

# NEUROSCIENCE

<http://biomed.med.miami.edu/graduate-programs/neuroscience>

## Overview

The Neuroscience Program was formed in 1989 by a committee of neuroscientists led by the Provost and organized as a university-wide program. A representative steering committee was established, and Dr. Richard Rotundo was appointed as the first chair. In 1992, the Neuroscience Program became an independent, PhD-granting entity. Neuroscience research is a major focus at the University of Miami and the Neuroscience Graduate Program (NGP) is currently composed of 30 graduate students and 78 faculty members with diverse research interests, but also with some areas of commonality. Areas of concentration include neurotrauma such as stroke, spinal cord injury and traumatic brain injury, mechanisms of addiction, neurodegenerative diseases such as multiple sclerosis and Alzheimer's disease, and sensory transduction of the somatosensory, visual, auditory, olfactory and gustatory systems. The Neuroscience Graduate Program faculty are from 19 different departments and distributed across three University of Miami campuses: Miller School of Medicine (MSOM) campus, Rosenstiel School of Marine and Atmospheric Science (RSMAS) campus and the Coral Gables (CG) campus. This comprehensive, diverse group of faculty, students and scientists that make up the Neuroscience Graduate Program is a cornerstone of research and graduate education in biomedical sciences at the University of Miami.

## Contact Information

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## Admission Requirements

Admission to the Neuroscience Program is through the common umbrella of Programs in the Biomedical Sciences (PIBS), for all biomedical PhD programs.

For more information, please visit this website (<http://biomed.med.miami.edu/graduate-programs/programs-in-biomedical-sciences-pibs/>).

## Curriculum Requirements

Graduate training is the major goal of the program, with emphasis on cellular, molecular, and genetic approaches to Neuroscience. A single core curriculum provides the didactic scaffold of the program. This curriculum consists of courses in Developmental Neuroscience, Membrane Biophysics, Introductory Neuroscience, Neural Systems, and Neuroanatomy. The core courses are supplemented with a variety of Special Topics Short Courses. Students also attend research seminars and a scientific journal club. The Neuroscience Steering Committee guides the students, overseeing their coursework, until they have passed their qualifying exams. From then on, their progress is supervised by individually tailored dissertation committees.

Code	Title	Credit Hours
<b>Biomedical Science Core</b>		
PIB 700	Journal Club	1
PIB 701	Introduction to Biomedical Sciences	5
PIB 702	Scientific Reasoning	3
PIB 705	Biostatistics for the Biosciences	3
PIB 731	Laboratory Research	1-6
PIB 780	Research Ethics	1
PIB 782	Professional Development: Skills for Success I	1
PIB 783	Professional Development: Skills for Success II	1
PIB 785	PIBS Bioinformatics Workshop	1
PIB 830	Doctoral Dissertation	1
<b>Neuroscience Required Courses</b>		
NEU 700	Seminars in Neuroscience	2
NEU 721	Principles of Membrane Physiology and Biophysics I	3
NEU 722	Principles of Membrane Physiology and Biophysics II	3

NEU 731 or NEU 732	Advanced Topics in Neuroscience Introduction to Neurological Diseases	1
NEU 732	Introduction to Neurological Diseases	1
NEU 761	Neuroscience 1B (Developmental Neuroscience)	2
NEU 762	NEU II - Systems Neuroscience	4
NEU 797	Neuroanatomy	3
<b>Research Credits</b>		<b>24</b>
NEU 830	Doctoral Dissertation	
NEU 840	Doctoral Dissertation- Post Candidacy	
NEU 850	Research in Residence	
<b>Total Credit Hours</b>		<b>61-66</b>

<sup>1</sup> Neuroscience students must take 1 seminar credit each fall and spring semester.

## Sample Plan of Study

Please note that the following is only a sample curriculum plan. Current students must discuss their plan with their program director to make adjustments as needed. It is the student's responsibility to contact the program to verify the information.

<b>Year One</b>		
<b>Fall</b>		<b>Credit Hours</b>
PIB 700	Journal Club	1
PIB 701	Introduction to Biomedical Sciences	5
PIB 702	Scientific Reasoning	3
PIB 731	Laboratory Research	1
PIB 780	Research Ethics	1
PIB 782	Professional Development: Skills for Success I	1
<b>Credit Hours</b>		<b>12</b>
<b>Spring</b>		
PIB 700	Journal Club	1
PIB 705	Biostatistics for the Biosciences	3
PIB 731	Laboratory Research	1
PIB 783	Professional Development: Skills for Success II	1
NEU 721	Principles of Membrane Physiology and Biophysics I	2
NEU 722	Principles of Membrane Physiology and Biophysics II	2
NEU 761	Neuroscience 1B (Developmental Neuroscience)	2
NEU 763		2
<b>Credit Hours</b>		<b>14</b>
<b>Summer</b>		
PIB 830	Doctoral Dissertation	1
<b>Credit Hours</b>		<b>1</b>
<b>Year Two</b>		
<b>Fall</b>		
NEU 700	Seminars in Neuroscience	1
NEU 762	NEU II - Systems Neuroscience	4
NEU 797	Neuroanatomy	3
NEU 830	Doctoral Dissertation	3
<b>Credit Hours</b>		<b>11</b>
<b>Spring</b>		
NEU 700	Seminars in Neuroscience	1
NEU 830	Doctoral Dissertation	3
<b>Credit Hours</b>		<b>4</b>

<b>Summer</b>		
NEU 830	Doctoral Dissertation	1
<b>Credit Hours</b>		<b>1</b>
<b>Year Three</b>		
<b>Fall</b>		
NEU 700	Seminars in Neuroscience	1
NEU 731	Advanced Topics in Neuroscience	1
NEU 840	Doctoral Dissertation- Post Candidacy	3
<b>Credit Hours</b>		<b>5</b>
<b>Spring</b>		
NEU 700	Seminars in Neuroscience	1
NEU 840	Doctoral Dissertation- Post Candidacy	3
<b>Credit Hours</b>		<b>4</b>
<b>Summer</b>		
NEU 840	Doctoral Dissertation- Post Candidacy	1
<b>Credit Hours</b>		<b>1</b>
<b>Year Four</b>		
<b>Fall</b>		
NEU 700	Seminars in Neuroscience	1
NEU 840	Doctoral Dissertation- Post Candidacy	2
<b>Credit Hours</b>		<b>3</b>
<b>Spring</b>		
NEU 700	Seminars in Neuroscience	1
NEU 840	Doctoral Dissertation- Post Candidacy	2
<b>Credit Hours</b>		<b>3</b>
<b>Summer</b>		
NEU 840	Doctoral Dissertation- Post Candidacy	1
<b>Credit Hours</b>		<b>1</b>
<b>Year Five</b>		
<b>Fall</b>		
NEU 700	Seminars in Neuroscience	1
NEU 840	Doctoral Dissertation- Post Candidacy	2
<b>Credit Hours</b>		<b>3</b>
<b>Spring</b>		
NEU 700	Seminars in Neuroscience	1
NEU 840	Doctoral Dissertation- Post Candidacy	2
<b>Credit Hours</b>		<b>3</b>
<b>Summer</b>		
NEU 850	Research in Residence	1
<b>Credit Hours</b>		<b>1</b>
<b>Total Credit Hours</b>		<b>67</b>

## Mission

The Neuroscience Graduate Program offers training leading to a Ph.D. in Neuroscience. The program's mission is to provide students with 1) an understanding of the central concepts in neuroscience and basic biomedical science and 2) the ability to formulate, carry out, and communicate original research in neuroscience.

## Student Learning Outcomes

- Students should demonstrate overall knowledge and understanding of the core concepts in neuroscience, including the essential skills necessary for conducting research in the field of neuroscience.
- Students should demonstrate critical thinking skills, the capability to develop hypotheses, and the ability to evaluate their hypotheses, paying attention to responsible conduct of research as appropriate.

- Students should demonstrate the ability to write effective scientific reports and to present scientific results orally.
- Students should, in honing research capabilities throughout their graduate careers, publish original research in peer-reviewed journals.
- Students should submit for extramural fellowships, the receipt of which will prove valuable to the student, the program, and the university.
- Students should be encouraged to formulate, carry out, and defend dissertation research in a timely manner, keeping the program's mean time from matriculation to defense low so that the student can take the next step in his or her career.

**NEU 700. Seminars in Neuroscience. 2 Credit Hours.**

Required each Fall and Spring for all NEU students, emphasizes student research presentations (30 min each for 2nd year students; 60 min each for student 3rd year on). Attendance at neuroscience related seminars is also required.

Requisite: Neuroscience.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**NEU 721. Principles of Membrane Physiology and Biophysics I. 3 Credit Hours.**

Course discusses chemical and physical structure of membranes, model systems, permeability and transport, membrane potential, ionic channels, excitability in nerve and muscle, ionophores, active transport, and membrane receptors. Identical with MCP 641.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**NEU 722. Principles of Membrane Physiology and Biophysics II. 3 Credit Hours.**

Course topics include osmosis and cell volume, tracer analysis of permeability and compartmentation, theory of channels and carriers, cable properties, Hodgkin-Huxley formalism, Na, K, and Ca ion channels, regulation of cellular Na, Ca activities, single-channel analysis, chemical synapses, membrane receptors, cell junctions, excitation and E-C coupling in muscle. Identical with MCP 642.

Prerequisite: NEU 721.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**NEU 731. Advanced Topics in Neuroscience. 1 Credit Hour.**

Special work, lecture, laboratory, reading, seminar, or a combination of these as determined by advisor in accordance with student's interest.

Requisite: Neuroscience.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**NEU 732. Introduction to Neurological Diseases. 1 Credit Hour.**

This course provides an advanced introduction to rare or relatively less discussed neurological diseases and comorbidities that may lead to major neurological conditions. This will be a 1-credit course comprising 10 lectures offered during the Spring 2025 semester. Each lecture will have a duration of one hour, followed by five multiple-choice questions that students can complete online by the end of the day. To meet course requirements, students must attend a minimum of 8 out of the 10 lectures, or alternatively, the best 8 out of 10 quiz scores will be considered for the final grade.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**NEU 760. Neuroscience 1A (Molecular and Cellular Neuroscience). 2 Credit Hours.**

An advanced introduction to modern neurobiology, focusing on the cellular and molecular biology of neurons, glia, synapses, and neurotransmitters.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**NEU 761. Neuroscience 1B (Developmental Neuroscience). 2 Credit Hours.**

This course will explore nervous system development from early neural induction and neurogenesis to the construction of neural circuits. Basic mechanisms of neurulation and CNS patterning, neural progenitor migration, neural crest and ectodermal placodes, programmed cell death, construction of neural circuits, axon guidance, synaptogenesis and several emerging techniques in neurobiology will be covered.

Requisite: Neuroscience.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**NEU 762. NEU II - Systems Neuroscience. 4 Credit Hours.**

The course aims to provide a general, but intensive, background to the neurosciences beyond Cellular Neuroscience (NEU 661) and Developmental Neuroscience (NEU 663) and to prepare students for more specialized neuroscience courses, for lab rotations, and for subsequent dissertation work. NEU 662 will present sensory, motor and integrative neuroscience at the level of functional systems, but will do so in the context of cellular and molecular neuroscience. The course concentrates on the experimental basis for our understanding of nervous system function and uses both didactic lectures and student discussions of current research literature. The course expects that students have a working knowledge of synaptic transmission, excitable cell membranes, and ion channels from previous coursework in PHS 641/2 and NEU 661, as well as a general knowledge of biochemistry and molecular biology from their PIBS course. It will also be useful to have taken NEU 663. [Pre-requisites: PHS641/2 and NEU661, or in exceptional cases, permission of instructors].

Requisite: Neuroscience.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**NEU 797. Neuroanatomy. 3 Credit Hours.**

This course is designed to teach functional neuroanatomy to individuals engaged in basic neuroscience research. Therefore, most of the emphasis will be placed upon gross anatomy, identification of pathways and circuits, and a description of the physiological functions of neuroanatomical systems. To the extent that it may help to explain functional aspects of the nervous system, each lecture will contain some clinical examples and/or case histories. An important feature of each class period will be a laboratory segment in which the student will study human and sheep brains, examine models of the brain, and use internet neuroanatomy websites containing pictures, text, clinical examples, and 3-dimensional rotations of the nervous system.

Requisite: Neuroscience.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**NEU 830. Doctoral Dissertation. 1-12 Credit Hours.**

Required for all PhD students before passing the Qualifying Examination. The student will enroll for credits as determined by the Program Office, but no more than a total of 6 credits.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Offered by Announcement Only.

**NEU 840. Doctoral Dissertation- Post Candidacy. 1-12 Credit Hours.**

Required for all PhD students before passing the Qualifying Examination. The student will enroll for credits as determined by the Program Office, but no more than a total of 6 credits.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall.

**NEU 850. Research in Residence. 1-14 Credit Hours.**

Students register in the semester they plan to submit their dissertation to the Graduate School.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.