NEUROSCIENCES (GS14)

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GS14 1021 Current Topics in Neurobiology of Disease (1 Credit)
Prerequisite: None. This course is an integrated approach to neurological diseases, which includes background information as well as the diagnosis, treatment, and biological mechanisms of the diseases under study. This course will provide students with a broad understanding and appreciation for invasive (e.g., electrocorticography (ECoG), stereo-electroencephalography (sEEG), local field potential (LFP), deep brain stimulation (DBS) and non-invasive (surface EEG, transcranial magnetic stimulation, transcranial current stimulation) recording and stimulation modalities as they relate to brain mapping, neurological/psychiatric diseases and disorders (e.g., stroke, epilepsy, depression, PTSD) as well as the augmentation and/or restoration of certain functions. Importantly, a discussion of ethical implications as well as the future of these emerging technologies will be threaded throughout and specifically addressed. Lectures will be given by leading experts in the field from UTHealth Houston, Rice University, and Baylor College of Medicine. This course is open to graduate students, medical students, residents, and postdoctoral fellows. Pass/Fail

GS14 1024 Systems Neuroscience (4 Credits)
Prerequisite: Consent of Instructor. This course cover the key concepts in systems neuroscience that allow students to understand how individual neurons and circuits process information and modulate behavior. The central idea behind this course is to illuminate the connection between physiology and function. In order to do this, we will concentrate on several key brain systems, and for each of these systems, we will interrogate how the structure and physiology of distinct brain circuits account for their function. The aim is to understand fundamental principles, not to survey the entire brain. We chose several different systems that are qualitatively different to illustrate the basic principles of systems neuroscience. The course will provide students with fundamental knowledge about the function, connectivity, and plasticity of neuronal circuits. We will do this by exploring how selected brain systems form perceptions of the external world, execute movements, make decisions, represent space, and form memories. In addition, we will examine how stress, fear, and reward are encoded and regulated, how the brain controls internal metabolic needs such as food intake, energy expenditure, temperature regulation and sleep, and how pain sensation is initiated peripherally and perceived centrally. We will emphasize unifying principles, including how the brain processes information, how different cell types contribute to the function of circuits, and how the brain is modified during learning and experience. An integral part of the course is a neuroanatomy lab that will relate the functional view presented during the lectures with the anatomical structures in which these functions are implemented. The course will also include article presentations in which each student has the opportunity to present a scientific paper related to the course material, discuss the findings, and ask questions. Letter Graded

GS14 1051 Sem in The Neurobiol of Lrng & Memry (1 Credit)
Prerequisite: None. This course has two major objectives. The first is to familiarize students with current research in learning and memory with particular emphasis on the cellular and molecular mechanisms. The second goal is to teach students how to give outstanding research seminars. Weekly 90-minute meetings involve alternate faculty and student presentations on current problems in the neurobiology of learning and memory. Faculty and student presentations cover recent articles from leading journals on the same topic. Students are instructed in the preparation of PowerPoint presentations, seminar organization, and techniques of oral presentation and are given feedback by faculty and fellow student following their presentations. Students can register for this course multiple times during their graduate career. Pass/Fail

GS14 1071 Translational Neuroscience (1 Credit)
Prerequisite: None. This course is a multidisciplinary course that focuses on understanding neurological diseases from both basic and clinical approaches. We will examine several brain disorders including neurodegenerative diseases and psychiatric-behavioral disorders. During each session, a basic and a clinical expert in one of the selected disorders will partner to introduce the general concepts of the neuropathology, clinical signs, diagnosis, therapeutic strategies, and current research directions of the specific disorder. The main goal of the course is to understand the important interdisciplinary role of basic and clinical research. These research efforts have a common mission: To improve the quality of life of patients suffering from these disorders. Highlighting the interconnection between basic and clinical research will help provide dual feedback to translate the results from bench to bedside. In most of the cases, a PhD faculty will partner with an MD faculty to explain both sides of the most current research. Only by combining knowledge will we be able to advance our efforts in the prevention, diagnosis and treatment of these neurological disorders. Auditing this course is permitted with course director's consent. Pass/Fail

GS14 1131 Neurobiology of Mental Health Disorders (1 Credit)
Prerequisite: None. This course will cover the current understanding of the biological basis of mental health disorders, including schizophrenia, bipolar disorder, depression, post-traumatic stress disorder, and substance use disorders. The course will include discussions on challenges that are unique to mental health disorders, and how knowledge of biological underpinnings can be translated to clinical treatments. The presentations will be led by researchers with expertise in the specific disorder and will focus on recent publications on the topic, to facilitate an interactive discussion with students. Upon successful completion of this course, students will understand the current knowledge of the biological basis of psychiatric disorders, including underlying molecular, cellular, and systems mechanisms. Students will appreciate how challenges unique to mental health disorders are being approached, what challenges remain, and future directions. Auditing this course is permitted with course instructor's consent. Pass/Fail

GS14 1141 Neuroimmunology (1 Credit)
Prerequisite: None. This course combines knowledge from the fields of Neuroscience and Immunology. The course covers not only the studies of the nervous system/immune system, but also the immune responses to certain neurological diseases, including Alzheimer's Disease, Multiple Sclerosis, Ischemic/Hemorrhagic Stroke, BBB disorders, etc. Specific immune cells will be discussed including the activation pathways of neutrophils, microglia, T/B cells upon pathogenic stimuli to the nervous system. The objectives of the course are to help students better understand the interactions of the nervous system and the immune system. Specifically, upon successful completion of this course, students will be able to better understand the roles of various immune cell types in the pathology of neuroinflammatory diseases, the molecular pathways that regulate the activation of immune cells and mobilization of inflammatory mediators. Auditing this course is permitted by course directors' consent. Pass/Fail

GS14 1151 Cancer Neuroscience (1 Credit)
Prerequisite: None. This is the first program to integrate neuroscience and cancer biology to spur a wave of innovation in cancer research and treatments. By building on nearly a decade of collaborative research and discussions among our faculty, this course aims to explore the interface between cancer biology and neuroscience and the impact of the nervous system on tumor development, tumor progression, and patient outcomes. Classes will cover several emerging areas, including the neural regulation of cancer initiation and growth, neuro-immune interactions, neural plasticity in the tumor microenvironment, translating research from bench to bedside, and quality of life issues. The course will bring together leading experts from across the fields of neuroscience, cancer biology, and immunology, as well as oncologists, surgeons, neurologists, integrative medicine and palliative care specialists, patients, and patient advocates to facilitate discussion of exciting new concepts and developments in this emerging field. The course will feature classes devoted to fundamental and translational research as well as workshops and panel discussions that include the following topics: neural regulation of cancer, glial cell regulation of cancer, cancer neuro-immunology, CNS and PNS malignancies, neurological sequelae of cancer therapies, quality of life, neural health, and rehabilitation. Auditing this course is permitted with course directors' consent. Pass/Fail

GS14 1173 Cognitive Neuroscience (3 Credits)
Prerequisite: Permission of the instructor. This course is an introductory graduate-level overview of cognitive neuroscience. The course will cover basics in history, neuroanatomy, methods of cognitive neuroscience, sensation and perception, control of action, learning and memory, emotion, language, attention, drugs and cognition, impulsivity, cognitive control, social cognition, and neurobiology of disease. The intent is to provide students with fundamental knowledge of how the brain relates to cognitive functions and how this may help in understanding and treatment of human diseases that affect the central nervous system. Letter Graded

GS14 1183 Biology of Neurological Diseases (3 Credits)
Prerequisite: None. This course will focus on the etiologies underlying major neural diseases. Led by GSBS faculty with related expertise, the course will review representative neural diseases and discuss seminal research papers in the respective fields, with emphasis on the current understanding of these diseases at molecular, cellular, and system levels. By completing this course, students should grasp the knowledge of fundamental biology of major neural diseases, appreciate the common and distinctive mechanisms underlying these diseases, learn the existing hypotheses and experimental paradigms as well as outstanding questions and main challenges in the field, and hone the ability to develop novel strategies for scientific and translational discoveries for this unique group of diseases. Auditing this course is permitted with course director's consent. Letter Graded

GS14 1213 Visual Neuroscience (3 Credits)
Prerequisites: GS14 1214: Molecular and Cellular Neuroscience and Consent of Instructor. This is an advanced elective course aimed at students in the neurosciences. The course will introduce the students to the core concepts of the anatomy, physiology and function of the visual system, with an emphasis on retinal circuitry. The retina is arguably the most valuable model to study the CNS. Its accessibility and organization makes it a convenient research tool with which to link anatomy and functionality, and study processes and diseases similar to those in the brain and spinal cord. The course will guide students to understand how image-forming and non-image forming functions of the retina are accomplished. Normal and dysregulated molecular events underlying developmental and physiological control of retinal function will also be covered. The course will alternate lectures and student presentations of significant articles in the field. Active involvement of the students in class is expected. Letter Graded

GS14 1214 Molecular and Cellular Neuroscience (4 Credits)
Prerequisite: None. This course is a graduate-level treatment of molecular and cellular neuroscience. It is designed for first-year graduate students and will introduce basic concepts of molecular, electrical and chemical signaling in individual neurons, synapses, and local neuronal circuits. Topics covered include the functional properties of membranes, receptors, and channels, intracellular signaling cascades, synaptic transmission, short- and long-term forms of synaptic plasticity, and information processing in neuronal dendrites and local circuits. Letter Graded

GS14 1223 Neurocircuits and Behavior (3 Credits)
Prerequisites: Molecular and Cellular Neuroscience (GS14 1214), Systems Neuroscience (GS14 1014) and consent of instructor. This is an advanced course aimed at students interested in the general field of Systems Neuroscience. The course will introduce new technological advances, as well as their application to examine the functional role of specific neural circuits in vivo. This course will employ a combination of introductory lectures and extensive in-class discussions of primary literature. In addition, students will be introduced to the manuscript peer review process by selecting manuscripts from a preprint server and identifying their conceptual and technical strengths and weaknesses. Letter Graded

GS14 1611 Current Topics in Neuroscience (1 Credit)
Prerequisite: None. This course will give an overview of the wide range of research being carried out in the GSBS Neuroscience Graduate Program, and is open to all first year graduate students. Through presentations and discussions with a different NSGP faculty member each week, students will gain an appreciation for some of the big ideas and unsolved questions in Neuroscience research, and become familiar with the experimental and theoretical approaches being used to tackle those questions. Anyone with a strong interest in Neuroscience research is encouraged to take this class. There are no exams or reading assignments, but students are expected to attend all presentations and to actively participate in class discussions. Pass/Fail

GS14 1612 Biostatistics for Life Scientists (2 Credits)
Prerequisite: Permission of instructor. This is an entry-to-intermediate-level course aimed at scientists in the life sciences. During the first half of the semester, the course will introduce students to the basic concepts and statistical tests that are routinely encountered in analyzing scientific data in designed experiments, as opposed to the analysis of clinical or epidemiological type data. Following an introduction to probability, students will learn what statistical tests are appropriate and how to run them. Emphasis is on intelligent usage rather than mathematical formality. Standard tests such as t, z, chi squared, ANOVA and regression analyses will be learned, as well as how power analyses and calculating sample size is performed. During the second half of the semester, advanced topics in life sciences, including Poisson distributions, clustering methods and multidimensional analyses will be included. Another goal of this course will be to build familiarity with the basic R toolkit for statistical analysis and graphics. Letter Graded