Neuroscience

Randy Nelson, Ph.D., Ph.D. (University of California, Berkeley) randy.nelson@hsc.wvu.edu

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, 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 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, 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 hypothalamicus 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

Scientific Integrity

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</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>
<tr>
<td>BMS 707</td>
<td>Experiential Learning for Biomedical Trainees</td>
<td>2</td>
</tr>
<tr>
<td>BMS 720</td>
<td>Scientific Writing</td>
<td>2</td>
</tr>
<tr>
<td>BMS 747</td>
<td>Foundations for Contemporary Biomedical Research 1</td>
<td>4</td>
</tr>
<tr>
<td>BMS 777</td>
<td>Foundations for Contemporary Biomedical Research 2</td>
<td>4</td>
</tr>
</tbody>
</table>

Research Forum

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBAN 761</td>
<td>Neuroscience Research Forum</td>
<td>7</td>
</tr>
<tr>
<td>NBAN 770</td>
<td>Fundamentals of Neuroscience 1</td>
<td>6</td>
</tr>
<tr>
<td>NBAN 772</td>
<td>Fundamentals of Neuroscience 2</td>
<td>4</td>
</tr>
</tbody>
</table>

Research

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBAN 797</td>
<td>Research</td>
<td>45</td>
</tr>
</tbody>
</table>

Journal Club

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBAN 760</td>
<td>Neuroscience Journal Club</td>
<td>5</td>
</tr>
</tbody>
</table>

Electives

<table>
<thead>
<tr>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualifying Examination</td>
<td>3</td>
</tr>
<tr>
<td>Dissertation Proposal</td>
<td></td>
</tr>
<tr>
<td>Dissertation Defense</td>
<td></td>
</tr>
</tbody>
</table>

Total Hours

87

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>Course</th>
<th>Fall Hours</th>
<th>Hours Spring</th>
<th>Hours Summer</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMS 700</td>
<td>1</td>
<td>1 BMS 700</td>
<td>1 NBAN 771</td>
<td>1</td>
</tr>
<tr>
<td>BMS 702</td>
<td>2</td>
<td>2 NBAN 770</td>
<td>6 NBAN 797</td>
<td>1</td>
</tr>
<tr>
<td>BMS 706</td>
<td>1</td>
<td>1 NBAN 760</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BMS 747</td>
<td>4</td>
<td>4 NBAN 761</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
### Major Learning Outcomes

**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.
- Develop experimental rigor and strategies for replicability.

### COURSES

**NBAN 701. Advanced Gross Anatomy. 2-6 Hours.**
PR: NBAN 703 or NBAN 724 and Consent. Morphological and functional analysis of a selected region, with dissection.

**NBAN 703. Human Structure. 1-17 Hours.**
PR: Admission to medical school or medical basic science graduate program or consent. Integrated approach combining human gross anatomy, microanatomy and embryology. Includes human cadaver dissection, microscopic anatomy of cells, tissues and organs with application to human health and disease.

**NBAN 705. Microanatomy. 5 Hours.**
PR: Admission to medical basic science graduate program or consent. Study of cells, tissues, and organs.
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 712. Special Topics in Anatomy. 2-4 Hours.
PR: Consent. Different topics of current interest in anatomy that are not included in the regular graduate courses.

NBAN 714. Applied Anatomy. 2-6 Hours.
PR: Consent. Detailed study of anatomy, adapted to the needs of the individual student.

NBAN 716. Craniofacial Growth and Maturation. 1 Hour.
PR: Consent. The current concepts of craniofacial growth and maturation are presented and integrated for application to clinical problems.

NBAN 718. Dental Histology. 6 Hours.
PR: Dental student standing or consent of instructor or chairperson. Cells, tissues, organs. Structure, function, and development of oral tissues.

NBAN 719. Advanced Head and Neck Anatomy. 1 Hour.
PR: Admission to medical, dental or basic science graduate programs, or consent. Head and neck craniofacial anatomy as it applies to specialties in dental or medical practice.

NBAN 724. Human Gross Anatomy. 7 Hours.
PR: Admission to dental school or medical basic science graduate program or consent. Human anatomy including cadaver dissection for dental students. (4 hr. lec., 3 hr. lab.).

NBAN 751. Advanced Microanatomy and Organology. 2-4 Hours.
PR: NBAN 705 or NBAN 709 and Consent. An extension of the major topics included in NBAN 705 or 709. Special emphasis on recent contributions.

NBAN 760. Neuroscience Journal Club. 1 Hour.
PR: Enrollment in Neuroscience Graduate Program. Current and topical research papers from the literature are reviewed in a student-centered presentation and discussion format. The Journal Club provides an opportunity to develop critical reading and presentation skills and to gain experience with current research topics in Neuroscience.

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.

NBAN 801. Human Structure. 19 Hours.
Integrated approach combining human gross anatomy, microanatomy and embryology. Includes human cadaver dissection, microscopic anatomy of cells, tissues and organs with application to human health and disease.