

Neuroscience (NSCI)

NSCI 5001 Neuroscience Survey I 2 Credits

The course provides a survey of research in neuroscience currently underway at Georgetown University. Each semester the course is given, 16 faculty present the research topic being studied in their laboratories with emphasis on experimental design strategies and choices. Different faculty are chosen to present in different semesters. Students are given a reading list for each topic and the formal presentation by the faculty member is followed by an interactive discussion session. Students prepare a mini-grant proposal on a research topic chosen in consultation with the course director and a faculty member with expertise on the topic.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment limited to students in the PHD-NEUR, PHD-NEUR-SM, PHD-PHAR or PHD-PHAR-SM programs.

Enrollment is limited to Graduate level students.

NSCI 5002 Cellular Molecular Neurosci 6 Credits

This is the first semester of the neuroscience core course required of all IPN students. It covers the fundamentals of cellular and molecular neuroscience including cellular neurophysiology, neuropharmacology, signal transduction, and nervous system development, cell death, and regeneration as well as regulatory systems. NSCI507, Critical Readings in Neuroscience, is a corequisite.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a major in Biology, Biology, Biology, Biology, Neurobiology, Neurobiology, Neurobiology, Neurobiology, Neuroscience, Neuroscience, Neuroscience, Neuroscience, Psychology, Psychology, Psychology or Psychology.

Enrollment is limited to Graduate level students.

NSCI 5003 Neurosci Critical Readings 1 Credit

With the facilitation by a faculty member, the students read and critically evaluate current research literature. All students are responsible for reading and “dissecting” every paper; one paper is read and critically analyzed for two weeks. The class is conducted by the students, as in the case of “problem-based [case-based] learning”, where the research article is treated as the “case.” Analysis is conducted by identifying the “given” facts from previous research and the hypotheses that the authors are attempting “to prove.” The methods (Experimental Design) and results are critically examined in the context of the hypotheses. Before evaluating the conclusions, the class generates a list of questions and “Learning Objectives” which they fulfill by researching previous literature prior to the second week. The second session begins with a discussion of the information relevant to the Learning Objectives and the questions raised during the first week are answered before critically evaluating the conclusions of the paper. The faculty member helps to facilitate the discussion and maintain a good balance of student participation.

Level: Graduate, Undergraduate

Corequisites:

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to students with a major in Biology, Biology, Biology, Biology, Neurobiology, Neurobiology, Neurobiology, Neurobiology, Neuroscience, Neuroscience, Neuroscience, Neuroscience, Psychology, Psychology, Psychology or Psychology.

Enrollment limited to students in the PHD-NEUR-SM program.

Enrollment is limited to Graduate level students.

NSCI 5004 Neurobiology of Disease 2 Credits

Study of Neurological Diseases

Level: Graduate, Undergraduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment limited to students in the PHD-NEUR or PHD-NEUR-SM programs.

NSCI 5005 Systems Cognitive Neurosci 6 Credits

The second semester of a pair of courses designed to introduce basic concepts in neuroscience and the experimental strategies that have been used to achieve our current awareness of the structure and function of the nervous systems. This spring part of Core consists of two parts, Regulatory Systems and Cognitive Neuroscience: Regulatory Systems - Autonomic and endocrine systems important for maintenance of sleep and waking and homeostasis, and their regulation by limbic system networks. Endocrine and hypothalamic/brainstem control of salt/water balance, thermoregulation, appetite, reproductive behavior, cardiorespiratory function, immune function and circadian rhythms will be discussed and related to regulation of mood and emotion by limbic system circuits. Behavioral regulation, including the concepts of classical and operant conditioning, reinforcement and punishment, conditioned emotional responses, and self-stimulation will be considered in the second part of the course. Cognitive Neuroscience – This section of the course discusses the neural bases of higher cognitive functions, including attention, executive function, language, social and affective cognition, learning and memory, and changes in cognitive processing during development and aging. The module also introduces students to methods in modern cognitive neuroscience, including neurophysiology, neuropsychology and functional imaging in experimental animals and humans. The module further includes a introducing students to human psychophysical experiments.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a major in Biology, Biology, Biology, Biology, Neurobiology, Neurobiology, Neurobiology, Neurobiology, Neuroscience, Neuroscience, Neuroscience, Neuroscience, Psychology, Psychology, Psychology or Psychology.

Enrollment is limited to Graduate level students.

NSCI 5006 Critical Readings II 1 Credit

With the facilitation by a faculty member, the students read and critically evaluate current research literature. All students are responsible for reading and “dissecting” every paper; one or more papers are read each week. The methods (Experimental Design) and results are critically examined in the context of the hypotheses. Material mirrors topics covered in Systems and Cognitive Neuroscience to provide a “deeper dive” into the literature relevant to topics covered in lectures. This is the Spring equivalent of NSCI-507.

Level: Graduate, Undergraduate

Corequisites: NSCI 5005

Grading: Pass/Fail Default

NSCI 5007 Surv Skills Ethics for Scien 2 Credits

This course will allow the student to develop an understanding of the skills and ethical questions important for a successful and satisfying career in science.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment limited to students in a Doctor of Philosophy degree.

NSCI 5008 Org of the Nervous System 1 or 2 Credits

Anatomy of The Nervous System

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a program in Neuroscience, Neuroscience, Neuroscience, Neuroscience, Psychology, Psychology, Psychology or Psychology.

Enrollment is limited to Graduate level students.

Enrollment limited to students in a Doctor of Philosophy degree.

NSCI 5009 Practical Data Anlys Exp Des 2 Credits

This course designed to be taken by PhD students conducting research in the second year in the program. They should be generating data from their own experiments and are planning on pre-doctoral grant submissions.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a program in Neuroscience, Neuroscience, Neuroscience, Neuroscience, Pharmacology, Pharmacology, Pharmacology, Pharmacology, Tumor Biology, Tumor Biology, Tumor Biology or Tumor Biology.

Enrollment is limited to Graduate level students.

NSCI 5550 Laboratory Rotation

Level: Graduate, Undergraduate

Grading: Pass/Fail Default

NSCI 6001 Adv Cellular Molec Neurosci 2 Credits

Review and discussion of primary literature focusing on synaptic transmission, molecular events in LTP, and molecular signal transduction.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 6002 Princi Pharm for Neuroscints 2 Credits

This course covers the basic principles of pharmacology that neuroscientists/neuropharmacologists need to understand principles of drug action, and pharmacotherapy. Major topics include pharmacokinetics and pharmacodynamics, major classes of drug targets, and signaling cascades. This course runs for the first half of the semester and shares lectures with PHAR-611.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a major in Pharmacology, Pharmacology, Pharmacology, Pharmacology, Neuroscience, Neuroscience, Neuroscience or Neuroscience.

Enrollment limited to students in the PHD-NEUR-SM program.

Enrollment is limited to Graduate level students.

NSCI 6003 Functional MRI: Theory Pract 0-3 Credits

Functional brain imaging techniques are important tools for both neuroscientists and clinicians. This course focuses on functional MRI (fMRI) with an emphasis on understanding the relationship between the underlying neuronal changes and the signal changes measured using fMRI. Additional topics include experimental design, fMRI data analysis, and interpretation of results. The course includes both lectures and hands-on labs. Students conduct, analyze, and write-up an fMRI experiment that they have designed and implemented. Textbook to be used in the course is: Functional Magnetic Resonance Imaging, Second Edition by Scott A. Huettel, Allen W. Song, and Gregory McCarthy Publisher: Sinauer Associates, Inc.; 2nd edition (December 31, 2008) ISBN-10: 0878932860 ISBN-13: 978-0878932863 http://www.amazon.com/Functional-Magnetic-Resonance-Imaging-Second/dp/0878932860/ref=sr_1_1?ie=UTF8&qid=1296314199&sr=8-1

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 6004 Neuroscience of Language 1 Credit

This course is designed to provide PhD students with an overview of core topics in Neuroscience of Language (NoL) and exposure to clinical populations and methods important to NoL research. This is the first course in a two-semester sequence. The first semester will likely cover the brain basis of speech perception and production, concept knowledge and semantics, lexical retrieval, and syntax. Communication disorders affecting these abilities will be discussed as well. Diversity, equity, and inclusion issues important to NoL research will be discussed throughout the course.

Level: Graduate

Prerequisites: NSCI 5002 and NSCI 5005

Grading: Pass/Fail Default

Equivalent to NSCI 524

Course registration restrictions:

Enrollment limited to students in the PHD-NEUR or PHD-NEUR-SM programs.

Enrollment is limited to Graduate level students.

NSCI 6005 Neuroscience of Language II 1 Credit

This tutorial is designed to provide an overview of the application of brain imaging to the study of human cognitive and sensorimotor processes. Principles of experimental design, statistical analysis and interpretation will be reviewed briefly at the beginning of the semester. For the remainder of the semester journal publications of functional neuroimaging studies employing fMRI or PET will be reviewed and discussed. These are selected to cover the functional organization of the visual system, including the processing of objects, words and faces. These will also be discussed in the context of brain development and clinical populations. A tour of the imaging facility and a data analysis laboratory will also take place. Weekly meetings will consist of students preparing a brief ½ page summary and critique of a particular paper and presenting these to the group. For three or four of the weekly meetings, outside speakers will be asked to present their own paper and then students will have an opportunity to discuss it directly with the author. At the end of the semester students will have to design their own study and present their proposed research to the group.

Level: Graduate, Undergraduate

Prerequisites: NSCI 524

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment limited to students in the PHD-NEUR program.

Enrollment is limited to Graduate level students.

NSCI 6006 Computational Neuroscience 2 Credits

Seemingly without effort, the human brain solves computationally very complex cognitive tasks such as recognizing facial expressions, understanding speech, planning and executing sequences of movements, or choosing actions from a range of competing alternatives to maximize the likelihood of reward in a given situation. How does the brain do it? For instance, how can signals from one hundred million photoreceptors on the retina fit through an optic nerve with just one million fibers? Given that many cognitive tasks are too varied to be coded genetically, how are tasks learned in the “deep” processing hierarchy of the brain, with some 13-odd synapses in the decision pathway? How does the brain learn to associate actions and rewards? How can we make decisions in the face of uncertainty? How does the brain deal with the redundancy of the motor plant, coordinating many joints to reach points in three-dimensional space? How can the brain recall complete memories from partial cues? This class will examine these and related questions, showing how cognitive processing across a variety of areas can be grounded in a small number of key neurocomputational principles. Emphasis will be placed on showing how these principles apply to a variety of cognitive domains, including vision, audition, memory, motor control, and decision making. The goal of this introductory class is to convey the underlying computational ideas with a minimum of mathematical overhead, stressing their usefulness even for areas of cognition where data are still insufficient to constrain quantitative models. Course Description Credits: 2 Time: Tuesdays, 1:15pm – 4pm Dates: Class starts on 9/1/2020, until 12/1/2020 Location: Neuroscience Meeting Room, Research Building, WP-07 Course Director: Maximilian Riesenhuber, PhD, Professor of Neuroscience (mr287@georgetown.edu) Office: New Research Building, WP-12 Open to graduate and advanced undergraduate students from neuroscience, psychology, cognitive science, computer science, and related disciplines. Undergraduate students should contact the course director for permission. Prerequisites Basic knowledge of neuroscience and/or psychology. Basic calculus and linear algebra. Willingness to learn whatever background is lacking. Contact the course director if unsure. Course Structure and Requirements This is a 2-credit course, but classes meet for three hours each, which allows for off-weeks when we won't meet, see the schedule below and the course schedule on the Canvas site. I highly recommend you add the Canvas online calendar to your personal calendar. Each class will consist of a lecture by Dr. Riesenhuber on the topic du jour and student-led presentations and discussions of research papers (4 papers of 20-30 minutes of presentation & discussion each), see “Schedule and Papers” below (note that the “Optional background papers” are optional further readings for those interested in particular topics). These presentations should include critical analyses of the methods and results, along with a discussion of the implications of the findings and three questions to be discussed with the class. Presenters should feel free to discuss questions about their papers with the course director in advance of their presentation. All class members will be expected to have read these papers before class and to come prepared with relevant questions/comments/ideas for the discussion. In addition, there will be (optional) computer exercises on key topics in the form of Jupyter notebooks that students can work on outside of class. A final project will be due on December 1. The final project will take the form of a 15-minute presentation on an original computational neuroscience project of the student's choosing. The project should aim to test (either experimentally or through simulations or a combination thereof) a computational hypothesis about the neural bases of a particular cognitive function. The presentation (to be emailed to Dr. Riesenhuber at mr287@georgetown.edu by midnight on December 1 – each day late takes off 5% of final project score) needs to include specific aims of the research project, background information about the topic studied, and a description of a series of experiments/computational studies to address the Specific Aims. The

NSCI 6008 Topics in Neuroinflammation 2 Credits

Studying the immune cells in the nervous system, what they are and what they do in normal and pathological states

Level: Graduate, Undergraduate

Prerequisites: (NSCI 501 or NSCI 5002) and (NSCI 503 or NSCI 5005)

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a program in Integrative Neuroscience, Integrative Neuroscience, Integrative Neuroscience, Integrative Neuroscience, Neuroscience, Neuroscience, Neuroscience or Neuroscience.

Enrollment limited to students in the MS-INNS program.

Enrollment is limited to Graduate level students.

NSCI 6009 MRI/fMRI Protocol Optimization 3 Credits

This course examines and explores the decision making used when choosing the multitude of parameters used in structural and functional MRI. The course builds on NSCI-521 (Functional MRI: Theory and Practice) or similar to explore how choices in MRI sequence parameters alter the raw images and in turn interact with various data analysis pipelines leading and ultimately the results of these experiments. Topics that will be explored include: optimizing tissue contrast (T1, T2, T2*, and PD) for various structural analysis pipelines, comparison of these to novel structural sequences, determining optimal choice of echo time for BOLD fMRI, exploring how multi-band fMRI acquisitions affect results, determining whether more directions or higher spatial resolution is preferable in DTI, and similar topics. Students are encouraged to suggest topics.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate Doctorate level students.

NSCI 6010 Literature In Neurodegenerati 1 Credit

A paper-based course which will cover a variety of topics in neurodegenerative disorders through student-lead, faculty facilitated discussions of primary literature.

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to students with a major in Neuroscience, Neuroscience, Neuroscience, Neuroscience, Pharmacology, Pharmacology, Pharmacology or Pharmacology.

Enrollment is limited to Graduate Doctorate level students.

NSCI 6011 Topics in Synaptic Transmission 2 Credits

Review in-depth of primary literature surrounding several topics of current interest in synaptic transmission. The first topic is selected by the instructor while the other topics are selected by the students. see <http://neuroscience.georgetown.edu/courses/NSCI601-09.htm>

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 6510 Advanced Neuroscience I 2 Credits

Advanced Neuroscience I is part of the first year core curriculum for the Interdisciplinary Program in Neuroscience. In Advanced Neuroscience I, PhD-level students will hear lectures from expert neuroscientists that will address advanced cellular and molecular neuroscience concepts in depth.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment limited to students in the following programs:

- PHD-BIOL
- PHD-NEUR
- PHD-NEUR-SM
- PHD-PHPH
- PHD-PHPH-SM
- PHD-PSYC

Enrollment is limited to Graduate level students.

NSCI 7949 Neuroscience Tutorial 1-4 Credits

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 8001 Experiences in Neuroscience

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment limited to students in the PHD-NEUR or PHD-PSYC programs.

Enrollment is limited to Graduate level students.

NSCI 8003 Adv Microscopy in Neuroscience 1 Credit

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment limited to students in the PHD-NEUR program.

Enrollment is limited to Graduate level students.

NSCI 9001 Tutorial: NSCI 1-4 Credits

Individualized instruction on advanced topics in Neuroscience by faculty in the IPN program. Students need to set up tutorials by contacting the faculty member they want to serve as their tutor, outlining the plan of study, and filling out the appropriate form to register the tutorial with approval from the IPN Curriculum Chair.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9002 NSCI Tutorial 1-4 Credits

Individualized instruction on advanced topics in Neuroscience by faculty in the IPN program. Students need to set up tutorials by contacting the faculty member they want to serve as their tutor, outlining the plan of study, and filling out the appropriate form to register the tutorial with approval from the IPN Curriculum Chair.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9004 NSCI Tutorial 1-4 Credits

Individualized instruction on advanced topics in Neuroscience by faculty in the IPN program. Students need to set up tutorials by contacting the faculty member they want to serve as their tutor, outlining the plan of study, and filling out the appropriate form to register the tutorial with approval from the IPN Curriculum Chair.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9005 Tut:Spec Topics in Neuroscience 1-2 Credits

Individualized instruction on advanced topics in Neuroscience by faculty in the IPN program. Students need to set up tutorials by contacting the faculty member they want to serve as their tutor, and filling out the appropriate form to register the tutorial.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9007 Tut:Spec Topics in Neuroscience 1-6 Credits

Individualized instruction on advanced topics in Neuroscience by faculty in the IPN program. Students need to set up tutorials by contacting the faculty member they want to serve as their tutor, and filling out the appropriate form to register the tutorial.

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9200 Teaching Practicum I 1-2 Credits

Teaching in one of various courses.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9210 Teaching Practicum II 1 or 2 Credits

Teaching in one of various courses.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9985 NSCI Lab Rotation Summer

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9986 NSCI Lab Rotation Fall

Laboratory rotation.

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9987 NSCI Lab Rotation Spring

Laboratory rotation.

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9993 Continuous Registration

Level: Graduate, Undergraduate

Grading: No Grade

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9994 Continuous Registration

Level: Graduate

Grading: No Grade

Course registration restrictions:

Enrollment is limited to Graduate level students.

NSCI 9999 Thesis Research

Thesis research leading to a doctoral dissertation.

Level: Graduate, Undergraduate

Grading: No Grade

Course registration restrictions:

Enrollment is limited to Graduate level students.