Neuroscience

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Degrees Offered

• Doctor of Philosophy
• Joint Doctor of Medicine and Doctor of Philosophy

Nature of the Program

The doctoral program in Neuroscience is committed to training the next generation of researchers and educators. Successful completion of degree requirements is based on research and scholarly achievement. Students will have opportunities to experience and acquire the skills needed for successful careers as independent scientists, including critical thinking, problem solving, writing, public speaking, and leadership. After completion of core coursework, students conduct an original research project culminating in a doctoral dissertation. Research experiences include evaluating scientific literature, identifying critical scientific issues, experimental design, grant and manuscript writing, publication of scientific papers, and presentations at national meetings. Students with career interests in teaching will have the opportunity to gain experience in innovative teaching methods and techniques, including problem-based learning, computer-assisted learning, and integrated teaching approaches. Faculty members have appointments in basic and clinical departments with expertise that spans all neuroscience sub-disciplines, including structural, cellular, molecular, behavioral, and developmental.

The neuroscience graduate program emphasizes research on the function and dysfunction of the brain and nervous system, providing students with innovative approaches to understanding neural mechanisms responsible for diseases such as Alzheimer’s disease, stroke, brain injury and repair, as well as fundamental understanding of cellular and molecular neurobiology, motor and sensory systems, neural processing, cognition, behavior, and neural development.

Completion of the Ph.D. degree is realized when a minimum of one first-authored manuscript, based on dissertation research, is accepted in a peer-reviewed journal, and the student successfully presents the research results to faculty of the graduate dissertation committee and program/department. Typically, four to five years are required to realize this goal.

Research Areas


Cognitive Neuroscience: sound recognition, spatial hearing and sensory integration using fMRI, use-dependent plasticity in motor cortex after stroke, neurogenic communication disorders, or chemotherapy.

Neural Injury: functional and structural integrity of the blood brain barrier in health and disease, role of neuroinflammation in CNS pathologies, stroke pathophysiology and neuroprotection.

Behavioral Neuroscience: airway innervation and asthma, structural and functional changes in the hypothalamus of seasonal breeders, neurobiological pathways controlling food intake and obesity, plasticity in the amygdala, development of new compounds to treat neurological and psychiatric disorders, developmental aspects of sleep and sleep and circadian rhythm disorders, molecular psychopharmacology; learning, memory, and synaptic plasticity; signal transduction pathways involved in neurodegenerative and neuropsychiatric disorders.

Interdisciplinary research projects include: structure and transcriptional mechanisms controlling neural gene expression, molecular biology, and molecular genetics of neural degeneration and regeneration in the central nervous system; developmental neurochemistry and environmental influences on brain development, especially nutrition; neuroanatomy and neurophysiology of somatosensory and auditory systems, structural plasticity of astrocytes and modulation of synaptic contacts in the central nervous system, developmental neurobiology of anxiety disorders, development of synaptic connections in the neocortex, developmental genetics of rodent behavioral mutants; neural basis of pulmonary diseases, especially asthma and occupational/environmental diseases; mechanisms regulating microcirculation under pathophysiological conditions.

FACULTY

GRADUATE PROGRAM DIRECTOR

• Randy Nelson - Ph.D., Ph.D. (University of California, Berkeley)

ASSOCIATE GRADUATE PROGRAM DIRECTOR

• Bernard G. Schreurs - Ph.D. (University of Iowa)
Doctor of Philosophy

MAJOR REQUIREMENTS

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<tr>
<th>Course Code</th>
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<td>BMS 700</td>
<td>Scientific Integrity</td>
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<td>BMS 701</td>
<td>Scientific Rigor and Ethics</td>
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<td>BMS 702</td>
<td>Biomedical Lab Experience</td>
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<td>BMS 706</td>
<td>Biomedical Research Methods</td>
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<td>BMS 707</td>
<td>Experiential Learning for Biomedical Trainees</td>
<td>2</td>
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<td>BMS 720</td>
<td>Scientific Writing</td>
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<td>BMS 747</td>
<td>Foundations for Contemporary Biomedical Research I</td>
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<td>NSCI 760</td>
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<td>Electives</td>
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<td>Qualifying Examination</td>
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<td>Dissertation Proposal</td>
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<td>Dissertation Defense</td>
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<td>Total Hours</td>
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Seminars and Research Forum

Students are required to register for seminar in each semester of residence.

Journal Club

Students are required to enroll in Journal Club each semester. The course involves the presentation and discussion of current research papers and will help acquaint students with the variety of methods used in scientific research.

Doctoral Research

Students will conduct research with a dissertation mentor during time in the program. Students register for research credits each semester, and their performance is graded by their dissertation mentor.

Qualifying and Dissertation Proposal/Ph.D. Candidacy

The oral qualifying exam is given at the end of the second year of study. The dissertation proposal is completed during the third year of study. Admission to Ph.D. candidacy occurs following the successful defense of the dissertation proposal.

Dissertation Defense and First-Author Paper Requirement

Students are allowed to defend their dissertation when a minimum of one manuscript with the student as first author, based on dissertation research, is accepted in a peer-reviewed journal. The final examination for the Ph.D. degree consists of orally defending a written dissertation in a public seminar and then in private to the graduate dissertation committee. Satisfactory performance in the oral defense will result in recommendation for granting of the Ph.D. degree.

Suggested Plan of Study*

First Year

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<tr>
<th>Course Code</th>
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<th>Hours</th>
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<td>Course</td>
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<td>Hours Summer</td>
<td>Hours</td>
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**Second Year**

- **Fall**
  - NSCI 772: 4 NSCI 760
  - NSCI 760: 1 NSCI 761
  - NSCI 761: 1 NSCI 797
  - NSCI 797: 3 Qualifying Examination
  - **Total**: 9

- **Spring**
  - NSCI 760: 1 NSCI 760
  - NSCI 761: 1 NSCI 761
  - NSCI 797: 4 NSCI 797
  - Elective: 3
  - **Total**: 9

- **Summer**
  - NSCI 760: 1 NSCI 797
  - **Total**: 1

**Third Year**

- **Fall**
  - NSCI 760: 1 NSCI 760
  - NSCI 761: 1 NSCI 761
  - NSCI 797: 4 NSCI 797
  - Elective: 3
  - **Total**: 9

- **Spring**
  - NSCI 760: 1 NSCI 797
  - **Total**: 1

- **Summer**
  - NSCI 760: 1 BMS 707
  - **Total**: 2

**Fourth Year**

- **Fall**
  - NSCI 761: 1 NSCI 761
  - NSCI 797: 8 NSCI 797
  - **Total**: 9

- **Spring**
  - NSCI 760: 1 NSCI 797
  - **Total**: 3

**Total credit hours: 88**

**NOTE:** The graduate curriculum is finalized with a plan of study once the mentor and laboratory have been selected in the first year. The plan of study is developed by the graduate committee in consultation with the student. The courses listed above include the required and elective coursework necessary for the student to finalize his/her plan of study. When the student enters the laboratory of his/her doctoral dissertation mentor repetitve enrollments in research, seminars, and colloquia are typical and will determine total hours necessary for degree completion.

*This is a suggested plan of study. Course sequences and length of time in program may vary depending on student and altered total credit hours.

**Major Learning Outcomes**

**NEUROSCIENCE**

- Independently design experimental protocols, conduct the experiments, analyze the results, and defend the experimental approach to other scientists.
- Develop and plan the test of hypotheses regarding significant problems in neuroscience.
- Ability to effectively reference the relevant literature in support of the student's research project. Ability to identify significance gaps in knowledge on a scientific topic in neuroscience. Ability to critically evaluate the strengths and weaknesses of the scientific literature.
- Effectively communicate research in abstracts written for research presentations, manuscripts for publication, research grant proposals, and the final dissertation.
- Effectively communicate both the student's research and general scientific topics in both informal and formal settings.
- Develop experimental rigor and strategies for conducting reproducible research.
- Demonstrate principles of ethics associated with appropriate research conduct.

**COURSES**

**NBAN 706. Advanced Neuroanatomy. 2-4 Hours.**  
PR: CCMD 775 and Consent. (Course may be repeated.) Detailed study of selected areas of the nervous system.

**NBAN 790. Teaching Practicum. 1-3 Hours.**  
PR: Consent. Supervised practice in college teaching of anatomy. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading may be S/U.).

**NBAN 791. Advanced Topics. 1-6 Hours.**  
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.
NBAN 792. Directed Study. 1-6 Hours.
Directed study, readings, and/or research.

NBAN 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

NBAN 794. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.

NBAN 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

NBAN 796. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

NBAN 797. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)

NBAN 798. Thesis or Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.

NBAN 799. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is P/F; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.