Degrees Offered

- Doctor of Philosophy
- Joint Doctor of Medicine and Doctor of Philosophy

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, 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, 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 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.

CURRENT RESEARCH AREAS INCLUDE THE FOLLOWING:

- **Sensory Neuroscience**: mechanisms of auditory and visual system development, inhibitory neural circuits in the brain stem and cortex, synaptic development of thalamocortical circuits, molecular genetic control of retinal development and neural patterning, cell biology of G-protein-mediated signal transduction in vertebrate photoreceptors, olfactory signal processing in the brain, post-translational modification of proteins and protein assembly.

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

- **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 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**

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

**Doctor of Philosophy**

**MAJOR REQUIREMENTS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMS 700</td>
<td>Scientific Integrity</td>
<td>2</td>
</tr>
<tr>
<td>BMS 702</td>
<td>Biomedical Lab Experience</td>
<td>2</td>
</tr>
<tr>
<td>BMS 706</td>
<td>Cellular Methods</td>
<td>1</td>
</tr>
</tbody>
</table>
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 in 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

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours Spring</th>
<th>Hours Summer</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMS 700</td>
<td>1 BMS 700</td>
<td>1 NBAN 771</td>
<td>7</td>
</tr>
<tr>
<td>BMS 702</td>
<td>2 NBAN 770</td>
<td>5 NBAN 797</td>
<td>1</td>
</tr>
<tr>
<td>BMS 706</td>
<td>1 NBAN 760</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BMS 747</td>
<td>4 NBAN 761</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BMS 777</td>
<td>1 NBAN 797</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours Spring</th>
<th>Hours Summer</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBAN 772</td>
<td>3 NBAN 760</td>
<td>1 BMS 720</td>
<td>2</td>
</tr>
<tr>
<td>NBAN 760</td>
<td>1 NBAN 761</td>
<td>1 NBAN 797</td>
<td>1</td>
</tr>
</tbody>
</table>
### Major Learning Goals

**NEUROSCIENCE**

- Demonstrate skill in designing experimental protocols and in conducting productive self-directed research in Neuroscience
- Be able to pursue independent research in specialized fields of Neuroscience and to work with and contribute to interdisciplinary teams.
- Develop research skills including scientific communication and critical thinking/problem solving ability by participating in seminars and designated research skill courses
- Gain hands-on experience in conducting original research, including acquisition of background information (e.g., literature research), experimental design, data collection and interpretation and communicating the importance and relevance of research discoveries.
- Develop research communication skills by writing abstracts for research presentations, manuscripts for publication, research grant proposals, and a thesis or dissertation.
- Be competent scientists able to contribute to basic and health-related research in Neuroscience.