# AS.080 (NEUROSCIENCE)

**AS.080.250. Neuroscience Laboratory. 3 Credits.**
This course will give students the 'hands-on' experience of the inter-disciplinary nature of neuroscience. Students will use anatomical and neuro-physiological techniques to understand the basic underlying principles of neuroscience.
**Prerequisite(s):** ( AS.080.305 AND AS.080.306 ) OR AS.200.141
Area: Natural Sciences

**AS.080.260. Bridging the gap between Biology and Statistics. 1 Credit.**
This course is designed to support the lectures and assignments in Probability and Statistics in Life Sciences, EN.553.211. This one-hour a week course is led by a behavioral biology professor with extensive expertise in statistics and mathematics. The primary goal of this course is to increase success and understanding of EN.553.211 by bridging the gap between theoretical statistics and biological thinking. In addition, when possible, examples and direct applications in neuroscience and behavioral biology will be presented to provide a context for EN.553.211 materials.
**Corequisite(s):** Students must also enroll in EN.553.211.

**AS.080.301. Behavioral Assessment of Animal Models of Cognition and Neuropsychiatric Disorders. 3 Credits.**
What does a rat exploring it's environment tell us about memory? How can a mouse help us better understand schizophrenia? This course will focus on procedures that are routinely used to study behavior in animal models of cognition and neuropsychiatric disorders. Topics will include motor function, emotional and motivational states, disorders such as dementia and schizophrenia, among others. Throughout the course, we will read and discuss original research articles to illustrate and compare some of the measures and results from the various procedures.
**Prerequisite(s):** Students may not have taken AS.200.302;AS.200.141 OR (AS.080.305 and AS.080.306), OR by instructor permission.
Area: Social and Behavioral Sciences

**AS.080.303. Structure of the Nervous System. 3 Credits.**
This course takes a structural biological approach to studying the nervous system. In using a systems approach it provides students of cellular-molecular and computational neuroscience with a thorough introduction to functional, microscopic and submicroscopic organization of the brain, spinal cord and peripheral nervous system.
**Prerequisite(s):** AS.080.305 AND AS.080.306
Area: Natural Sciences

**AS.080.304. Neuroscience Learning and Memory. 3 Credits.**
This course is an advanced survey of the scientific study of learning and memory. Different perspectives will be used to review the science of learning and memory including the cellular-molecular basis of synaptic plasticity, the functional circuitry involved in learning and memory and memory systems in the brain. The course is designed to provide a deep understanding of the issues and current debates in learning and memory research and focuses specifically on animal models of memory and memory impairment. This is an interactive lecture course with a strong emphasis on student participation.
**Prerequisite(s):** AS.200.141 OR ( AS.080.305 AND AS.080.306 ) OR ( AS.020.312 AND AS.020.306 ) or instructor permission.
Area: Natural Sciences

**AS.080.305. Neuroscience: Cellular and Systems I. 3 Credits.**
(Formerly Nervous Systems I) Neuroscience: Cellular and Systems I is a fully integrated, two-semester course that surveys the cellular and molecular biology of neurons as well as the structure and function of the nervous system. Students must register for Neuroscience: Cellular and Systems II offered in the second term. Course open to JHU undergraduates only.
**Prerequisite(s):** AS.080.203 OR AS.050.203 OR AS.200.141 OR AS.080.105 OR AS.050.105 or instructor permission.
Area: Natural Sciences

**AS.080.306. Neuroscience: Cellular and Systems II. 3 Credits.**
(Formerly Nervous Systems II) Neuroscience: Cellular and Systems II uses the functional organization of the somatosensory system as a means to examine mechanisms of neutral development. Generation and maturation of neurons, guidance of axons, formation of synapses and the regressive events that shape the adult nervous system will be examined. At the same time we will explore the structure and function of brain regions that allow us to feel pain and temperature, detect vibration, recognize shape and perceive where we are in space. Finally, the single-neuron events that lead to adaptive changes in function will be explored in the context of central nervous system control of movement and of higher order functions of speech and memory. Students who do not register for Neuroscience: Cellular and Systems I offered during the first term should not register for this class.
**Prerequisite(s):** AS.080.305
Area: Natural Sciences

**AS.080.308. Neuroeconomics. 3 Credits.**
Every day decisions often require us to weigh the costs and benefits of engaging in a particular course of action in order to obtain some expected outcome. Unfortunately, we often lack the information necessary to obtain our desired goal with complete certainty. Economists have long been interested in understanding human decision-making under these circumstances. In parallel, neuroscientists have made great strides at describing the underlying neural basis of simple decision-making. However, despite much progress in both fields, our understanding of how the brain makes decisions is incomplete. In order to strengthen and further research in both fields, the interdisciplinary field of Neuroeconomics arose. This course will survey the field of Neuroeconomics focusing on theoretical concepts developed by economists and the role these theories are playing in guiding current experimental neuroscience.
**Prerequisite(s):** AS.080.306 OR AS.200.141 OR AS.020.312
Area: Natural Sciences

**AS.080.310. Synaptic Function and Plasticity. 3 Credits.**
The function of the nervous system is based on synaptic transmission between neurons. Synapses are not static structures, but dynamically change with experience. Experience-dependent synaptic plasticity not only allows proper development of the nervous system in tune with the environment, but also is the basis for learning and memory. This course will cover the structure and function of synapses, and how they are altered by experience to encode information.
**Prerequisite(s):** (AS.020.305 AND AS.020.306) OR (AS.080.305 AND AS.080.306)
Area: Natural Sciences

**AS.080.316. Prefrontal Cortex- Computational Models and Neurophysiology. 3 Credits.**
The course will cover the function of the prefrontal cortex. We will discuss various computational models of prefrontal function and neurobiological evidence for these models. The class will consist of lectures, student presentations, and discussions.
**Prerequisite(s):** AS.080.305 AND AS.080.306 or Instructor Permission.
Area: Natural Sciences

**AS.080.320. The Auditory System. 3 Credits.**
This course will cover the neuroanatomy and neurophysiology of the human auditory system from the ear to the brain. Behavioral, electrophysiological, and neuroimaging methods for assessing peripheral and central auditory function will be discussed. Acquired and developmental disorders of auditory function will be reviewed using clinical case studies.
**Prerequisite(s):** AS.080.305 OR AS.080.203 OR AS.050.203 OR AS.200.141 OR AS.020.312 or instructor permission.
Area: Natural Sciences

**AS.080.321. Computational Neuroscience. 3 Credits.**
This course is designed to give students an overview of computational neuroscience. The topics discussed will cover many exciting domains of the field including neural coding, decision-making, learning, attention and connectomics. Lectures will be complemented with hands on experience working with computational models using Matlab and/or other programming language. The overarching goal of the course is to increase overall literacy in the field of computational neuroscience and to gain an appreciation of the interplay between experimental and theoretical neuroscience.
**Prerequisite(s):** AS.080.306 OR AS.200.141. Familiarity with programing in Matlab will be helpful but not necessary.
Area: Natural Sciences

**AS.080.322. Cellular and Molecular Biology of Sensation. 3 Credits.**
Leading scientists in sensory biology from the Johns Hopkins community will present the most current knowledge in the cellular and molecular biology of sensation. A lecture and a student presentation of an exemplar manuscript will be presented each week on a different topic of sensory systems.
Area: Natural Sciences

**AS.080.326. Neurobiology and Diseases of the Peripheral Nervous System. 3 Credits.**
This course will cover neurobiology and disorders of the peripheral nervous system (PNS). A particular emphasis will be on cellular interactions within the PNS and with target tissues. For example, the two principal components of the peripheral nerves- axons and Schwann cells- have intimate and continuous cellular communications that are critical for physiological function of the PNS. The course will teach how these cellular interactions are developed, maintained throughout life, and are impacted by injury and diseases.
**Prerequisite(s):** AS.080.305 AND AS.080.306
Area: Natural Sciences

**AS.080.328. Behavioral Neuroscience Lab. 3 Credits.**
Class designed to give students first-hand knowledge of the behavioral procedures and techniques used to study behavior in the field of neuroscience. Students will gain hands-on experience by carrying out some of the behavioral tasks used to assess animals under specific behavioral domains, discuss why certain aspects (i.e. genotype, environment conditions, group size, etc.) are important factors to consider when designing, planning, and carrying out such experiments, and learn the relevance of behavioral research in translational medicine.
**Prerequisite(s):** AS.200.141 OR AS.200.302 OR AS.080.301 OR (AS.080.305 AND AS.080.306) or permission by instructor.
Area: Natural Sciences

**AS.080.334. Unraveling Circuits in Systems Neuroscience- Emerging Techniques. 3 Credits.**
Rapid technological development in neuroscience provides researchers with new tools and strategies to ask important questions about the neural basis of behavior. In this course, we will examine some of these emerging techniques, along with a sampling of the questions they have allowed scientists to answer. We will consider the conceptual insights that arise from answering these questions, as well as investigate the fundamental science behind the cutting-edge techniques that allow us to understand brain function in health and disease.
**Prerequisite(s):** AS.080.305 AND AS.080.306 or Instructor Approval
Area: Natural Sciences

**AS.080.336. Brain-Body Interactions in Health and Disease. 3 Credits.**
Both classical and recent primary research papers that deal with cross signaling of other major organs with the nervous system, particularly the central nervous system, will be discussed. Students will be exposed to emerging literature on how peptides, signaling molecules, and hormones effect the nervous system function both in health and in diseases.
**Prerequisite(s):** AS.080.305 AND AS.080.306
Area: Natural Sciences

**AS.080.345. Great Discoveries in Neuroscience. 3 Credits.**
This course examines the historical and intellectual context of selected, key advances in neuroscience, how they were made and the impact they had on an understanding of the nervous system. Particular attention will be paid to advances in cellular and molecular neuroscience. Among the topics covered will be the discovery of monoamine neurotransmitters and of endocannabinoids, the role of neurotrophins in neural development, and prion-based diseases of the brain.
**Prerequisite(s):** AS.080.306
Area: Natural Sciences

**AS.080.355. Computational Principles of Biological Vision. 3 Credits.**
Even though we take it for granted, vision is a superpower. It is so central to how most of us interact with the world, and so effortless, that we are unaware of the astronomically complex computations that underlie it. There are no computer vision programs that can match the performance of the human visual system in understanding the real, physical, 3D world. On the biological side, vision is the most thoroughly studied sensory system. As such, vision is a rich target for computational understanding of the brain. Vision is the topic that both of us actively study, and remain passionately excited about. In this course, we present our up-to-the-minute synthesis of what we consider to be the most important insights into how vision, especially object vision, works, at the level of biological information processing. We believe the result is a coherent, mechanistic account of how the brain transforms images into visual understanding. We know of no textbook that provides a comparable viewpoint. In addition to presenting this visual information processing framework, we hope to teach you how to critically evaluate current research papers within that framework. To this end, we will be incorporating discussions of current research papers into our lectures and assignments. The course will feature a series of weekly lectures (delivered as videos) and a weekly assignment. The weekly assignment will be an essay, and will make up the largest portion of your grade. The remainder of your grade will come from one larger final essay. We will offer 2 weekly, voluntary Zoom meetings to discuss any questions about the material that might have come up.
**Prerequisite(s):** AS.080.306
Area: Natural Sciences

**AS.080.360. Diseases & Disorders of the Nervous System. 3 Credits.**
**Prerequisite(s):** ( EN.580.421 AND EN.580.422) OR ( AS.020.305 AND AS.020.306 ) OR AS.080.306 or instructor permission.
Area: Natural Sciences

**AS.080.362. Neurobiology of Hearing. 3 Credits.**
The course focuses on sound processing, including current research topics in Auditory Neuroscience, including synaptic physiology, neural circuitry, acoustics, physiology, and behavior. Course taught in Salamanca. This course fulfills upper-level Neuroscience electives. Course must be taken for a grade.
Area: Natural Sciences
Writing Intensive

**AS.080.366. Neuroscience of Pain. 3 Credits.**
This course is a systems-oriented course focusing on the basic neural processing of pain signals in both the spinal cord and the brain. Class lectures will cover the anatomical and molecular basis for the transmission and perception of pain signals, basic concepts such as allodynia, hyperalgesia, peripheral and central sensitization, remodeling, the pathophysiology of chronic pain disorders and the cognitive and emotional aspects of pain. We will also discuss the regulation of pain signals by descending systems, and current practices and new advances in the treatment of pain.
**Prerequisite(s):** AS.080.305 OR AS.080.306 OR AS.020.312 or permission of instructor.
Area: Natural Sciences, Social and Behavioral Sciences
Writing Intensive

**AS.080.370. The Cerebellum: Is it just for motor control?. 3 Credits.**
The cerebellum is traditionally thought to be involved in movement and motor control, and observations of patients with cerebellar damage do in fact show motor deficits. However, since the proliferation of functional MRI, cerebellar activations have been observed in a surprising number of brain activation studies that were designed to investigate the neural correlates of cognitive function. Over the past 2 decades, an increasing number of investigators have tried to characterize the role of the cerebellum in cognitive function. Through lectures and reading discussions this course will survey cerebellar circuitry, neuroimaging and neuromodulatory methods for investigating the cerebellum, and traditional and non-traditional functions of the cerebellum, including cerebellar involvement in cognitive functions such as language, working memory, and executive control.
**Prerequisite(s):** ( AS.080.306 AND AS.080.203 ) OR AS.050.203
Area: Natural Sciences, Social and Behavioral Sciences

**AS.080.400. Research Practicum: Language Disorders-Community Based Learning. 2 Credits.**
This course provides the opportunity to learn about adult aphasias; language disorders which are one of the most common consequence of stroke. You will receive training in Supportive Communication Techniques and work as a communication partner with an individual with aphasia for two hours per week. Three class meetings for orientation and reading assignments will be held on campus; training and practicum will be conducted at a local aphasia support center. Transportation required. A valid driver's license for zip car use.This is a two (2) credit practicum.
Area: Natural Sciences, Social and Behavioral Sciences

**AS.080.411. Advanced Seminar: Neuroscience I. 3 Credits.**
For students in the first semester of the BS/MS Program. Instructor permission required.
Area: Natural Sciences

**AS.080.412. Advanced Seminar: Neuroscience II. 3 Credits.**
For students in the 2nd semester of the BS/MS Program.
Area: Natural Sciences

**AS.080.413. Advanced Seminar: Neuroscience III. 3 Credits.**
For students in the 3rd semester of the BA/MS Program.
Area: Natural Sciences

**AS.080.500. Scientific Communication: Neuroscience. 0.5 Credits.**
Scientific communication is crucial to advancing science. The Scientific Communication section is taken concurrently with Neuroscience Research and consists of a two hour research orientation session held at the beginning of the semester and a two hour exit session held at the end of the semester. The student is also expected to meet with their lab supervisor or attend a lab meeting once a week to understand the research the lab is currently working on and receive feedback on the work they are doing. See special notes section for specific meeting day/time.Students must sign up for Scientific Communication prior to signing up for NS Research until they complete their 6 credits of research. See Neuroscience Research website for more details.
**Prerequisite(s):** You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.
**Corequisite(s):** AS.080.531 OR AS.080.541 AS.080.551 OR AS.080.561

**AS.080.511. Independent Study. 1 - 3 Credits.**
**Prerequisite(s):** You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

**AS.080.531. Research Neuroscience-Freshmen. 1 - 3 Credits.**
Students must register for AS.080.500 (Scientific Communication) until you have reached 6 credits of required neuroscience research.
**Prerequisite(s):** You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.
**Corequisite(s):** AS.080.500

**AS.080.541. Research Neuroscience – Neuroscience Majors. 1 - 3 Credits.**
Students must register for AS.080.500 (Scientific Communication) until you have reached your 6 credits of required neuroscience research.
**Prerequisite(s):** You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.
**Corequisite(s):** AS.080.500

**AS.080.550. Neuroscience BS/MS Summer Research - Seniors.**
This summer research course is only for Neuroscience BS/MS students that are seniors in the program over the summer.
**Prerequisite(s):** You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

**AS.080.572. Direct Readings/Independent Study. 0 - 3 Credits.**
**Prerequisite(s):** You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

**AS.080.582. Neuroscience: Internship. 1 - 3 Credits.**
**Prerequisite(s):** You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

**AS.080.601. Neuroeconomics -Graduate Level.**
Every day decisions often require us to weigh the costs and benefits of engaging in a particular course of action in order to obtain some expected outcome. Unfortunately, we often lack the information necessary to obtain our desired goal with complete certainty. Economists have long been interested in understanding human decision-making under these circumstances. In parallel, neuroscientists have made great strides at describing the underlying neural basis of simple decision-making. However, despite much progress in both fields, our understanding of how the brain makes decisions is incomplete. In order to strengthen and further research in both fields, the interdisciplinary field of Neuroeconomics arose. This course will survey the field of Neuroeconomics focusing on theoretical concepts developed by economists and the role these theories are playing in guiding current experimental neuroscience. Only graduate students can register for this course. Instructor signature is required.

**AS.080.610. Experiential Learning: HopKids – Kennedy Krieger Institute.**
This experiential learning experience provides the opportunity to learn and interact with children recovering from brain, spinal, and musculoskeletal injuries. Students will travel to the Kennedy Krieger Institute to volunteer in the Child Life Department where they will participate in a variety of therapeutic activities including playing with the children and helping them achieve goals on Saturdays (days/times TBA). Students will gain valuable clinical experience while learning patient empathy. Students MUST attend a mandatory orientation and a mandatory exit session held on the Homewood campus (see section web notes for days/times). Students are required to present a written description of their experiences and to discuss their experiences at the exit session. Transportation will be provided by the JHMI shuttle. No credit - S/U Grading Only

**AS.080.612. Experiential Learning: Autism and other Neurological Disorders.**
In this experiential learning experience, students will work with children who have a variety of neurological disabilities, including autism, cerebral palsy and Down syndrome through exercise and recreational activities. We partner with the KEEN (Kids Enjoy Exercise Now), a nonprofit organization. Student “coaches” will receive a profile for the KEEN athlete that they will pair up with during a session. Students will receive initial training and then select 4 sessions to attend. Sessions are held on the first and third Sunday of each month during the semester at KEEN centers in Maryland. Students MUST attend a mandatory orientation and a mandatory exit session held on the Homewood campus (see section web notes for days/times). Students are required to present a written description of their experiences and to discuss their experiences at the exit session. Transportation will be via student carpools using Zipcars, personal vehicles or Hop Vans. No credit - S/U Grading Only

**AS.080.614. Experiential Learning: STEM in the Classroom.**
STEM subjects are particularly important in today’s society and getting students interested in these areas early is crucial. Working with Making Neuroscience Fun (MNF), a community outreach program, which brings age-appropriate interactive presentations about the brain and nervous system to Baltimore city and county elementary school students, our students share their love of the sciences with young children. The elementary school students learn about the nervous system and our students learn valuable communication skills. Hopkins students will receive initial training prior to participating and will select and present 6, 45-minute presentations. In order to participate, students must be available either 7am-11am or 11am-3pm at least one day per week, Monday-Friday. Students MUST attend a mandatory orientation, a mandatory training and a mandatory exit session held on the Homewood campus (see section web notes for days/times). Students are required to present a written description of their experiences and to discuss their experiences at the exit session. Students will also be given the opportunity to work with the faculty to develop new materials for the program. Presentations will take place at Baltimore city and county elementary schools. Transportation to the schools will be via student carpools using Zipcars or personal vehicles. No credit - S/U Grading Only

**AS.080.616. Experiential Learning: Working with Children in the Clinic.**
This experiential learning experience provides students the opportunity to learn, play and interact with children receiving treatment in over 20 different specialties including dermatology, endocrine, GI, immunology, urology, plastics and hematology. Students will volunteer in outpatient clinics at the Johns Hopkins Children's Center where they will encourage, provide developmentally supportive play for children and participate in a variety of activities including art projects, coloring, board games, and reading. Students will gain valuable clinical experience and be exposed to a wide range of children with a variety of diseases/illnesses. Students MUST attend a mandatory orientation and a mandatory exit session held on the Homewood campus (see section web notes for days/times. Students will sign up for 5 shifts on a first-come, first-serve basis after the mandatory orientation. Shifts are Mondays 1pm-3pm, Tuesdays 10am-12pm, Wednesdays 1pm-3pm, Thursdays 10am-12pm and Fridays 10am-12pm throughout the semester. Students are required to present a written description of their experiences and to discuss their experiences at the exit session. Volunteer shifts will take place at outpatient clinics in the Rubenstein Child Health Building. Transportation will be provided by the JHMI shuttle. No credit - S/U Grading Only

**AS.080.618. Experiential Learning: Helping an Aging Community: Social and Cognitive Support for Seniors.**
This experiential learning opportunity provides a hands-on experience, working side-by-side with elderly individuals at the Keswick Multi-care Center and the Roland Park Place. Students will have a chance to interact with residents that have both short-term and long-term cognitive and physical impairments. The residents typically live on the premises but may also be participating in a daytime care only program. Students will interact with the residents in various enriching ways in order to develop a better understanding of how our mind and body ages with time. Students will gain hands-on experience working with residents with dementia, Alzheimer's and other cognitive impairments that effect the body and the brain. 4 students per semester. Students MUST attend a mandatory orientation and a mandatory exit session to be held onsite (Day/Time TBD). Students are required to provide a written description of their experiences and to discuss their experiences at the exit session. Time Commitment: 2-3 hours a week for the entire semester. Must provide medical immunization records to include- flu shot and PPD (tuberculosis). Transportation will be provided by the JHMI shuttle. No credit - S/U Grading Only

**AS.080.620. Theoretical Neuroscience.**
Topics of theoretical neuroscience and computational neuroscience will be discussed based on the original literature. Students are expected to actively participate in the discussion and also to present selected material to the class.

**AS.080.630. Bodian Seminar Series.**
The Bodian Seminar is an interdisciplinary colloquium for discussion of current research into the neural basis of mental processes. Leading researchers, generally from outside the University, are invited to give lectures, which will be announced per e-mail. Undergraduate students who register for this course are asked to study a publication by the speaker, as provided with the announcement, and to prepare a question for each speaker together with a brief discussion of the possible answers. Permission required for undergraduate students.

**AS.080.631. Bodian Seminar Series.**
Graduate students and Seniors with instructor permission. The Bodian Seminar is an interdisciplinary colloquium for discussion of current research into the neural basis of mental processes. Leading researchers, generally from outside the University, are invited to give lectures. About 12 lectures are scheduled per semester (see http://www.mb.jhu.edu/seminars.asp). Speakers, titles of lectures, and dates are announced to participants per e-mail (contact Debby Kelly, 410 516-8640). The announcements also include links to one or two recent publications of the speaker. Undergraduate students who register for this course are asked to study these papers and to prepare a question for each speaker together with a brief discussion of the possible answers. Question and discussion have to be in writing and turned in the day before the lecture. Undergradutes must e-mail the instructor for permission (von.der.heydt@jhu.edu) prior to registering for the course.

**AS.080.660. Commencement Project.**
This course is for BA/MS students that have completed their year of research and are now working on their final thesis. In this course, students devote their semester to preparing their final thesis documentation and move forward with their Master's Thesis Defense which is the last piece to the program. This course is for BA/MS student only and students should only register for this course in their last semester in the program.

**AS.080.849. Teaching Practicum.**
Permission required. Graduate students only.

**AS.080.850. Mentored Research: Neuroscience I.**
For students in the BA/MS Program first semester. Permission required.

**AS.080.851. Mentored Research: Neuroscience.**
Writing Intensive

**AS.080.852. Mentored Research: Neuroscience II.**
Permission Required. For students in the BA/MS Program.

**AS.080.854. Mentored Research: Neuroscience III.**
For students in the BA/MS Program Perrmission required.

**ME.440.300. Research Practicum in Neuroscience.**
Provides an opportunity for students to actively conduct research in Neuroscience.

**ME.440.301. Research in Neuroscience (Undergraduate).**
Provides an opportunity for undergraduate students to actively conduct research in Neuroscience.

**ME.440.699. Neuroscience Elective.**
For Medical Students only. Specialized Topics in Neuroscience. Refer to Medical Student Electives Book located at https://www.hopkinsmedicine.org/som/students/academics/electives.html.

**ME.440.705. Cellular and Molecular Basis of Neural Development II: Regulation of Neural Connectivity.**
This is a seminar and reading course devoted to the discussion of the cellular and molecular processes underlying neuronal development.

**ME.440.707. Molecular and Cellular Mechanisms of Synaptic Transmission.**
An advanced seminar and reading course devoted to the molecular and cellular mechanisms underlying synaptic transmission and the regulation of synaptic plasticity. We will discuss fundamental discoveries in the areas of synapse formation, transmitter release, vesicle recycling, ribbon synapses, dendritic modulation, LTP/LTD, and homeostatic regulation. Students will present two papers and provide written answers to questions about the assigned reading.

**ME.440.709. Neuropharmacology.**
The course will illustrate the use of diverse approaches (molecular, biochemical, electrophysiological and behavioral) to decipher how psychotropic drugs impact the brain. The course will utilize a lecture format for the first two classes and then switch to a "journal club" format in which students will present classic and recent articles. Topics to be covered include: opiates, benzodiazepines, antipsychotic drugs, and antidepressant drugs.

**ME.440.711. Cellular and Molecular Basis of Neural Development I: Neuronal Differentiation.**
A seminar and reading course devoted to the discussion of the cellular and molecular processes underlying neuronal development. Topics include cell proliferation and migration, nervous system patterning, differentiation of neurons and glia, morphogen and growth factor signaling mechanisms, neuronal polarity, and neural stem cell biology. Examples from vertebrate and invertebrate model systems will be covered. This course is designed to complement The Cellular and Molecular Basis of Neural Development II: Axon Guidance and Synaptogenesis, offered alternate years.

**ME.440.715. Trends in the Neurobiology of Aging.**
This course will reveiw recent research progress in the fields of agin and neurodegenerative disorders with coverage of cellular, moleular, and systems neuroscience.

**ME.440.722. Visual System.**
From outer segments of photoreceptors to the Fusiform Face Area of the cerebral cortex we hav ecome to understand how the visual system works at each of many fundamental levels. This course examines the basis for perception of visible objects at each of these levels. We will use teh secondary literature (scientific reviews) to accent the hard-won truths about visual system functional organization and to highlight ongoing controversies. Students will be led through carefully chosen reviews in a series of lectures and written summaries prepared by faculty. Three exams and a final exam will test students not on their memorization of minutiae but on their understanding of fundamental principles.

**ME.440.723. Writing About the Brain.**
The goal of this course is to train working neuroscientists to effectively and clearly communicate ideas aboout nervous system function of a general audience

**ME.440.724. Neuroscience Career Skills.**
This course is intended to help graduate students in the Neuroscience Graduate Program obtain an appreciation of options, challenges, and steps towards careers in the field of neuroscience.

**ME.440.800. Research in Neuroscience.**
Research in Neuroscience.

**ME.440.801. Readings in Neuroscience (Journal Club).**
A weekly talk on current literature topics of special interest. Students present either journal articles or their own research depending on their year in the program.

**ME.440.802. Current Topics in Neuroscience (Research Seminar).**
Weekly lecture on current research by active researchers. Topics are chosen so that an overall balance of subjects in neuroscience are covered in the course of a year. Students receive a reading list before the seminar and will be given an opportunity to meet with outside speakers.

**ME.440.808. Physiology of Sensory Transduction.**
A reading/presentation course focusing on visual and chemical transductions. The electrophysiological approach will be emphasized. A couple of long or several short papers will be presented and discussed by students each week.

**ME.440.810. Readings In Systems Neuroscience.**
A weekly talk on current literature topics of special interest. Students present journal articles for discussion.

**ME.440.811. Neuroscience Cognition I.**
This is the first half of a 4-quarter course on the cellular and molecular basis of neural function adn the neural basis of perception, cognition, and behavior. Topics covered in this half include (1) development and structure of the nervous system, (2) cellular neurophysiology, (3) neural signaling and coding, and (4) audition, vocalization, and language. Lectures will be presented by faculty in the Neuroscience, Neurology, Biomedical Engineering, Psychology, and Cognitive Science departments. The course will also include discussion sections based current literature and several neurotechniques sessions designed to familiarize student with current experimental approaches in cellular, systems and molecular neurosciences. This course is required of all students in the Neuroscience Graduate Program.

**ME.440.812. Neuroscience Cognition II.**
This is the second half of a 4-quarter course on the cellular and molecular basis of neural function and the neural basis of perception, cognition, and behavior. Topics covered in this half include (1) perception of objects, space, and self, (2) movement and balance, (3) learning and memory, (4) neurological and psychiatric disorders, and (5) global function in the nervous system. Lectures will be presented by faculty in the Neuroscience, Neurology, Biomedical Engineering, Psychology, and Cognitive Science Departments. The course will also have a laboratory component. This course is required of all students in the Neuroscience Graduate Program.

**ME.440.813. Current Issues in Systems and Cognitive Neuroscience.**
The mammalian brain is an information processing system without parallel. It excels at recognizing objects and substances, reconstructing space, making decisions, and controllig complex behaviors. The neural mechanisms underlying these abilities are studied by a large community of systems and cognitive neuroscientists. This research has generated a rapidly evolving field of high-profile discoveries and lively debates between competing laboratories. Our course aims to convey a clear sense of this field by focusing on current experimental and conceptual controversies regarding organization and function in the primate nervous system. Each week will focus on a different topic represented by two or more recent papers (selected by an instructor) reflecting timely questions or opposing points of view. Students will present the papers informally and direct a debate over the relative merits of hte conflicting view points.

**ME.440.814. Research in Neuroscience (BCMB).**
Thesis Research

**ME.440.816. Topics in Cortical Plasticity.**
Experience-dependent changes in cortical synapses and circuits are critical for proper development of the nervous system and for memory storage. This course will focus on recent findings on fundamental mechanisms of plasticity from synapses to circuit level through discussions of recent research papers.

**ME.440.817. Psychedelics.**
In this course we will explore the history and uses of psychoactive compounds, the neurobiological basis of their activity, and their potential for healing. Along the way we will attempt to debunk some of the most common myths about this especially controversial class of drugs. Each session, one student will take the lead in discussing the assigned primary research articles (except for 2-3 documentary film sessions, which will take up the whole period). Beyond didactic learning, this graduate level course is designed to hone students' skills in oral presentations, critical thinking, as well as composition and editing of manuscripts.

**ME.440.819. Rigor, Reproducibility, and Responsibility in Science.**
In order to become successful scientists, graduate students need to learn much more than just how to design, perfom, and interpret experiments. Graduate students need to learn many professional norms and practices central to a successful scientific career. Most importantly, graduate students need to learn about what constitutes scientific misconduct and about proper behavior involving issues of authorship and various conflicts of interest. Student need to learn about rules, regulations, and ethics relating to animal and human experimentation. Further, they need to learn about how to choose a lab, keep proper records, deliver presentations, and seek funding. Finally, they need to learn the complex relationship between scientists and society.

**ME.440.820. Circuits and Brain Disorders.**
The course is designed to serve as an introduction to neurodegenerative disorders of the nervous system, and is intended to provide a balance of basic neurobiology, clinical presentation, biomarkers, genetics, and therapeutic approaches. One of the goals would be to highlight the distinct circuitry that is most impacted by each disorder. The curriculum includes: (1) one lecture per week and (2) a coordinated journal club once per week.