NEUROSCIENCE (NGG)

NGG 510 Neurotransmitter Signaling & Neuropsychopharmacology
The goals of this course are three-fold: 1. Provide an overview of major psychiatric disorders 2. Provide in-depth information on neurotransmitters, emphasizing the wealth of new molecular information on how neurons function and communicate, as well as the basis for psychotherapeutics (one class per week). 3. Develop skills to appreciate, present, and critically evaluate the current literature in neurotransmitter signaling and neuropsychopharmacology (one class per week).
Taught by: Steve Thomas, Chris Pierce, Wade Berrettini, Liz Heller-Mesznik
Course offered spring; even-numbered years
Activity: Lecture
1 Course Unit

NGG 521 Brain Computer Interface
This course is geared to advanced undergraduate and graduate students interested in understanding the basics of implantable neuro-devices, their design, practical implementation, approval, and use. Reading will cover the basics of neuro signals, recording, analysis, classification, modulation, and fundamental principles of Brain-Machine Interfaces. The course will be based upon twice weekly lectures and "hands on" weekly assignments that teach basic signal recording, feature extraction, classification and practical implementation in clinical systems. Assignments will build incrementally toward constructing a complete, functional BMI system. Fundamental concepts in neurosignals, hardware and software will be reinforced by practical examples and in-depth study. Guest lecturers and demonstrations will supplement regular lectures.
Also Offered As: BE 521
Prerequisites: BE 301 (Signals and Systems) or equivalent, computer programming experience, preferably MATLAB (e.g., as used in BE labs, BE 209/210/310). Some basic neuroscience background (e.g. BIOL 215, BE 305, BE 520, NGG core course), or independent study in neuroscience, is required. This requirement may be waived based upon practical experience on a case by case basis by the instructor.
Activity: Lecture
1 Course Unit

NGG 534 Seminar in Current Genetics Research
In this course we will focus on examples of human disease gene models and examine how these genetic model systems can be used to learn more about how and why a disease occurs and how it might be better diagnosed or treated. The course will meet once a week for 1.5 - 2.0 hours. Prior to each class, the student discussion leader for the week is expected to meet at least once with the assigned faculty preceptor to discuss their presentation.
Taught by: Thomas Jongens
Course usually offered in spring term
Activity: Seminar
1 Course Unit

NGG 572 Electrical Language of Cells
This course introduces students to high-speed electro-chemical signaling mechanisms that occur in nerve and other excitable cells during normal activity. Topics considered in substantial detail include: a) basic description of the passive and active membrane electrical properties; b) the molecular architecture and functional role of ion channels in cell signaling; c) the role of the calcium ion as an ubiquitous chemical messenger, with applications to neuro-secretion; d) excitatory and inhibitory transmission in the central nervous system; e) sensory transduction, as illustrated by the visual, olfactory, and auditory pathways. The course assumes a standard background in cell biology, as well as basic concepts from college physics and college calculus.
Taught by: Toshinori Hoshi, Doug Coulter
Course usually offered in fall term
Activity: Lecture
1 Course Unit

NGG 573 Systems Neuroscience
This course provides an introduction to what is known about how neuronal circuits solve problems for the organism and to current research approaches to this question. Topics include: vision, audition, olfaction, motor systems, plasticity, and oscillations. In addition, the course aims to provide an overview of the structure of the central nervous system. A number of fundamental concepts are also discussed across topics, such as: lateral inhibition, integration, filtering, frames of reference, error signals, adaptation. The course format consists of lectures, discussions, readings of primary literature, supplemented by textbook chapters and review articles.
Taught by: Yale Cohen, Christopher Pierce
Course usually offered in spring term
Activity: Lecture
1 Course Unit

NGG 575 Neurobiology of Learning and Memory
This course focuses on the current state of our knowledge about the neurological basis of learning and memory. A combination of lectures and discussions will explore the molecular and cellular basis of learning in invertebrates and vertebrates from a behavioral and neural perspective. This course is intended for upper level undergraduate and graduate students.
Taught by: Hilary Gerstein
Course offered fall; odd-numbered years
Activity: Seminar
1 Course Unit
NGG 578 Advanced Topics in Behavioral Genetics
The first half of this course focuses on the use of genetic techniques to study the molecular and cellular bases of behavior. Reverse genetic approaches utilizing gene knockout and transgenic technology and forward genetic approaches using mutagenesis and quantitative genetic techniques will be discussed, as well as application of these studies to different model organisms. Genetic approaches to behavior and complex disease in humans will be illustrated with a lecture on neurodegenerative disorders. The second half of this survey course will provide an introduction to autism and other neurodevelopmental disorders. The class will include clinical descriptions of autism as well as closely related disorders such as Fragile X syndrome for which there are now well developed model systems. It will be team taught by experts in each of the content areas covered including psychology, neurology, genetics, animal modeling, cognitive neuroscience. The scope will be from genes to brain to behavior to treatment.
Taught by: Maja Bucan, Robert Schultz
Course offered spring; even-numbered years
Activity: Lecture
1 Course Unit

NGG 584 Neurobiology of Sleep and Arousal
The objectives of this course are to discuss mechanisms controlling sleep and arousal; to survey novel approaches to investigations in these areas; indicate the clinical relevance of these ideas where possible. The course is run in the style of a journal club where in each weekly session, students review and discuss influential papers in the field.
Taught by: David Raizen, Max Kelz
Course offered fall; even-numbered years
Activity: Lecture
1 Course Unit

NGG 588 Topics in Translational Neuroscience
This course will introduce graduate students in neuroscience and related disciplines to basic mechanisms and clinical features of major categories of nervous system disease. Each two-hour class will consist of two-parts; a formal lecture followed by a seminar on the same topic. The formal basic science lectures will discuss genetic, molecular, and cellular mechanisms relevant to the disease examined while the seminar will illustrate how that information can be used in the clinical setting to promote further discovery and inform treatment. Some of the seminar will be associated with the Clinical Neuroscience Training Program (CNST) to provide the opportunity to interact with medical students and clinicians. The course will rely on assigned readings of primary research papers and discussions during class.
Taught by: Mariella De Biasi
Course usually offered in spring term
Activity: Lecture
1 Course Unit

NGG 594 Theoretical and Computational Neuroscience
This course surveys recent theoretical models of neural function. Students will be introduced to the basic techniques of modelling and computer simulation. Topics include models of synaptic plasticity, neuronal processing and oscillations, and models of various brain regions including cortex, thalamus, cerebellum, and hippocampus. Particular emphasis will be placed on models of the visual system from development to perceptual phenomena such as structure-from-motion, shape-from-shading, and stereopsis. Higher level processes including cortical integration will be considered. Applied neural network models of Hopfield, Sejnowski, and parallel distributed processing will also be presented.
Taught by: Vijay Balasubramanian
Course usually offered in spring term
Prerequisites: Previous coursework in physiology and in differential equations and some familiarity with computers, or instructor’s permission.
Activity: Lecture
1 Course Unit

NGG 597 Neural Development, Regeneration and Repair
The goals of this course are to examine the principles underlying nervous system development and to learn how understanding developmental mechanisms can inform strategies to promote regeneration and repair. This is not a survey course. Rather, the course will focus on selected topics, for which we will discuss the genetic, molecular and cellular strategies employed to study these problems in different model organisms. Emphasis is on how to interpret and critically evaluate experimental data. Each class is 1.5 hours in length. During the first hour, and assigned paper will be discussed in detail. During the last 20-30 minutes, faculty will introduce methods, concepts and background information pertinent to the paper that will be discussed at the following meeting.
Taught by: Greg Bashaw, Wenqin Luo
Course usually offered in fall term
Activity: Lecture
1 Course Unit

NGG 598 Advanced Systems Neuroscience
This course takes an integrative approach to the study of nervous system function. We will explore neural strategies for transforming sensory information into motor commands that specify specific behavior. We will use example systems of different modalities to explore concepts such as neural coding, action selection and learning etc., at levels ranging from synaptic input analysis at single sensory neurons and their effect on local network processing to larger scale population analyses. The course will consist of an introductory section to provide a conceptual framework for studying neural circuits at the systems level. This will be followed by additional sections that each explores specific neural systems within the context of this conceptual framework. Prerequisite: CORE III (NGG 573, Systems Neuroscience) or Permission of the Course Director.
Taught by: Marc Schmidt, Long Ding
Course offered fall; odd-numbered years
Prerequisite: Core III or Permission of course director
Activity: Lecture
1 Course Unit

NGG 600 Topics in Neurobiology of Disease 001: Neurodegenerative Diseases
Activity: Seminar
0.5 Course Units
NGG 615 Protein Conformational Diseases
Protein misfolding and aggregation has been associated with over 40 human diseases, including Alzheimer’s disease, Parkinson’s disease, amyotrophic lateral sclerosis, prion diseases, alpha (1)-antitrypsin deficiency, inclusion body myopathy, and systemic amyloidoses. This course will include lectures, directed readings, and student presentations, to cover seminal and current papers on the cell biology of conformational diseases including topics such as protein folding and misfolding, protein degradation pathways, effects of protein aggregation on cell function, model systems to study protein aggregation and novel approaches to prevent protein aggregation. Taught by: Yair Argon, Harry Ischiropoulos Course offered fall; odd-numbered years Also Offered As: BMB 518 Activity: Lecture 1 Course Unit

NGG 618 Recovery After Neural Injury
The human nervous system is subject to several types of injury, (traumatic, ischemic, epileptic, demyelinating and/or inflammatory) that cause serious functional deficits. The mechanisms used by the central and peripheral nervous systems for functional recovery from these injuries will be described in this course. The molecular and cellular pathobiology of CNS injury will be reviewed and methods to enhance functional recovery will be discussed in detail. These include the limitation of secondary neuronal damage by pharmacological manipulations (neuroprotection), the promotion of regeneration, and plasticity, the application of bioengineering strategies, and the use of behavioral rehabilitative approaches. Course Format: a combination of lecture, journal club style student presentations and classroom discussion. Taught by: Akiva Cohen, D Kacy Cullen Course offered spring; odd-numbered years Activity: Lecture 1 Course Unit

NGG 695 Scientific Writing
This 7-class course is designed to introduce students to basic scientific writing skills and is timed for second year graduate students preparing for qualifying examinations. Participants will review the general principles of clear, persuasive writing, and will apply these principles to writing for a scientific audience. Particular emphasis will be placed on conveying the significance of your research, outlining the aims, and discussing the results for scientific papers and grant proposals. The course will also provide an overview of the structure and style of research grant proposals and scientific manuscripts. Classes are highly interactive, and the majority of class time will be spent discussing student scientific writing. The goal of the course is to encourage active and open interaction among students. Ideal endpoints include improved self-editing, and development of effective strategies for offering and receiving editorial recommendations among peers. Taught by: Harry Ischiropoulos, Joshua Ian Gold Course usually offered in spring term Prerequisites: NGG Pre-candidacy exam students only. Activity: Seminar 0.5 Course Units

NGG 699 Lab Rotation
Activity: Laboratory 3 Course Units

NGG 706 Neuroeconomics
This seminar will review recent research that combines psychological, economic, and neuroscientific approaches to study human and animal decision-making. This course will focus on our current state of knowledge regarding the neuroscience of decision-making, and how evidence concerning the neural processes associated with choices might be used to constrain or advance economic and psychological theories of decision-making. Topics covered will include decisions involving risk and uncertainty, decisions that involve learning from experience, decisions in strategic interactions and games, and social preferences. Taught by: Joseph Kable One-term course offered either term Activity: Seminar 1 Course Unit

NGG 799 Independent Study Neurobiology and Neurophysiology of Addiction: Emphasis on Nicotine and Adolescence
One-term course offered either term Activity: Independent Study 1 Course Unit

NGG 899 Pre-Dissertation Lab Rotation
One-term course offered either term Activity: Laboratory 0.5 Course Units

NGG 990 Master’s Thesis
Course not offered every year Activity: Masters Thesis 1 Course Unit

NGG 995 Dissertation
Activity: Dissertation 1 Course Unit