human brain, the generation and differentiation of the various cell types, and the formation of the vast network of neural connections. How neurodevelopmental dysregulation can result in pathologies including dyslexia, ADHD, schizophrenia and autism.

Prerequisite(s): NEUR 2200, or both NEUR 2201 and NEUR 2202.

Lectures three hours a week.

**NEUR 3999 [0.0 credit]****Co-operative Work Term**

Includes: Experiential Learning Activity

**NEUR 4001 [0.5 credit]****Special Topics in Neuroscience**

Each section of NEUR 4001 deals with a different topic. Topics change yearly. Students may register in more than one section of NEUR 4001 but can register in each section only once.

Prerequisite(s): NEUR 3200, or NEUR 3204 and NEUR 3206 and NEUR 3207, or permission of the Department.

Lectures three hours a week.

**NEUR 4200 [0.5 credit]****Seminar on Current Advances in Neuroscience**

Headline research in neuroscience. Topics may include technical and conceptual advances, ethical issues, medical improvement, and social impacts of neuroscience research.

Precludes additional credit for PSYC 4200 (no longer offered).

Prerequisite(s): fourth year standing and one of NEUR 3200, NEUR 3206 or NEUR 3207.

Seminar three hours a week.

**NEUR 4202 [0.5 credit]****Seminar on Current Research in Neuroscience and Psychiatric Disease**

Recent research in clinical neuroscience including biological, developmental, experiential and environmental factors that contribute to disease. Topics may include depressive disorders, schizophrenia, autism, ADHD, anorexia, narcolepsy, substance abuse, and personality disorders.

Prerequisite(s): fourth year standing and one of NEUR 3200, NEUR 3206 or NEUR 3207.

Seminar three hours a week.

**NEUR 4203 [0.5 credit]****Seminar on Current Research in Neuroscience and Clinical Neurology**

Recent research in neurological disease, including biological, developmental, experiential and environmental factors that contribute to disease. Topics may include stroke, multiple sclerosis, migraine, seizure disorder, Parkinson's disease, ALS, chronic pain, Alzheimer's disease and concussion.

Prerequisite(s): fourth year standing and one of NEUR 3200, NEUR 3206 or NEUR 3207.

Seminars three hours a week.

**NEUR 4301 [0.5 credit]****Neurobiology of Energy Homeostasis**

Focus on neuroanatomical and molecular mechanisms underlying how mammals adapt to changes and challenges in the environment. Topics include regulation of feeding, energy expenditure, water balance, and temperature regulation.

Prerequisite(s): NEUR 3304.

Lectures three hours a week.

**NEUR 4302 [0.5 credit]****Sex and the Brain**

Neurobiological processes behind reproductive behaviours in various animal species including humans. Evaluation of data concerning neurobiological differences between sexes, biological determinants of sexual orientation, and relating to neurobiology of sex disorders.

Precludes additional credit for NEUR 3302 (no longer offered).

Prerequisite(s): NEUR 3304.

Lectures three hours a week

**NEUR 4303 [0.5 credit]****Indigenous Health & Mental Health**

The physical and mental health issues of Indigenous people in the context of the cultural, environmental, developmental and biological factors that contribute to comorbid conditions and greater risk and resilience.

Prerequisite(s): 3rd year standing or above.

Lectures three hours a week.

**NEUR 4305 [0.5 credit]****Immune-Brain Interactions**

Communication between the brain and the immune system; messengers mediating the interaction. How disturbances of immune-brain signaling can lead to disease (multiple sclerosis, Parkinson's) and to changes in mood and cognition.

Precludes additional credit for NEUR 3305 (no longer offered).

Prerequisite(s): NEUR 3200 or NEUR 3207.

Lectures three hours a week.

**NEUR 4306 [0.5 credit]****The Neural Basis of Addiction**

How substance and behavioural addictions impact neural function to ultimately lead to the neuropathology of addiction in vulnerable populations. Contemporary neurobiological theories of addiction will also be addressed.

Precludes additional credit for NEUR 3306.

Prerequisite(s): NEUR 3204.

Lecture three hours a week.

**NEUR 4600 [0.5 credit]****Advanced Lab in Neuroanatomy**

Advanced experiential learning in neuroanatomy, histology and microscopy.

Includes: Experiential Learning Activity

Prerequisite(s): NEUR 3200 or both NEUR 3206 and NEUR 3207, fourth-year standing in a Neuroscience program, a minimum Major CGPA of 9.0 and permission of the Department.

**NEUR 4801 [0.5 credit]****Neuroethics**

Ethical issues of key importance to current neurobiological research. Topics may include the use of animals in research, stem cell research, genetic diagnosis and gene therapy, neuroimaging, and the effect on identity and autonomy of manipulations such as psychopharmaceuticals and psychosurgery.

Prerequisite(s): NEUR 3200 or both NEUR 3206 and NEUR 3207.

Lectures and seminars three hours a week.

**NEUR 4900 [0.5 credit]****Independent Study**

A reading or research course for selected students who wish to investigate a particular topic of interest. Normally students may not offer more than one credit of independent study in their total program.

Includes: Experiential Learning Activity

Prerequisite(s): third- or fourth- year standing and permission of the Department.

**NEUR 4905 [1.0 credit]****Honours Workshop**

The course will focus on active learning in areas that include written and oral communication, evaluation and interpretation of results, statistics and data management, emphasizing transferable skills that will be most appropriate for non-research career paths.

Includes: Experiential Learning Activity

Precludes additional credit for NEUR 4907 and NEUR 4908.

Prerequisite(s): fourth-year standing in an Honours Neuroscience program and permission of the Department. Lectures and seminars three hours a week, and colloquia three hours a week.

**NEUR 4907 [1.0 credit]****Honours Essay and Research Proposal**

An independent essay based critical review and research proposal on a topic in neuroscience, using library resources, under the direct supervision of a Faculty advisor. Evaluation is based on a written report.

Includes: Experiential Learning Activity

Precludes additional credit for NEUR 4905 and NEUR 4908.

Prerequisite(s): NEUR 3200, or both NEUR 3206 and NEUR 3207, and fourth-year standing in an Honours Neuroscience program, a minimum Major CGPA of 9.0 and permission of the Department.

Seminar three hours a week and colloquia three hours a week.

**NEUR 4908 [1.0 credit]****Honours Research Thesis**

An independent research project undertaken under the direct supervision of a faculty advisor typically from the Department of Neuroscience. Evaluation is based on a written report and poster.

Includes: Experiential Learning Activity

Precludes additional credit for NEUR 4905 and NEUR 4907.

Prerequisite(s): NEUR 3200, or both NEUR 3206 and NEUR 3207, and fourth-year standing in an Honours Neuroscience program, a minimum CGPA of 9.0 and permission of the Department.

Colloquia three hours a week.