First Year Courses

NEUR-701. Introduction to Neuroscience I. (5)
Co-listed: N/A
Replaces: NUSC 712
Description: Neuroscience I is the first in a required two-course series for first-year neuroscience graduate students covering basic topics in the neurosciences. Neuroscience I is offered only in the fall semester and deals with neuroanatomy (six weeks), cellular and molecular neuroscience (six weeks), and developmental neuroscience (three weeks). Approximately one third of the course includes laboratory work in neuroanatomy. For non-Neuroscience students, the neuroanatomy block may be taken separately as a two-credit course, and the cellular and molecular neuroscience block may be taken separately as a two-credit course. Instructor: Oppenheim

NEUR-702. Introduction to Neuroscience II. (4)
Co-listed: N/A
Replaces: NUSC 713
Description: Neuroscience II is the second in the series of required courses for first-year neuroscience graduate students covering basic topics in the neurosciences. Topics covered include: developmental neuroscience (3 weeks), sensory (six weeks) and motor systems (six weeks). Cognitive and computational neuroscience are also covered. For non-Neuroscience students, the sensory block may be taken separately as a two-credit course, and the motor systems block may be taken separately as a two-credit course. Instructor: Oppenheim

NEUR-703. Quantitative Methods in Behavioral Science. (2)
Co-listed as: Track 5 course TBD
Replaces: PSPR 741
Description: Addresses applied statistical approaches within common behavioral research studies. Focus is on selection of the most appropriate test for research aims and hypotheses as well as computational methods. Specific topics include power analyses, effect sizes, analyses of variance, analyses of covariance, regression techniques, multivariate statistics, and post-hoc testing. Instructor: Liguori

NEUR-704. Seminars in Neuroscience. (1)
Co-listed as: N/A
Replaces: NUSC 709
Description: This will be a weekly seminar given by students, postdocs, faculty and external speakers. It will run throughout the year and will be structured so that each student will present a research seminar in a given year. First–third year students will give a 30-minute seminar and senior students will give an hour seminar. First year students will be assigned seminar slots during the summer between first and second year. The remaining slots will be used by postdocs and faculty. Once a month or bi-monthly, there will be an external speaker. Departments and the WNCsFN Chapter will take turns sponsoring the seminars by external speakers. Students will be required to maintain a seminar notebook. Instructor: TBA

NEUR-705. Tutorial in Neuroscience. (0)
Co-listed as: N/A
Replaces: NUSC 715; NBAT 702
**Description:** The Tutorial in Neuroscience will run during the spring and fall semesters. The format is one in which a faculty member or postdoc presents his/her research and a student presents a paper on a topic related to that research. It will be a required course for 1st and 2nd year students, but will be open to all students. **Instructor:** TBA

**NEUR-706. Research.** (1-9)
- Co-listed as: N/A
- Replaces: NUSC 725,726; NBAT 791,792
- **Description:** Lab research in all areas of modern neurobiology, including studies done as part of the first-year research rotations and the requirements for the doctoral dissertation.

### Upper Level Courses

#### Behavioral Neuroscience

**NEUR-711. Animal Behavior.** (3)
- Co-listed as: PSY 623; BIO 623
- Replaces: N/A
- **Description:** Survey of laboratory and field research on animal behavior. **Instructor:** Connor

**NEUR-712. Hormones and Behavior.**
- Co-listed as: BIO 624
- Replaces: N/A
- **Description:** (3) Introduction to the hormonal regulation of behavior in a broad range of animals, including humans and invertebrates. Topics include reproductive behavior, parental behavior, social behavior, sex differences, aggressive behavior, stress, mood, and the regulations of molting in insects. **Instructor:** Fahrbach

**NEUR-713. Chronobiology.** (3)
- Co-listed as: BIO 625
- Replaces: N/A
- **Description:** Introduction to the field of biological rhythms, covering different types of rhythms, their evolution, and the mechanisms by which such rhythms are generated and regulated at the molecular, cellular, and system levels. **Instructor:** E. Johnson

**NEUR-714. Behavioral Neuroscience.** (3)
- Co-listed as: N/A
- Replaces: NUSC 701
- **Description:** Behavioral neuroscience is a relatively new and rapidly expanding discipline utilizing techniques of molecular biology, neurochemistry, neurophysiology, and psychology to investigate the neurobiological basis of behavior. A broad overview of the field and its relationship to these individual disciplines is presented. The course provides a survey of the field from the cellular level to the complexity of molar aspects of behavior including learning and memory. An introduction to lab models of human neurobiological disorders is included. **Instructor:** TBA

**NEUR-715. Behavioral Pharmacology.** (3)
- Co-listed as: Track 5 course TBD
- Replaces: NUSC 722; PSPR 722
- **Description:** Focuses on behavioral factors that influence the effects of drugs. Material presented provides a detailed review of the rate-dependent, reinforcing, and stimulating effects
of drugs. Additional topics include behavioral factors related to tolerance and sensitization and a review of animal models of drug action. **Instructor:** TBA

**Cell and Molecular Neuroscience**

**NEUR-721. Molecular Neuroscience.** (3)
Co-listed as: N/A
Replaces: NUSC 704; NBAT 704
**Description:** Introduces graduate and advanced undergraduate students to the basic principles of neurobiology as studied by cell and molecular biologists. Lectures introduce invertebrate and vertebrate model neuronal systems and the cellular and molecular methods to study them. P—POI. **Instructor:** Hegde

**NEUR-722. Special Topics in Stem Cell Biology.** (3)
Co-listed as: MMTS 719; MOGN 719; CABI 719 or Track 4 course TBD
Replaces: N/A
**Description:** Utilizes directed reading assignments from the primary literature and student presentation of seminal papers to introduce students to the field of Stem Cell Biology and the underlying biology of stem cell properties. Content will focus primarily on human stem cells and will include, but will not be limited to, pluripotency and its maintenance, the role of chromatin remodeling in fate determination and lineage restriction, self-renewal & differentiation, and genetically induced pluripotent stem cells derived from somatic cells. The field is expanding rapidly and the content will be modified as needed to incorporate new findings and developing applications in translational medicine. (2H, 2C) Prerequisites for this course: POI **Instructor:** Wilson

**NEUR-723. Neuroendocrinology.** (3)
Co-listed as: Track 5 course TBD
Replaces: NUSC 736; PSPR 736
**Description:** Recent advances in neuroendocrinology, with emphasis on receptor-linked functions, hormonally-active drugs, and influences of pharmacologic agents on neuroendocrine function. In a tutorial setting, students study principles of structure and function, examine current technology and published literature, and design and critique experimental approaches. **Instructor:** TBA

**Cognitive Neuroscience**

**NEUR-731. Human Cognition.** (3)
Co-listed as: PSY 728
Replaces: N/A
**Description:** This is a graduate course in cognitive psychology, cognitive neuropsychology, and cognitive neuroscience in which we will review what we currently know, or think we know, about human cognition and its underlying neural basis. The course will focus on characterizing components of cognition such as attention, memory, language, and perception in terms of their functional properties and in terms of how they are instantiated in the brain. **Instructor:** Dagenbach

**NEUR-732. Perception.** (3)
Co-listed as: PSY 629
Replaces: N/A
**Description:** How we perceive the world differs from what exists in reality. The study of Perception examines these discrepancies and how the psychological world relates to the physical world as indicated by the formal title “psycho-physics”. This course will explore the
principles that underlie how psychologists study the processes of the senses. It will focus on three main issues: (1) the philosophical problems that underlie the mind-body problem, (2) the physiological mechanisms that determine how the body works, and (3) the perceptual mechanisms that demonstrate how the mind interprets the world. **Instructor: Schirillo**

**Development and Aging of the Nervous System**

**NEUR-741. Developmental Neuroscience.** (3)
Co-listed as: BIO 652  
Replaces: N/A  
**Description:** Focuses on the development of neural structures and the plasticity of the mature nervous system. Special attention is given to experimental model systems, particularly Drosophila melanogaster. The labs feature molecular, immunocytochemical, and cell culture techniques for studying neurons. **Instructor:** Fahrbach

**NEUR-742. Developmental Neurobiology I: Molecular Control of Neural Lineages and Differentiation.** (3)  
Co-listed as: N/A  
Replaces: NUSC 751; NBAT 751  
**Description:** Designed as an introduction to principles of early neural development. Topics include both the genetic and epigenetic control of early developmental events, including the determination of neuronal and glial cell lineages, expression of homeotic genes and neural pattern formation, inductive signal events required for neuronal differentiation and migration in both the central and peripheral nervous system, and the role of the extracellular environment in axonal growth. Students examine both historical and current models of molecular mechanisms regulating neural development through prescribed readings, tutorials and interactive discussion sessions. A weekly hands-on tutorial introduces students to a variety of cellular and molecular methods including mRNA analysis (mRNA purification, electrophoresis and Northern blot analysis, Rnase protection assays, RT-PCR analysis, cryostat sectioning, in situ hybridization) and protein analysis (protein polyacrylamide gel electrophoresis—PAGE, Western blot analysis, Immunoassays and Immunocytochemistry). **Instructor:** Oppenheim

**NEUR-743. Developmental Neurobiology II: Progressive and Regressive Events in Neural Development.** (3)  
Co-listed as: N/A  
Replaces: NUSC 752; NBAT 752  
**Description:** Emphasizes regressive and progressive events required for the maturation of neural systems. Topics include molecular mechanisms of regulating both normal and pathological cell death in neurons and glia, including extracellular signals, receptors and intracellular pathways promoting or preventing cell death. Also included are topics concerning the development, specificity and pruning of synaptic connections in neural networks, as well as the role of cell adhesion and extracellular matrix in the formation of neural networks. Students examine both historical and current molecular models of cell death, neurotrophism, neurotrophic factors and their receptors. A weekly hands-on tutorial introduces students to a variety of cellular and molecular methods including in vitro methods of analysis (explant and dissociated neuronal cell culture assays for studies of cell death and axonal growth) and in vitro methods (quantitative analysis of cell death including fluorescent, histological and TUNNEL labeling of cell death, methods of axonal and dendritic labeling and EM ultrastructural analysis of synaptic changes). **Instructor:** Milligan
NEUR-744. Developmental Neurobiology III: Neural Plasticity and Regeneration. (3)
Co-listed as: N/A
Replaces: NUSC 753; NBAT 753
Description: Focuses on the capacity of neural networks to be modified by experience or to be reconstructed after injury. Examines molecular mechanisms proposed for activity-dependent competition in the initial construction of the nervous system, the plasticity of connections in models of activity-mediated sprouting, mechanisms proposed for neural plasticity in learning and memory, and a comparison of events required for neuronal repair and regeneration in the PNS and CNS. Current attempts to utilize neural transplantation to enhance the recovery of function in models of neurological diseases and trauma are also reviewed. Students examine both historical and current models of neural plasticity and regeneration through prescribed readings, tutorials and interactive discussion sessions. Instructor: Riddle

NEUR-745. Physiology and Pharmacology of Aging. (3)
Co-listed as: Track 5 course TBD
Replaces: NUSC 730; PSPR 730
Description: Seminar on the physiology of aging and the study of drugs and the aging process. Presentations address current topics relevant to age-dependent changes in various organ systems and theories of aging. The topics of age-related alterations in drug absorption, kinetics, and metabolism are also examined. Emphasis is on degenerative diseases and mechanisms of action. Instructor: Nicolle

Sensory Neuroscience

NEUR-751. Sensory Biology. (3)
Co-listed as: BIO 664
Replaces: NUSC 764
Description: Lecture and lab course that examines a variety of sensory systems. The emphasis is on sensory physiology, although other aspects of sensory systems, e.g. molecular biology and anatomy, are also covered. In the laboratory, students learn several different procedures which they use to conduct assigned experiments. A final project is required in which students design and carry out their own experiments. Instructor: Silver

NEUR-752. Bioacoustics. (3)
Co-listed as: BIO 736
Replaces: N/A
Description: Analysis of the mechanisms of sound production, transmission, and reception, and their relevance to animal orientation and communication. Instructor: Conner

NEUR-753. Sensory Neuroscience I: Audition and Vision. (3)
Co-listed as: N/A
Replaces: NBAT 741
Description: This course is designed to introduce students to sensory neurobiology of visual, auditory, olfactory and gustatory systems from the cellular to systems level. Under each sensory system, the topics cover the receptors in the sensory organs, signal transduction, subcortical and cortical areas, and higher order processing. The course also includes topics relevant to sensory perception such as attention, working memory, decision making and plasticity. The course is structured to enable the students to learn
how individual sensory systems function and to recognize the parallels between sensory systems. **Instructor:** Hegde

**NEUR-754. Sensory Neuroscience II: Somatosensation, Taste and Olfaction.** (3)  
**Co-listed as:** N/A  
**Replaces:** NBAT 742  
**Description:** This course is the second in a series that focuses on mammalian sensory systems. The course is designed to introduce students to somatosensory, pain and multisensory processing from the molecular to the systems level. The aim is to introduce key concepts of global organization that transcend individual modalities. Cellular, molecular, behavioral and pharmacological approaches will be covered against the backdrop of relevant model sensory systems. **Instructor:** McHaffie

**NEUR-755. Research Design in Sensory and Systems Neurobiology.** (3)  
**Co-listed as:** N/A  
**Replaces:** NBAT 761,762  
**Description:** This course combines didactic material with hands-on approaches so that students learn to properly design experiments in neurobiology and are able to analyze quantitatively the resulting experimental data. The didactic component provides a brief survey of fundamental mathematical and statistical concepts (e.g., probability, Bayesian inference, curve fitting, hypothesis testing, nonparametric statistics), which serves as a foundation for more advanced techniques used to analyze neuronal data (e.g., signal detection theory, cross-correlograms, information theory). Through computer-lab sessions and homework assignments tailored to each topic, students translate the theoretical knowledge to practical application as they learn to use the Matlab programming environment. The specific quantitative methods covered, as well as the sample data used for the hands-on analysis assignments, are tailored according to the students' backgrounds, programming experience, and research interests. **Instructor:** Salinas

**Substance Abuse and Addiction**

**NEUR-761. Neuropharmacology.** (3)  
**Co-listed as:** Track 5 course TBD  
**Replaces:** NUSC 707; PSPR 740  
**Description:** General survey of neuropharmacology, emphasizing neurotransmitters, receptors and their interactions. Discusses general principles of drug action, including receptor binding, second messengers, and neurotransmitter metabolism. Surveys neurotransmitter function, including acetylcholine, biogenic amines, excitatory and other amino acids, and neuropeptides. **Instructor:** Jones

**NEUR-762. Biology of Alcohol Abuse—Alcoholism.** (3)  
**Co-listed as:** Track 5 course TBD  
**Replaces:** PSPR 724  
**Description:** Designed to instruct graduate and postdoctoral students on the pharmacological, physiological, and behavioral effects of alcohol. Lectures cover topics ranging from the epidemiology and etiology of alcohol abuse and alcoholism to the basic biochemistry, metabolism, and pharmacokinetics of alcohol in the mammalian system. Lectures concerning effects of alcohol on specific organ systems include the hepatic system, the endocrine system, reproductive systems, the cardiovascular system, the gastrointestinal system, and the renal and pancreatic systems. Lectures focusing on the effects of alcohol on the nervous system include neureceptor interactions, ethanol’s effects on intracellular signaling processes,
neuroanatomical substrates for the actions of alcohol, systems electrophysiology, and mechanism of the behavioral effects of alcohol such as the reinforcing effects, anxiolytic effects, amnestic effects, and motor impairing effects. The neuroscience lectures provide the basis for an exploration of the conditions leading to tolerance and dependence, and how the brain adapts to prolonged exposure to alcohol. **Instructor:** Jones/Weiner

**NEUR-763. Neurotoxicology.** (3)
**Co-listed as:** Track 5 course TBD
**Replaces:** NUSC 728; PSPR 728
**Description:** Identifies damage specific to the central nervous system that occurs after exposure to neurotoxic compounds. Emphasis is on cellular mechanisms that are altered and the classes of neurotoxic agents that induce cell damage. Experimental models and risk assessment are explored. **Instructor:** TBA

**NEUR-764. Current Topics in Drug Abuse.** (3)
**Co-listed as:** Track 5 course TBD
**Replaces:** PSPR 717, 718
**Description:** Provides students with perspective in the problem of drug abuse. Defines the basic issues central to the field of drug abuse, including concepts of tolerance, physical dependence and reinforcement mechanisms, and relates these issues to the current problems of drug abuse in society. Describes how current research in drug abuse contributes to the design of rational treatment and prevention programs. **Instructor:** TBA

**Translational Neuroscience**

**NEUR-771. Clinical Neuroscience.** (3)
**Co-listed as:** N/A
**Replaces:** NUSC 703
**Description:** Lectures and class discussions dealing with topics in neurobiology, pathophysiology, and treatment of patients with neurological and behavioral/psychiatric problems. Includes a brief introduction to major concepts of patient treatment and care with utilization of up-to-date methodology in clinical neuroscience. Students have the opportunity to observe and participate in patient evaluation and diagnostic testing in the clinical setting and to visit many of the neuroscience-related clinical research and treatment centers. Taught by both clinicians and basic science researchers. **Instructor:** Milligan

**NEUR-772. Drug Discovery and Development.** (3)
**Co-listed as:** Track 5 course TBD, Track 4 course TBD
**Replaces:** PSPR 734
**Description:** Introduces students to the intricacies of the pharmaceutical industry. Emphasis is on providing an overview of drug discovery from both the pharmacologic and business perspective. Students receive an overview of drug metabolism and pharmacokinetics, drug discovery, pre-clinical and clinical testing, and bioinformatics. **Instructor:** TBA

**NEUR-773. Introduction to Regenerative Medicine.** (3)
**Co-listed as:** BMES 631
**Replaces:** N/A
**Description:** The course explores the current state of the field of regenerative medicine with specific emphasis on the technological challenges that limit the efficacy and clinical translation of engineered tissues and therapies. Course content will be presented from both the life science (e.g., cell biology, organ physiology, biochemical methods) and engineering perspective (e.g.,
transport phenomena, materials engineering) to compare and evaluate alternative approaches and strategies that are being developed and tested. Emphasis is placed on the promising roles of stem cells, biologically-inspired materials, and gene therapies. Pre: BIOL 4884, MATH 2224. (3H, 3C) Graduate standing. **Instructor:** Wilson

Journal Clubs

**NEUR-781. Directed Journal Club in Sensory Neuroscience.** (1)
Co-listed as: N/A
Replaces: NBAT 747,748
**Description:** Correlates with the formal lecture courses in Sensory Neuroscience I and II. Students are required to read and critique papers chosen to complement the classroom lectures. Both seminal papers and current research are reviewed. The directed nature of the readings enhances the student’s appreciation and understanding of the formal lectures. Students lead the presentation of the journal articles, thus providing opportunities for teaching in the area of sensory systems. **Instructor:** Hegde/McHaffie

**NEUR-782. Directed Journal Club in Developmental and Molecular Neurobiology.** (1)
Co-listed as: N/A
Replaces: NBAT 757,58
**Description:** Correlates with the formal lecture courses in Cellular, Molecular, and Developmental Neurobiology I-III. Students are required to read and critique papers chosen to complement the classroom lectures. Both seminal papers and current research are reviewed. The directed nature of the readings enhances the student’s appreciation and understanding of the formal lectures. Students lead the presentation of the journal articles, thus providing opportunities for teaching in these areas. **Instructor:** Milligan

**NEUR-783. Directed Journal Club in Network Science in Neuroimaging.** (1)
Co-listed as: N/A
Replaces: NUSC 763
**Description:** This journal club covers articles related to network science and its application in biological systems, with a particular emphasis on the brain. Assigned reading will cover methodological foundation of network science, as well as the current literature on applications of network science in neuroimaging studies. Although the brain network will be of the main focus, readings may also include other types of networks such as biological, social and technological networks. **Instructor:** Hayasaka

**NEUR-784. Translational Cognitive Aging Journal Club.** (1)
Co-listed as: N/A
Replaces: N/A
**Description:** The interface of Gerontology, Physiology, Pharmacology and Neuroscience is the focus of a Cognitive Aging journal club that meets twice a month. This journal club includes faculty and students that study the mechanisms of rodent, monkey and human brain aging in order to foster an understanding of and create progress in translational-science cognitive aging research. The first meeting of the month is spent focusing on the basic science (molecular or imaging) that informs cognitive aging in primates. The second meeting of the month is focused on molecular behavioral neuroscience in rodent models with an emphasis on the basic mechanisms of learning and memory in the aged brain. **Instructor:** Nicolle and Peiffer

NEUR 786. Behavioral Pharmacology Journal Club. (1)
Co-listed as:  Track 5 course TBD
Replaces:  NUSC 715; NBAT 702

Description:  In this course, students read and present journal articles of current or historical importance that involve drugs and have behavior as the primary dependent variable.
Instructor:  Roberts

Special Topics Courses

NEUR-791. Readings and Directed Study in Neurobiology. (1-2)
Co-listed as:  N/A
Replaces:  NUSC 783,784; NBAT 715,716

Description:  Designed to provide an opportunity for graduate students to learn specific topics in the field that may not be covered by regular courses. Materials from the primary literature are presented to other participants, including at least one faculty member. The format is intended to generate in-depth discussion in a setting where each student acts as the lecturer. The supervising faculty member and the student will determine together the schedule and credit hours (either 1 or 2) for the course.  Instructor:  TBA

NEUR-792. Special Topics in Developmental Neurobiology. (2)
Co-listed as:  N/A
Replaces:  NUSC 711; NBAT 721, 722

Description:  Designed to focus on a specific theme each semester, including such topics as cell death and regressive events, synaptogenesis, determination and differentiation, axonal guidance and pathway formation, neuronglia interactions, and neurotrophic agents.  Instructor:  TBA

NEUR-793. Advanced Readings in Neuropharmacology. (2)
Co-listed as:  Track 5 course TBD
Replaces:  PSPR 713, 714

Description:  Individualized instruction involving detailed review of literature pertaining to a specific area of interest in neuropharmacology.  Instructor:  TBA

NEUR-794. The Development and Anatomy of Sensory Systems. (2)
Co-listed as:  N/A
Replaces:  NBAT 735

Description:  Designed as an introduction to the structure and ontogeny of the sensory pathways. Provides a foundation for the subsequent advanced coursework in sensory systems, which provides one of the most fertile experimental areas in developmental biology. Topics include basic genetic control of developmental processes; embryonic development of the sensory nervous system; development and organization of subcortical sensory pathways; development of sensory cortices; role of the environment in neural development; and the genetics of neuronal ontogeny.  Instructor:  Riddle

NEUR-795. Readings and Research in Neuropsychology. (2)
Co-listed as:  PSY 782
Replaces:  NUSC 782

Description:  Allows the graduate student, working under the supervision of a faculty member, to pursue and receive credit for a special project in an area not covered by regular courses or a special research project not related to the master’s thesis. Supervising faculty member and credit hours for the course are determined by graduate committee prior to registration.
Instructor: TBA

NEUR-796. Special Topics in Sensory Neuroscience: Hearing and Multi-Sensory Integration. (2)
Co-listed as: N/A
Replaces: NBAT 731, 732.
Description: Emphasizes current topics in neuroscience pertaining to sensory systems. Topics cover neurobiology of individual sensory systems such as visual, auditory, somatosensory, olfactory, and gustatory systems. The importance of multi-sensory integration, i.e. how different sensory systems function together to generate perception, is highlighted. Includes lectures, seminars, discussions, and reading assignments in the area of interest. P—POI. Instructor: TBA

NEUR-797. Manuscripts, Seminars, and Posters. (2)
Co-listed as: N/A
Replaces: NUSC 760
Description: A highly interactive course with enrolled students receiving detailed feedback on all written assignments. Covers areas such as writing style, composing abstracts, constructing figures and legends, as well as simulating the e-submission process (text, figures, cover letter, etc.). In addition, previously published work is dissected for style, structure, and presentation. Didactic lectures cover a wide range of subjects, including but not limited to, EndNote (for Web); basics of Adobe Illustrator; authorship issues, and responses to reviewer’s comments. Background in neuroscience not required. Open to graduate students from all programs. Instructor: Turner