PH.D. IN 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
Coleen Atkins (CATkins@med.miami.edu), PhD, (CATkins@med.miami.edu) Graduate Program Director Maya Kono, MS, (mkono@med.miami.edu) Senior Program Coordinator
Office of Graduate and Postdoctoral Studies
Rosenstiel Medical Sciences Building, Suite 1128A
1600 NW 10th Avenue, M857
Miami, FL 33136

neuroscience@miami.edu
305 243 3368

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.

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tr>
<td>PIB 700</td>
<td>Journal Club</td>
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<td>PIB 701</td>
<td>Introduction to Biomedical Sciences</td>
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<td>PIB 783</td>
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<td>PIB 785</td>
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<td>NEU 700</td>
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<tr>
<td>NEU 721</td>
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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.

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<tr>
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<td>NEU I - Molecular and Cellular Neuroscience</td>
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<td>NEU 763</td>
<td>Developmental Neuroscience</td>
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<td>**Year Two</td>
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<td>NEU 762</td>
<td>NEU II - Systems Neuroscience</td>
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<td>NEU 797</td>
<td>Neuroanatomy</td>
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<td>Doctoral Dissertation</td>
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1 Neuroscience students must take 1 seminar credit each fall and spring semester.
| Year Three | Fall | NEU 700 | Seminars in Neuroscience | 1 |
| | | NEU 731 | Advanced Topics in Neuroscience | 3 |
| | | NEU 840 | Doctoral Dissertation- Post Candidacy | 3 |
| | | | Credit Hours | 5 |
| | Spring | NEU 700 | Seminars in Neuroscience | 1 |
| | | NEU 840 | Doctoral Dissertation- Post Candidacy | 3 |
| | | | Credit Hours | 4 |
| | Summer | NEU 840 | Doctoral Dissertation- Post Candidacy | 1 |
| | | | | 1 |
| Year Four | Fall | NEU 700 | Seminars in Neuroscience | 1 |
| | | NEU 840 | Doctoral Dissertation- Post Candidacy | 2 |
| | | | Credit Hours | 3 |
| | Spring | NEU 700 | Seminars in Neuroscience | 1 |
| | | NEU 840 | Doctoral Dissertation- Post Candidacy | 2 |
| | | | Credit Hours | 3 |
| | Summer | NEU 840 | Doctoral Dissertation- Post Candidacy | 1 |
| | | | | 1 |
| Year Five | Fall | NEU 700 | Seminars in Neuroscience | 1 |
| | | NEU 840 | Doctoral Dissertation- Post Candidacy | 2 |
| | | | Credit Hours | 3 |
| | Spring | NEU 700 | Seminars in Neuroscience | 1 |
| | | NEU 840 | Doctoral Dissertation- Post Candidacy | 2 |
| | | | Credit Hours | 3 |
| | Summer | NEU 850 | Research in Residence | 1 |
| | | | Credit Hours | 1 |

**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.

**Goals**

- Ensure that students obtain fundamental knowledge of the central concepts in neuroscience and basic biomedical science
- Ensure that students obtain the ability to formulate, carry out, and communicate original research in neuroscience
- Equip students with an understanding of rigorous experimental design, statistical methodology, and quantitative literacy in neuroscience
- Provide rigorous training for writing and orally presenting neuroscience
- Develop student’s ability to write a successful grant application
- Nurture a student’s ability to teach others neuroscience and to collaborate to achieve common research goals
- Promote publishing of original research performed with high ethical and rigorous standards that make a substantial contribution to neuroscience

**Total Credit Hours**

67
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 demonstrate the ability to write effective scientific reports and to present scientific results orally.
- 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 721. Principles of Membrane Physiology and Biophysics I 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. (2 credits)

NEU 722. Principles of Membrane Physiology and Biophysics II Osmosis and cell volume, permeability and compartmentation, 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. Prerequisite: NEU 721. (2 credits)

NEU 761. Neuroscience I – Molecular and Cellular Neuroscience An eight-week introduction to the cellular and molecular biology of the nervous system. The course is an intensive, interactive discussion of experimental method, data analysis regarding neurons, synapses, sensory cells, glia and learning/memory. (2 credits)

NEU 762. Systems Neuroscience Sensory, motor and integrative neuroscience at the level of functional systems. The course concentrates on the experimental basis for our understanding of nervous system function using didactic lectures and student discussions of research literature. Students are expected to have a working knowledge of synaptic transmission, excitable cell membranes, and ion channels from previous coursework in NEU 721/722 and NEU 761. [Prerequisites: NEU 721/22 and NEU 761, or in exceptional cases, permission of instructors]. (4 credits)

NEU 763. Developmental Neuroscience This course will explore nervous system development from early neural induction and neurogenesis to the construction of neural circuits. Cellular and molecular mechanisms of neurulation and CNS patterning, neural progenitor migration, neural crest and ectodermal placodes, programmed cell death, construction of neural circuits and axon guidance, and synaptogenesis will be covered. (2 credits)

NEU 797. Neuroanatomy Functional neuroanatomy for neuroscience research. Emphasis is on gross anatomy, identification of pathways and circuits, and a description of the physiological functions of neuroanatomical systems. Each lecture will contain some clinical examples and/or case histories, and a laboratory segment for study of human and sheep brains. Brain models and online tools including 3-dimensional rotations are included. (2 credits)

NEU 731. Advanced Topics in Neuroscience A seminar course with guided readings and discussions based on research literature. The course is taught by faculty in areas related to their research topics. The course may include writing assignments or homework exercises. All NEU program students are required to pass this course at least once before requesting sufficiency. Not available every semester. Announcements for this course are sent by email to all NEU students. (1 credit)

NEU 750. Modeling CNS Injury and Repair (elective) An overview of a number of complex modeling systems using in CNS Injury and Repair biomedical research. The course examines models, such as spinal cord injury, traumatic brain injury, ischemic/stroke injury, experimental autoimmune
encephalomyelitis (EAE) model of multiple sclerosis, axon regeneration in retinal nerve and spinal cord, and drosophila models of degeneration. The course will consist of both lectures and hands-on laboratory components. Not available every academic year. (1 credit)

**NEU 700. Seminars in Neuroscience** Required each Fall and Spring for all NEU students, emphasizes student research presentations (30 min each for 2nd year students; 60 min each for 3rd year on). Attendance at neuroscience related seminars is also required. (1 credit)

**NEU 830. Doctoral Dissertation – Pre Candidacy** Dissertation Research before requesting Admission to Candidacy (i.e. before Qualifying Exam). No more than 6 (six) of these credits may be taken prior to completion of the Qualifying Exam. (variable credits)

**NEU 840. Doctoral Dissertation – Post Candidacy** Dissertation Research after Admission to Candidacy. (variable credits)

**NEU 850. Research in Residence – Defense Semester** Dissertation Research after the student has defended their dissertation but is preparing dissertation for final submission to Graduate School, or has accumulated the permissible total in doctoral research credits.