NEUROSCIENCE, PHD

The Neuroscience Doctoral Program is an interdisciplinary graduate program composed of doctoral students and faculty members from departments across five divisions and three campuses of Tulane University. As an educational branch of the Tulane Brain Institute, the program is administered through the School of Science and Engineering and governed by the Neuroscience Doctoral Training Committee. Appointed by the Director of the Tulane Brain Institute, the Committee is composed of a director and five faculty members representing the Main and Medical School campuses. Contributing divisions include the Schools of Science and Engineering, Liberal Arts, Medicine, Public Health and Tropical Medicine, and Primate Center. Faculty research programs are funded through grants competitively awarded by federal, state, and private agencies under four major themes: Memory and Cognition; Neurodegenerative Disease; Neural Injury and Repair; Hormone-Brain Interactions; and Brain-Body Health.

Doctoral students conduct cutting-edge research in modern laboratory environments that foster supportive instruction and intensive training in the neurosciences. The Neuroscience Doctoral Program provides graduate students with a broad education in both the theoretical and applied aspects of basic research in the neurosciences. Through their coursework and research, students receive diversified training in neuroanatomy, neurophysiology, neuropharmacology, neuroendocrinology, molecular and cellular neurobiology, behavioral neuroscience, cognitive neuroscience, and research methods. In addition, students have opportunities to present and publish their research findings, and to gain experience in grant writing and teaching pedagogy. The objective of the Neuroscience Doctoral Program is to prepare graduate students for their future postdoctoral training and careers in academia, industry, and related professions.

All students are guaranteed to receive financial support for five years as long as satisfactory and timely progress is made toward the degree. Financial support includes a full tuition waiver and a stipend paid every other week over twelve months of the year. Students are funded during their first two years by teaching assistantships. After the first two years students are supported by research assistantships arranged though their major advisors in their permanent laboratories.

Requirements

Doctoral Degree Requirements

The pursuit of the Ph.D. degree is a journey with five major milestones. (1) Students must successfully complete a curriculum consisting of core and elective courses taken during the first two years of study. (2) Students complete three rotations in different laboratories, each 6-8 weeks in duration, during the first year of study in order to identify a permanent laboratory. (3) Students must pass written and oral components of a qualifying examination in the third year of study administered by the Doctoral Committees. (4) Students must prepare and defend a dissertation prospectus before their Doctoral Committees in the fourth year of study. (5) Students must complete their dissertation research, prepare a written form of the dissertation, orally defend the dissertation, and receive approval from their Doctoral Committees as the final step toward earning the Ph.D. within five years.

Required Course Work

A minimum of 50 course credits are required for the Ph.D. in Neuroscience. Of these 50 credits, 38 credits are fulfilled by completing core courses (20 credits), research rotations (6 credits), and elective courses (12 credits). Up to 12 additional credits may be satisfied by registration in NSCI 7980 Research In Neuroscience-Phd (1-9 c.h.). Credits earned in NSCI 9990 Dissertation Research (3 c.h.) do not count toward the 50 required credits. Course credits taken beyond the 50-credit minimum are included in the tuition waiver. Up to 15 course credits toward the final 50 required credits can be earned in Tulane's Master's Programs in Neuroscience (4+1 and M.S.). However, the following courses taken at the Master's level cannot count toward the Ph.D. degree: (Brain Institute Seminar, Trends in Neuroscience, Research in Neuroscience).

Core Courses

The completion of core courses is required of all doctoral students, which comprise 20 of the 50 total credits required for the Ph.D. in Neuroscience.

NSCI 7110 Graduate Neuroscience I (3 c.h.) – Offered only during fall semesters, this course encompasses the basic principles of neuroscience at the graduate level, focusing on cellular and molecular neurobiology, neurophysiology and plasticity, and developmental neurobiology.

NSCI 7120 Graduate Neuroscience II (3 c.h.) – Offered only during spring semesters, this course encompasses the basic principles of neuroscience at the graduate level, focusing on systems neuroscience and behavioral neuroscience as well as neuroanatomy.

NSCI 6150 Methods in Neuroscience (3 c.h.) – Offered only during fall semesters, this course encompasses experimental design as well as contemporary theories, methodological approaches, and common techniques used in neuroscience research. Basic and translational neuroscience methods are included. Approaches include molecular, cellular, genetic, biochemical, computational, and behavioral.

NSCI 6030 Brain Institute Seminar (1 c.h.) – Offered every semester, this seminar series is designed to provide students with exposure to contemporary research conducted by neuroscientists at Tulane and from other local and national institutions. Students receive academic credit for Brain Institute Seminar during their first four semesters of study in the doctoral program, but are expected to attend throughout their period of graduate training.

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**NSCI 6040 Trends In Neuroscience (1 c.h.)**  – Offered every semester, this course is designed to allow students to learn to critically read and interpret scientific literature and to present and discuss research with their peers. Students receive academic credit for *Trends in Neuroscience* during their first four semesters of study in the doctoral program.

**PSYC 6090 Univariate I (3 c.h.)**  – Offered only during fall semesters, this course covers experimental design and statistical analyses used in scientific research. Topics include z-distribution, t-distribution, analysis of variance, post-hoc tests subsequent, correlation, simple and multiple linear regression, and chi-square analysis. Students may petition to substitute other graduate-level statistics courses taught at Tulane for *Univariate Statistics I*.

**INTD 6010 Responsible Conduct of Research (0 c.h.)** - Offered during the fall semesters by the Tulane University Research Compliance Office, this course is required by the federal funding agencies for students earning doctoral degrees in a biomedical-related science.

**Elective Courses**

A minimum of 12 course credits (4 elective courses) may be obtained for courses with numbers of 6000 or 7000. A list of some appropriate three-credit elective courses follows. Students should consult other departments and programs for other electives of potential interest, which must be approved by the Director of the Neuroscience Doctoral Program.

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**Courses**

**NSCI 6030 Brain Institute Seminar (1)**

Students attend weekly departmental seminars as an introduction to research hypotheses, techniques and presentations. Course may be repeated up to unlimited credit hours.

**NSCI 6040 Trends In Neuroscience (1)**

Students select, analyze, present, and discuss recent empirical articles in the field of Neuroscience. During most weeks, an article authored by a neuroscientist who is presenting a departmental colloquium will be selected to facilitate understanding of the presentation. Therefore, students are required to enroll in the companion course NSCI 6030, Neuroscience Seminar. Course may be repeated up to unlimited credit hours.

**NSCI 6060 Behavioral Endocrinology (3)**

An introduction to the roles of steroid and peptide hormones in physiology and behavior. Lectures focus on the hormonal mechanisms that control reproductive and regulatory functions in human and infrahuman species.

**NSCI 6070 Neurobiology of Aging (3)**

This course will survey the current literature in clinical and research journals regarding the Neurobiology of the aging process. Emphasis is placed on the state of research in aging, looking at experimental design issues as well as published results. Connections will be drawn between the research literature and current clinical practice, as well as what the research literature says regarding aging and lifestyle.

**NSCI 6110 Brain and Language (3)**

The goal of this course is to learn how the brain is organized to produce and comprehend language and to understand linguistic disorders attendant on brain damage. There is an optional service learning component in which students can work with a speech therapist at a local healthcare provider.

**NSCI 6130 Sport Rel Brain Injury (3)**

This course will provide students with a conceptual and practical appreciation of contemporary neuroscience techniques that are utilized for the assessment and rehabilitation of athletes that suffer sport related concussion(s), including both strengths and limitations. The course will provide an innovative and engaging environment within the community for supervised exploration of specific components of sport concussion management including education/prevention and baseline testing. The students will also communicate research findings in oral and written formats. Course grades will be determined by the students performance on test(s), scientific article critiques, student lead class discussions, and a group project. In lieu of a final exam, students will submit a group project that will simulate the process to complete a clinical research project.
**NSCI 6150 Methods in Neuroscience (3)**
A lecture course exposing students to contemporary theories and techniques used in cellular and behavioral neuroscience by Tulane neuroscientists in their own research programs. The course is taught by faculty members representing several departments from both the uptown and downtown campus and the Health Sciences Center.

**NSCI 6200 General Endocrinology (3)**
This course explains the basics of hormone action and hormone interactions with their receptors, with an emphasis on the molecular mechanisms by which homeostasis is maintained in multicellular organisms. Physiological outcomes of hormone actions on different organs, as well as aberrant hormone action will be covered. Open to undergraduates by petition who plan to transfer credit to the 4+1 Program in Neuroscience.

**NSCI 6220 Neural Microengineering (3)**
In recent years, a number of technologies have been developed and utilized for probing the nervous system. This course will focus on microscale tools, technologies, and techniques employed for the control, manipulation, and study of the nervous system in vitro. Course material will be presented primarily by students who prepare presentations from extensive background literature review. A number of projects will be assigned as design challenges in which multiple interdisciplinary groups will research and present proposed solutions to the same challenge. No background in engineering or math is required. Generally offered every other Spring.

**NSCI 6310 Cellular Neuroscience (3)**
In-depth coverage of the basic principles of cellular neuroscience, including the biophysical basis of the membrane potential, action potential generation and propagation, and synaptic signaling. Students also will be introduced to the synaptic organization of higher neural systems, such as the visual, auditory and somatic sensory systems. In addition, a term paper is required. Open to graduate students only. Students are required to take NSCI 6360, Topics in Cellular Neuroscience, to obtain graduate credit.

**NSCI 6320 Systems Neuroscience (3)**
The subject of this course is the human nervous system, its anatomy, connectivity and function. Discusses the normal structure of the nervous system and the relationship of that structure to physiological function. The course is taught from a practical, clinical point of view and is intended to prepare students for further study in the neurosciences. In addition, a term paper is required. Prerequisite(s): CELL 3310 or NSCI 3310.

**NSCI 6330 Neurobiol Learn & Memory (3)**
An introduction to the study of the neural mechanisms involved in learning and memory. The course involves detailed study of the memory systems of the brain as well as historical trends, theoretical perspectives and empirical findings that are associated with the neurobiology of learning and memory. Open to undergraduates by petition who plan to transfer credit in Neurobiology of Learning and Memory to the 4+1 Program in Neuroscience.

**NSCI 6340 Neurobiology of Disease (3)**
Advanced course on the higher neural functions of the nervous system and neurological diseases resulting from disruption of these functions. An emphasis is placed on the physiology of the nervous system and neural dysfunction caused by inherited and acquired diseases. Topics range from motor control and neuromuscular diseases to high cognitive function and dementia. Clinical interventions as well as current research are discussed. In addition, a term paper is required. Open to undergraduates by petition who plan to transfer credit in Neurobiology of Disease to the 4+1 Program in Neuroscience.

**NSCI 6350 Developmental Neurobiol (3)**
A broad overview of the different stages of neural development. Examination of the molecular aspects of developmental neurobiology, with reference to some important signaling pathways involved in neural growth and specification. Particular attention will be given to those active research fields, such as growth cone guidance and collapse and activity-dependent development, and applications of these to injury and disease. In addition, a term paper is required. Open to undergraduates by petition who plan to transfer credit to the 4+1 Program in Neuroscience.

**NSCI 6360 Neuroscience & CNS Dissection (3)**
The course emphasis is extracting intact Central Nervous System (CNS) structures with connecting peripheral nerves. The course will look at specific pathways (afferent, efferent, dermatomes) and discuss related clinical manifestations associated with lesions to the individual CNS and peripheral nerve structures. Team dissection will attempt to save substantial segments of cranial nerves and will explore the structures with which they communicate. As student progress through the dissection they will: 1) identify structures that surround and or cover the CNS; 2) log them in a course notebook and then dissect appropriate structures. Grading will be based upon participation, complete notebooks and final dissection results. (e.g., did you remove the brain, spinal cord, and peripheral nerves as a single unit in reasonable condition?) Notes: Satisfies neuroscience laboratory requirement. Cross-listed with NSCI 3360.

**NSCI 6370 Molecular Neurobiology (3)**
Introduction to the molecular biology of neurons and neuronal function. Topics of study will include: the molecular composition of nerve cells, and how this provides a basis for their functional properties; their synaptic connectivity; how they receive, transmit and retain information at a molecular level. Studies will focus on current research in the field of molecular neurobiology. In addition, a term paper is required. Open to undergraduates by petition who plan to transfer credit to the 4+1 Program in Neuroscience.
**NSCI 6400 Neuroscience Applied (3)**
This course is designed for neuroscience graduate students to help them utilize and apply their skills and knowledge of neuroscience and to help prepare them for their future professions. The course consists of individual and group presentations, discussion of selected readings, career preparation activities, invited speakers, evaluation/feedback, and a final project as students develop their critical thinking, analytical, and communication skills. For Graduate Students only.

**NSCI 6450 Genome Biology (3)**
Genome-level science is changing the pace of biomedical research and medicine. This course will examine how whole genomes, transcriptomes, and proteomes are studied, and what we are learning about the biology of multiple organisms using these novel techniques. Epigenetics, genomics, and proteomics will be covered in the context of disease and the development of novel therapeutics. NOTE: Cross-listed as CELL/NSCI 4450/ 6450/ 7450.
Prerequisite(s): NSCI 4370 or CELL 3030.

**NSCI 6500 Adv Molec Neurobiology (3)**
This course provides detailed description and in-depth discussion of current techniques and experimental topics in the field of molecular neurobiology.

**NSCI 6530 Psychopharmacology (3)**
An introduction to the effects of psychoactive agents on the nervous system. Lectures emphasize the mechanisms by which drugs regulate neurotransmitter systems to alter psychological and physical states. Open to graduate students. Open to undergraduates by petition who plan to transfer credit in Psychopharmacology to the 4+1 Program in Neuroscience.

**NSCI 6550 Syn Org of the Brain (3)**
The goal of this course is to discuss and understand functional connections within and between areas of the brain to lead to a greater understanding of brain function and behavior. We will focus on limbic and memory systems. A strong emphasis will be placed on in-class discussions and student presentations to enhance critical thinking and oral presentation skills.

**NSCI 6590 Stress & Trauma (3)**
This course provides an overview of the psychobiological bases of stress and trauma reactions and related psychological disorders.

**NSCI 6630 Cellular Neurophysiology (3)**
Survey of current topics and techniques in the physiology of neurons and neuronal circuits, concentrating primarily on electrophysiological studies.

**NSCI 6660 Special Topics (1-3)**
Courses offered by visiting professors or permanent faculty primarily for undergraduates. For description, consult department.

**NSCI 6661 Special Topics in NSCI (0-3)**
Course may be repeated up to unlimited credit hours.

**NSCI 6665 Special Topics Lab (1-3)**
Special Topics Lab.

**NSCI 6900 Graduate NSCI Internship (1-3)**
Course may be repeated up to unlimited credit hours.

**NSCI 6940 Transfer Coursework (0-20)**
Transfer coursework at the 6000 level. Departmental approval required.

**NSCI 7100 Special Projects In NSCI (1-3)**
Individual studies in a selected field with approval of instructor and advisor. Course may be repeated up to unlimited credit hours.

**NSCI 7110 Graduate Neuroscience I (3)**
An advanced survey of cellular neuroscience team-taught by members of the Tulane Neuroscience Program faculty. Topics covered include, among others: neuronal electrogenic properties, synaptic transmission and neuromodulation, signal transduction, neurotransmitter systems, synaptic plasticity, blood-brain barrier, glia, and neuropsychiatric disorders. The objective of the course is to achieve a fluency in neuroscience that will provide a foundation for pursuing further graduate-level neuroscience study and research. Restrictions: Open only to graduate students in Neuroscience.
NSCI 7120 Graduate Neuroscience II (3)
This course is concerned with the structure and function of the human nervous system. In addition to lectures, this course provides hands-on examination of neuroanatomical structures. Most neuroscience research requires a working knowledge of the structural components of the nervous system as the basis of understanding conceptual aspects of nervous system function. This course is designed to provide a clear and concise account of the anatomy of the human nervous system in sufficient detail to understand the main functions and common disorders which impact the nervous system. This method will demonstrate how knowledge of neuroanatomy can aid in understanding clinical symptoms and emphasizes those areas of neuroanatomy which are particularly relevant to human neurological disorders. In addition, this course will focus on some broad aspects of human neuroscience and how they are rooted in the structure of the nervous system. Restrictions: Open only to graduate students in Neuroscience.

NSCI 7130 Research Rotations (3)
First-year doctoral students in Neuroscience complete research rotations in three different laboratories lead by faculty members of the Tulane Brain Institute before placement in a permanent laboratory to pursue doctoral training. The research objectives of each rotation are outlined by the supervising faculty member at the beginning of the rotation, typically 6-8 weeks in length. Three credits are earned for the first research rotation completed during the fall semester in the doctoral program and three additional credits are earned for the two research rotations completed during the spring semester. Course may be repeated 2 times for credit. Restrictions: Open only to first-year doctoral students in Neuroscience.

NSCI 7240 College Teaching Pedagogy (3)
The objective of Teaching Pedagogy is to provide a structured learning experience for doctoral students in Psychology and Neuroscience to facilitate their preparation to teach at the collegiate level and to increase their competitiveness on the job market. The course focuses on strategies and techniques to teach undergraduate and graduate courses in Psychology and Neuroscience.

NSCI 7241 College Teaching Practicum (1-4)
College Teaching Practicum allows doctoral students in Psychology and Neuroscience to design, prepare, and team-teach a section of an undergraduate course in their areas of expertise. Students receive supervision and mentoring based on classroom observations by Dr. Dohanich and other faculty members. Each student enrolled in the course teaches approximately 25% of an undergraduate course. Final grades are based on the effectiveness of teaching as evaluated by Dr. Dohanich using the attached rubric provided the CELT Peer Observation Program. The College Teaching Pedagogy course (PSYC/NSCI 7240) is the mandatory pre-requisite course for College Teaching Practicum.

NSCI 7260 Graduate Communications (3)

NSCI 7450 Genome Biology (3)
Genome-level science is changing the pace of biomedical research and medicine. This course will examine how whole genomes, transcriptomes, and proteomes are studied, and what we are learning about the biology of multiple organisms using these novel techniques. Epigenetics, genomics, and proteomics will be covered in the context of disease and the development of novel therapeutics. NOTE: Cross-listed as CELL/NSCI 4450/ 6450/ 7450.

NSCI 7940 Transfer Credit-Grad (1-3)
Course may be repeated up to unlimited credit hours.

NSCI 7980 Research In Neuroscience-PhD (1-9)
Individual research supervised by faculty.

NSCI 7981 Research in Neuroscience -MA (1-9)
Individual research supervised by faculty. Course may be repeated up to unlimited credit hours.

NSCI 9980 Master's Thesis Research (3)
Research toward completion of a masters degree. Course may be repeated up to unlimited credit hours.

NSCI 9990 Dissertation Research (3)
Research toward completion of a doctoral degree. Course may be repeated up to unlimited credit hours.