INDIANA UNIVERSITY

University Graduate School 2008-2009 Academic Bulletin

Medical Neuroscience

School of Medicine
Indianapolis

Program Director
Professor Grant Nicol*

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Departmental URL
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Graduate Faculty

(An asterisk [*] denotes membership in the University Graduate School faculty with the endorsement to direct doctoral dissertations.)

Distinguished Professors
M. H. Aprison* (Emeritus, Biochemistry and Molecular Biology), Bernardino Ghetti* (Medical and Molecular Genetics, Neurobiology, Pathology, Psychiatry)

Chancellor's Professors
Janice C. Froehlich* (Medicine, Cellular and Integrative Physiology), Joseph DiMicco* (Pharmacology and Toxicology)

Albert Eugene Sterne Professor
Christopher McDougle* (Psychiatry)

Raymond E. Houk Professor of Psychiatry
Anantha Shekhar* (Neurobiology, Pharmacology and Toxicology)

Joyce and Iver Small Professor of Psychiatry, Neurobiology, and Medical Genetics
John Nurnberger Jr.* (Neurobiology, Psychiatry)

Paul Stark Professor of Pharmacology
Michael Vasko* (Pharmacology and Toxicology)

Showalter Professor
Grant Nicol* (Pharmacology and Toxicology)

Mari Hulman George Professor
Xiao Ming Xu (Neurological Surgery)

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Raymond C. Beeler Professor of Radiology
Andrew Saykin (Radiology)

Professors
Tatiana Foroud* (Medical and Molecular Genetics), Charles Goodlett* (Psychology), Joseph Hingtgen* (Emeritus, Clinical Psychology, Neurobiology in Psychiatry), Debomoy Lahiri* (Psychiatry, Medical and Molecular Genetics), William McBride* (Biochemistry and Molecular Biology, Neurobiology in Psychiatry), James Murphy* (Neurobiology, Psychology), Sean O'Connor* (Psychiatry), Gerry Oxford* (Stark Neuroscience Research Institute, Pharmacology and Toxicology), Simon Rhodes* (Cellular and Integrative Physiology, Pharmacology and Toxicology), Jay Simon* (Psychiatry, Biochemistry and Molecular Biology), David Suzuki* (Ophthalmology, Anatomy and Cell Biology), Zao C. Xu* (Anatomy and Cell Biology), Feng Zhou* (Anatomy and Cell Biology)

Associate Professors
Ellen A.G. Chernoff* (Biology), Dena Davidson* (Psychiatry), Nicholas J. Grahame* (Psychology), Eri Hashino* (Otolaryngology, Anatomy and Cell Biology), Cynthia Hingtgen* (Neurology, Pharmacology and Toxicology), David Kareken* (Neurology, Neuropsychology), Michael Kubek* (Anatomy and Cell Biology), Wei-Hua Lee* (Pediatrics, Anatomy and Cell Biology), Aimee Mayeda* (Psychiatry), John H. Schild (Biomedical Engineering), Debbie Thurmond* (Biochemistry and Molecular Biology), Frederick Unverzagt (Psychology), Ruben Vidal (Pathology and Laboratory Medicine), Donald Wong* (Anatomy and Cell Biology)

Assistant Professors
Nikolai Broustovetski (Pharmacology and Toxicology), R. Andrew Chambers (Psychiatry), Theodore Cummins (Pharmacology and Toxicology), Yansheng Du* (Neurology), Andrew Hudmon* (Biochemistry and Molecular Biology), Rajesh Khanna (Pharmacology and Toxicology), Samy Meroueh* (Biochemistry and Molecular Biology), Evan Morris (Biomedical Engineering), Alexander B. Niculescu III (Psychiatry), Alexander Obukhov (Cellular and Integrative Physiology), Xiaoxi Qiao (Opthalmology), Leonid Rubchinsky (Mathematical Sciences), Xin Zhang (Medical and Molecular Genetics)

Associate Research Professor
Sandra Morzorati* (Neurobiology)

Assistant Research Professor
Richard J. Thielen (Neurobiology, Biochemistry and Molecular Biology)

Graduate Advisor
Professor Grant Nicol*, MS A402, (317) 274-1570

Degrees Offered
Master of Science and Doctor of Philosophy

Special Program Requirements
(See also general University Graduate School requirements.)

Bachelor's degree in chemistry, biological sciences, physics, mathematics, engineering, or psychology, which includes courses in general chemistry (8 credit hours), organic chemistry (8 credit hours), physics (4 credit hours), biological sciences (8 credit hours), and mathematics through calculus. Promising students may be accepted even though certain undergraduate prerequisites may be lacking, but they must remove deficiencies during the first year of graduate study. The Graduate Record Examination General Test results must be available before applicants will be considered for admission.

Master of Science Degree

Course Requirements
A total of 30 credit hours, including at least 17 credit hours of approved courses and 3 credit hours of research.

Thesis
Required.

Final Examination
Comprehensive oral examination.

Doctor of Philosophy Degree

Course Requirements
A total of 90 credit hours, including dissertation. A minimum of 36 credit hours must be in course work, the remainder in research.

Minor
Twelve (12) credit hours must be taken in one of the basic sciences associated with the Medical Neurobiology Program: anatomy, biochemistry, biology, medical genetics, microbiology and immunology, pathology, pharmacology, physiology and biophysics, and psychology. The minor can also be fulfilled by taking G715, G716, and G717.

Qualifying Examination
Written and oral.

Final Examination
Oral defense of dissertation.

Core courses include N800, N801, N802, N612, G743, N614, G744, N616, G745, P615, D527. Additional appropriate courses in the Departments of Anatomy, Biochemistry, Biology, Medical Genetics, Microbiology and Immunology, Pathology, Pharmacology and Toxicology, Physiology and Biophysics, and Psychology will be accepted for credit toward the major with prior approval of the student's advisor.

Courses

N800 Research in Medical Neurobiology (cr. arr.) P: Consent of instructor with whom research is being done. Supervised literature and laboratory research in selected area(s) of medical neurobiology.

N801 Seminar: Topics in Medical Neurobiology (1 cr.) Required of all graduate students in program. Recent topics in medical neurobiology covered by literature and research reports and discussions by faculty, graduate students, and invited guest lecturers.

N802 Techniques of Effective Grant Writing (3 cr.) The grantsmanship course is designed to teach graduate students how to write an NIH application and to provide information on the review process. Students will complete an NIH R03 application by the end of the semester. All students will participate in a mock IRG-style review of each application at the end of the course.

N611 Fundamental Neuroscience—Introduction to Cell and Molecular Biology (1 cr.) A lecture/discussion course to introduce the student to general principles of cell and molecular biology and to provide an overview of general anatomy, electrical properties of neurons, and synaptic transmission. This course is designed as a primer for subsequent courses in the series (N612 through N617).

N612 Fundamental Neuroscience—Neurotransmitter Dynamics and Synaptic Plasticity (2 cr.) P: Consent of Instructor. A lecture/discussion course to explore the fundamental mechanisms involved in transmitter synthesis, release, storage, reuptake and general metabolism. Molecular mechanisms of synaptic plasticity as well as facilitation and depression of synaptic strength will also be explored.

N613 Fundamental Neuroscience—Electrical Signaling and Ion Channel Biology (2 cr.) P: Consent of Instructor. A lecture/discussion to explore the electrical properties of neurons, including various ion channels, ion channel pharmacology, and the generation, shape and conduction of action potentials.

N614 Fundamental Neuroscience—Special Senses and Integrative Neurophysiology (2 cr.) P: Consent of Instructor. A lecture/discussion course to explore fundamental concepts and mechanisms related to various sensory receptors (photo receptors, hair cells), spinal reflex circuits, central pattern generators, and the visual system as complex integrative model.

N615 Fundamental Neuroscience—Neuropharmacology of Synaptic Transmission (2 cr.) P: Consent of Instructor. A lecture/discussion course to explore the pharmacology of synaptic transmission with emphasis on transmitter receptors and basic pharmacologic principles including potency, efficiency, drug-protein interactions, ternary models for receptor activation, etc.

N616 Fundamental Neuroscience—Developmental Biology of Neuroscience (2 cr.) P: Consent of Instructor. A lecture/discussion course to explore concepts in basic neuroembryology including examination of molecular cures for axial patterning, axonal pathfinding and growth, developmental regulation of gene transcription, neural stem cells and glia; cell precursors, and regionalization of nervous system function.

N617 Fundamental Neuroscience—Intracellular Signal Transduction in Neurons (2 cr.) P: Consent of Instructor. A lecture/discussion course to explore the fundamentals of signal transduction with emphasis on G-protein signaling mechanisms, post-translational modifications of neural proteins, growth factor, integrin and calcium signaling pathways, and lipid signaling in neurons.

Anatomy
D527 Neuroanatomy (3 cr.)
D863 Peripheral Nervous System (2-3 cr.)
D875 Topics in Advanced Neuroanatomy (2-5 cr.)
D876 Neurotransmitter and Neuroendocrine Cytology and Anatomy (3 cr.)

Biochemistry
B500 Introductory Biochemistry (3 cr.)
B835 Neurochemistry (3 cr.)
B836 Advanced Topics in Neurochemistry (2 cr.)

Graduate
G743 Fundamentals of Electrical Signaling and Ion Channel Biology (1 cr.) Experimental basis for cellular and molecular concepts of electrical excitability and membrane transport through ion channels. The goals are to foster an understanding of how we accumulate information and to provide students with tools to evaluate hypotheses and to define unanswered questions, rather than provide current “facts” to memorize.

G744 Neuropharmacology of Synaptic Transmission: Receptors and Ligands (1 cr.) Experimental basis for current cellular and molecular concepts of postsynaptic receptors and signals involved in chemical synaptic transmission in the nervous system. The goals are to foster an understanding of how we accumulate information and to provide students with tools to evaluate hypotheses and to define unanswered questions, rather than provide current “facts” to memorize.

G745 Fundamentals of Intracellular Signal Transduction in Neurons (1 cr.) Experimental basis for cellular and molecular concepts of intracellular signaling cascades attending neurotransmitter, growth factor, and cytokine receptor activation in neurons. The goals are to foster an understanding of how we accumulate information and to provide students with tools to evaluate hypotheses and to define unanswered questions, rather than provide current “facts” to memorize.

G865 Fundamental Molecular Biology (3 cr.) P: B800 or equivalent. Principles of molecular structure, function, and biosynthesis; core information regarding prokaryotic and eukaryotic gene continuity and metabolic coordination; introduction to multicellular systems and problems.

Pharmacology and Toxicology
F602 Pharmacology: Lecture (5 cr.)

Physiology and Biophysics
F613 Mammalian Physiology Lecture (5 cr.)