

Neuroscience

Chair

David M. Berson

Neuroscience is the scientific study of the nervous system, including its development, functions, and pathologies. It is an interdisciplinary field that encompasses neurobiology (anatomy, physiology, biochemistry, molecular biology, genetics), elements of psychology and cognitive science, and mathematical and physical principles involved in modeling neural systems.

The Department of Neuroscience offers an undergraduate concentration leading to the Sc.B. degree and a graduate program leading to the Ph.D. degree. These programs include courses offered by the department and by several allied departments. The Department of Neuroscience has modern facilities for conducting research in a broad range of areas from molecular mechanisms to behavior and undergraduate students are encouraged to pursue research projects.

For additional information, please visit: <http://neuroscience.brown.edu/>

Neuroscience Concentration Requirements

Neuroscience is an interdisciplinary field that seeks to understand the functions and diseases of the nervous system. It draws on knowledge from neurobiology as well as elements of psychology and cognitive science, and mathematical and physical principles involved in modeling neural systems. Through the Neuroscience concentration, students develop foundational knowledge through courses in biology, chemistry, and mathematics as well as three core courses in neuroscience. They are also required to develop facility with research methodologies (through courses in statistics and laboratory methods) before moving into specific topics in the field (e.g., visual physiology, neurochemistry and behavior, and synaptic transmission and plasticity). Members of the Neuroscience faculty are affiliated with the Brown Institute for Brain Science, a multidisciplinary program that promotes collaborative research about the brain. Prospective concentrators should contact Elyse_Netto@brown.edu in order to have a faculty advisor assigned to them.

Standard program for the Sc.B. degree

The concentration combines a general science background with a number of specific courses devoted to the cellular, molecular, and integrative functions of the nervous system. The concentration allows considerable flexibility for students to tailor a program to their individual interests. Elective courses focus on a variety of areas including molecular mechanisms, cellular function, sensory and motor systems, neuropharmacology, learning and memory, animal behavior, cognitive function, bioengineering, theoretical neuroscience and computer modeling.

The concentration in neuroscience leads to an Sc.B. degree. The following background courses, or their equivalent, are required for the degree:

Background Courses:

MATH 0090	Introductory Calculus, Part I	1
MATH 0100	Introductory Calculus, Part II	1
PHYS 0030	Basic Physics A	1
PHYS 0040	Basic Physics B	1
BIOL 0200	The Foundation of Living Systems	1
CHEM 0330	Equilibrium, Rate, and Structure	1
CHEM 0350	Organic Chemistry	1

Core Concentration Courses:

NEUR 0010	The Brain: An Introduction to Neuroscience	1
NEUR 1020	Principles of Neurobiology	1
NEUR 1030	Neural Systems	1

One critical reading course 1

NEUR 1440	Mechanisms and Meaning of Neural Dynamics
NEUR 1530	Communication In the Brain: What We Know and How We Know It
NEUR 1560	Developmental Neurobiology
NEUR 1970	Independent Study
CLPS 1760	The Moral Brain
PHP 1890	The Craving Mind
1930/40 Topics in Neuroscience	

One statistics course 1

PHP 1501	Essentials of Data Analysis
PHP 1510	Principles of Biostatistics and Data Analysis
PHP 2510	Principles of Biostatistics and Data Analysis
APMA 0650	Essential Statistics
APMA 1650	Statistical Inference I
CLPS 0900	Statistical Methods
SOC 1100	Introductory Statistics for Social Research
EDUC 1110	Introductory Statistics for Education Research and Policy Analysis
BIOL 0495	Statistical Analysis of Biological Data

One lab method 1

NEUR 0680	Introduction to Computational Neuroscience
NEUR 1600	Experimental Neurobiology
NEUR 1630	Big Data Neuroscience Lab
NEUR 1650	Structure of the Nervous System
NEUR 1660	Neural Computation in Learning and Decision-Making
NEUR 1670	Neuropharmacology and Synaptic Transmission
NEUR 1680	Computational Neuroscience
NEUR 1970	Independent Study
CLPS 1194	Sleep and Chronobiology Research
CLPS 1490	Functional Magnetic Resonance Imaging: Theory and Practice
CLPS 1491	Neural Modeling Laboratory
CLPS 1492	Computational Cognitive Neuroscience
BIOL 0800	Principles of Physiology
BIOL 1880	Comparative Biology of the Vertebrates

Four electives related to neuroscience 4

Four courses that will enhance your understanding of the field of neuroscience. While electives need not be from the neuroscience department, the following list are common courses taught by Neuroscience and other departments that are often used as electives. We encourage students to explore the broader course catalog and consult with their concentration advisor to explore the full range of electives, rather than limiting themselves to this list:

NEUR 0650	Biology of Hearing
NEUR 0680	Introduction to Computational Neuroscience
NEUR 1040	Introduction to Neurogenetics
NEUR 1440	Mechanisms and Meaning of Neural Dynamics
NEUR 1540	Neurobiology of Learning and Memory
NEUR 1560	Developmental Neurobiology
NEUR 1600	Experimental Neurobiology
NEUR 1630	Big Data Neuroscience Lab
NEUR 1600	Experimental Neurobiology

NEUR 1630	Big Data Neuroscience Lab
NEUR 1650	Structure of the Nervous System
NEUR 1660	Neural Computation in Learning and Decision-Making
NEUR 1670	Neuropharmacology and Synaptic Transmission
NEUR 1740	The Diseased Brain: Mechanisms of Neurological and Psychiatric Disorders
NEUR 1970	Independent Study
NEUR 2110	Statistical Neuroscience
All NEUR 1930/1940	Seminar Course
CLPS 0120	Introduction to Sleep
CLPS 1150	Memory and the Brain
CLPS 1193	Laboratory in Genes and Behavior
CLPS 1400	The Neural Bases of Cognition
CLPS 1478	Translational Models of Neuropsychiatric Disorder
CLPS 1480C	Cognitive Control Functions of the Prefrontal Cortex
CLPS 1490	Functional Magnetic Resonance Imaging: Theory and Practice
CLPS 1492	Computational Cognitive Neuroscience
CLPS 1495	Affective Neuroscience
CLPS 1561	The Nature of Attention
CLPS 1580E	Perception, Attention, and Consciousness
CLPS 1620	Developmental Cognitive Neuroscience
CLPS 1760	The Moral Brain
BIOL 1100	Cell Physiology and Biophysics
BIOL 1100	Cell Physiology and Biophysics
BIOL 1260	Physiological Pharmacology
ENGN 1220	Neuroengineering
PHP 1890	The Craving Mind
BIOL 1545	Human Genetics and Genomics
COST 1020	Cognitive Neuroscience of Meditation

Total Credits 17

¹ Independent study and honors research projects are encouraged.

Neuroscience Graduate Program

The program in Neuroscience offers graduate study leading to the Doctor of Philosophy (Ph.D) degree. The program is designed to educate and train scientists who will become leaders in the field and contribute to society through research, teaching and professional service. The core of the training involves close interaction with faculty to develop expertise in biological, behavioral, and theoretical aspects of neuroscience. Graduate research and training are carried out in the laboratories of the program's faculty. These faculty trainers lead outstanding well-funded research programs that use cutting edge technology to explore the nervous system.

For more information on admission and program requirements, please visit: <http://www.brown.edu/academics/gradschool/programs/biomed-neuroscience> (<http://www.brown.edu/academics/gradschool/programs/biomed-neuroscience/>)

Courses

NEUR 0010. The Brain: An Introduction to Neuroscience.

Introduction to the mammalian nervous system with emphasis on the structure and function of the human brain. Topics include the function of nerve cells, sensory systems, control of movement and speech, learning and memory, emotion, and diseases of the brain. No prerequisites, but knowledge of biology and chemistry at the high school level is assumed.

Fall	NEUR0010	S01	16043	Arranged		(M. Paradiso)
Fall	NEUR0010	C01	18329	T	7:00-8:00PM	'To Be Arranged'
Fall	NEUR0010	C02	18311	T	8:00PM-9:00PM	'To Be Arranged'
Fall	NEUR0010	C03	18312	W	7:00-8:00PM	'To Be Arranged'
Fall	NEUR0010	C04	18332	W	8:00PM-9:00PM	'To Be Arranged'
Fall	NEUR0010	C05	18333	Arranged		'To Be Arranged'
Fall	NEUR0010	C06	18315	Arranged		'To Be Arranged'
Fall	NEUR0010	C07	18335	Arranged		'To Be Arranged'
Fall	NEUR0010	C08	18336	Arranged		'To Be Arranged'
Fall	NEUR0010	C09	18318	Arranged		'To Be Arranged'
Fall	NEUR0010	C10	18319	Arranged		'To Be Arranged'
Fall	NEUR0010	C11	18320	Arranged		'To Be Arranged'
Fall	NEUR0010	C12	18340	Arranged		'To Be Arranged'
Fall	NEUR0010	C13	18341	Arranged		'To Be Arranged'
Fall	NEUR0010	C14	18342	Arranged		'To Be Arranged'
Fall	NEUR0010	C15	18324	Arranged		'To Be Arranged'
Fall	NEUR0010	C16	18325	Arranged		'To Be Arranged'
Fall	NEUR0010	C17	18345	Arranged		'To Be Arranged'
Fall	NEUR0010	C18	18346	Arranged		'To Be Arranged'
Fall	NEUR0010	C19	18328	Arranged		'To Be Arranged'

NEUR 0650. Biology of Hearing.

Examines the sensory and perceptual system for hearing; the external, middle, and inner ears; the active processes of the cochlea; sound transduction and neural coding; neural information processing by the auditory system; and the nature of auditory perception and its biological substrate. Prerequisite: an introductory course in Neuroscience, Cognitive Science, Physics, Engineering or Psychology.

NEUR 0680. Introduction to Computational Neuroscience.

An introductory class to computational neuroscience. Students will learn the main tools of the trade, namely differential equations, probability theory and computer programming, as well as some of the main modern neural-modeling techniques. Assignments will include the writing of simple Matlab code.

NEUR 0700. Psychoactive Drugs and Society.

Will examine psychoactive drugs from two perspectives: (1) biological mechanisms of drug action and (2) the impact of psychoactive drug use on society and society attitudes towards psychoactive drug usage. Drugs to be discussed will include alcohol, opiates, cocaine, marijuana, LSD, nicotine and caffeine, as well as drugs used therapeutically to treat psychiatric disorders. This course will benefit students who are interested in exploring both the biological and social aspects of psychoactive drug use. Prerequisite: NEUR 0010 or equivalent.

NEUR 1020. Principles of Neurobiology.

A lecture course covering fundamental concepts of cellular and molecular neurobiology. Topics include structure of ion channels, synaptic transmission, synaptic development, molecular mechanisms of synaptic plasticity, learning and memory and neurological diseases. Prerequisite: NEUR 0010. Strongly recommended: BIOL 0200 or equivalent.

Spr	NEUR1020	S01	24714	TTh	9:00-10:20(01)	(C. Aizenman)
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NEUR 1030. Neural Systems.

This lecture course examines key principles that underlie the function of neural systems ranging in complexity from peripheral receptors to central mechanisms of behavioral control. Prerequisite: NEUR 0010 or the equivalent. First year and Graduate students require instructor approval.

Fall	NEUR1030	S01	16046	Arranged		(M. Linden)
Fall	NEUR1030	C03	16049	Th	6:00-6:50	(M. Linden)
Fall	NEUR1030	C04	16050	Arranged		(M. Linden)
Fall	NEUR1030	C05	16051	F	3:00-3:50	(M. Linden)
Fall	NEUR1030	C06	16052	Arranged		(M. Linden)
Fall	NEUR1030	C07	17763	M	3:00-3:50	(M. Linden)
Fall	NEUR1030	C08	17764	Arranged		(M. Linden)
Fall	NEUR1030	C09	18610	Arranged		(M. Linden)
Fall	NEUR1030	C10	18694	Arranged		(M. Linden)

NEUR 1040. Introduction to Neurogenetics.

Recent advances in molecular biology and molecular genetics have allowed researchers to test specific hypotheses concerning the genetic control of behavior and neurological disease. This course will familiarize you with the relatively new and exciting field of neurogenetics. We will cover basic topics, new ideas, and unsolved problems in neurogenetics primarily through the two assigned texts. However, neurogenetics is essentially a "frontier" area in neuroscience, and the best way to approach this topic is by scientific literature, which will be covered in some lectures.

Spr	NEUR1040	S01	24715	Arranged		(K. Kaun)
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NEUR 1440. Mechanisms and Meaning of Neural Dynamics.

We humans can shift our attention, perceive new objects, make complex motions, and adjust each of these behaviors within fractions of a second. Neurons and systems of neurons vary in their activity patterns on millisecond to second time scales, commonly referred to as "neural dynamics." This course addresses mechanisms underlying this flexibility and its potential meaning for information processing in the brain. The course integrates biophysical, computational, single neuron and human studies. In addition to lectures and readings, students will learn how to build computational models to simulate neural dynamics at various scales from single neurons to networks, using Matlab and the Human Neocortical Neurosolver. Computational modeling will be taught hands-on in an interactive lab session each week. Please request override through Courses@Brown.

Fall	NEUR1440	S01	16055	TThF	1:00-1:50(08)	(C. Moore)
Fall	NEUR1440	L01	16056	W	3:00-4:40	(C. Moore)

NEUR 1520. Exploring Neural Data.

While a large part of being a neuroscientist involves performing experiments to collect data, the reality of studying the brain is that you can often collect way more data than you know what to do with! In this course, we will discuss data analytic challenges in neuroscience. We will provide real data sets for hands-on student activities. By the end of the course, students will have the basic tools and techniques to begin to work with neuroscience data themselves. Topics will include spike train, EEG and behavioral analyses. The course will emphasize basic computer programming skills in Python.

NEUR 1530. Communication In the Brain: What We Know and How We Know It.

Neurons communicate through the thousands of synapses they form. In this seminar-style course, we will explore the cellular and molecular underpinnings of synaptic transmission. We will then examine how synapse number and function can be modulated to shape circuit function during development, learning & memory formation, and in response to perturbations. We will develop scientific thinking skills and an understanding of experimental approaches in modern neuroscience by focusing on how the field investigates synaptic transmission and plasticity. All readings are from primary literature. Please request override through C@B.

Fall	NEUR1530	S02	18473	MW	3:00-4:20(10)	(K. O'Connor-Giles)
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NEUR 1540. Neurobiology of Learning and Memory.

Exploration of learning and memory from the molecular to the behavioral level. Topics will include declarative and procedural memory formation and storage, associative and non-associative learning, cellular and molecular mechanisms for learning, and disorders affecting learning and memory. Examples will be drawn from numerous brain areas and a variety of model systems, including humans. Students will gain experience interpreting experiments from primary literature. Prerequisite: NEUR 1020.

Spr	NEUR1540	S01	24716	Arranged		(M. Linden)
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NEUR 1560. Developmental Neurobiology.

The course will explore core concepts of developmental biology in the context of the developing nervous system. Topics will include: neuronal specification, cell migration, axon guidance, synapse formation, and neural plasticity. Students will gain experience with the primary literature and learn about cellular and molecular mechanisms of brain development and the tools and model organisms used to study them. Request override through C@B. The decision will be made based on a variety of factors including: seniority, concentration requirement, etc.

Spr	NEUR1560	S01	24717	W	3:00-5:30	(A. Jaworski)
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NEUR 1600. Experimental Neurobiology.

Intensive laboratory experience in neuroscience appropriate for students with basic background in Neurobiology. Learn and employ the classical neurophysiological techniques of extracellular recording, intracellular recording and receptive field mapping using a variety of animal species. Experiments will include recording of sensory signals in the cockroach leg; frog sciatic nerve and sciatic nerve/muscle preparation and intracellular recording of neurons in Aplysia. Instruction on and practice of effective science writing is another component to this course. Labs are supplemented by informal lectures. Enrollment limited to 18. Please request override through C@B. Overrides will not be given until after the first course meeting.

Spr	NEUR1600	S01	24718	W	1:00-5:00(06)	(J. Stein)
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NEUR 1630. Big Data Neuroscience Lab.

Recent technological developments have transformed neuroscience research, enabling us to generate comprehensive 'big data' sets that are often shared freely amongst the neuroscience community. This lab course will explore strategies to effectively use such open-sourced neuroscience data sets. Students will identify fundamental open questions in brain science and develop strategies to mine open-source sequencing, imaging and connectivity data to address their research questions.

Fall	NEUR1630	S01	16057	TTh	9:00-10:20(02)	(A. Fleischmann)
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NEUR 1650. Structure of the Nervous System.

Combined lecture and laboratory course on the anatomy of the central nervous system. Lectures survey the circuitry of the major neural systems for sensation, movement, cognition, and emotion. Laboratory exercises (Mon. 10:30-12:30) include brain dissections, microscopy of neural tissue, and discussion of clinical cases. Prerequisites: NEUR 0010, NEUR 1020, and NEUR 1030. Please request an override through C@B. Please keep in mind that decisions on overrides may not be made until the first meeting of the course.

Fall	NEUR1650	S01	16053	Arranged		(D. Berson)
Fall	NEUR1650	C01	18371	Arranged		'To Be Arranged'
Fall	NEUR1650	C02	18372	Arranged		'To Be Arranged'

NEUR 1660. Neural Computation in Learning and Decision-Making.

Your brain is constantly making decisions, receiving feedback about those decisions, and learning from that feedback. In this course we will examine the neuroscience underlying these processes from a computational perspective. The course will involve reading scientific papers from cognitive neuroscience, building and testing the computational models that have been developed to synthesize this literature, and, as a final project, extending an existing model of learning or decision making and characterizing its behavior. A primary goal for the course is to develop the tools and motivation to translate verbal theories of behavior into formal and testable computational models.

Spr	NEUR1660	S01	24719	TTh	9:00-10:20(01)	(M. Nassar)
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NEUR 1670. Neuropharmacology and Synaptic Transmission.

Synaptic transmission will be studied from a biochemical and pharmacological point of view. We will explore the factors regulating neurotransmitter synthesis, storage, release, receptor interaction, and termination of action. Proposed mechanisms of psychoactive drugs and biochemical theories of psychiatric disorders will be examined. Prerequisites: NEUR 0010 and BIOL 0200 or the equivalent.

NEUR 1680. Computational Neuroscience.

A lecture and computing lab course providing an introduction to quantitative analysis of neural activity and encoding, as well as modeling of neurons and neural systems. Emphasizes Matlab-based computer simulation. Prerequisites: NEUR 0010, 1020 or 1030; APMA 1650 or equivalent; APMA 0330 or 0350 or equivalent. Experience with Matlab desirable. Please request an override through C@B. Please keep in mind that decisions on overrides may not be made until the first meeting of the course.

NEUR 1740. The Diseased Brain: Mechanisms of Neurological and Psychiatric Disorders.

The goals of this course are to illustrate what basic science can teach us about neurological disorders and how these pathologies illuminate the functioning of the normal nervous system. Consideration will be given to monoallelic diseases (e.g. Fragile X Syndrome, Duchenne Muscular Dystrophy and Tuberous Sclerosis) as well as genetically complex disorders, such as Autism, Schizophrenia and Alzheimer's Disease. Emphasis will be on the cellular and molecular basis of these disorders and how insights at these levels might lead to the development of therapies. Prerequisites: NEUR 1020. BIOL 0470 suggested.

NEUR 1750. Brain Rhythms in Cognition, Mental Health and Epilepsy. "Everything in the universe has a rhythm, everything dances." – Maya Angelou.

The brain, too, dances. Its rhythms are the result of millions of neurons coordinating each other's activity. This course will explore how these rhythms are generated, how they relate to our perception and cognition, and how they can be used to better understand and diagnose psychiatric and neurological disorders. Our readings in this seminar will range from historical reviews of brain rhythms to modern primary literature employing cutting-edge experimental neuroscience techniques. Prerequisite: NEUR 0010 or the equivalent.

NEUR 1930A. Cognitive Neuroscience: Motor Learning.

This critical reading course will investigate the behavioral and neural mechanisms of motor learning. Readings will focus on work done with neuroimaging, neural recording and neuropsychological approaches that have addressed how the brain organizes and controls different forms of motor learning including simple conditional, practice-related changes and sensory-motor associations. Prerequisites: NEUR 0010, NEUR 1020, and NEUR 1030, or equivalent.

NEUR 1930B. From Neurophysiology to Perception.

This seminar will use readings from the research literature to explore the neural basis of perception. There will be an emphasis on vision, though other sensory modalities may be discussed. Prerequisites: NEUR 0010, NEUR 1020, and NEUR 1030, or equivalent.

NEUR 1930C. Development of the Nervous System.

The course will explore core concepts of developmental biology in the context of the developing nervous system. Topics will include: neuronal specification, cell migration, axon guidance, synapse formation, and neural plasticity. Students will gain experience with the primary literature and learn about cellular and molecular mechanisms of brain development and the tools and model organisms used to study them. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration.

NEUR 1930D. Cells and Circuits of the Nervous System.

Selected topics on the biology of neurons and neuronal networks emphasizing original research literature about the membrane physiology, transmitter function, synaptic plasticity, and neural interactions of different vertebrate central nervous systems. Appropriate for graduates and undergraduates with strong neuroscience background. Offered alternate years. Previously offered as NEUR 2150.

NEUR 1930E. Great Controversies in Neurobiology.

This upper-level course examines some of the great controversies in the history of neurobiology. Reading material is drawn primarily from the primary scientific literature, so students are expected to already be familiar with reading scientific papers. Each theme will focus on a particular controversy, examining experimental evidence supporting both sides of the issue. Prerequisites: NEUR 0010 and NEUR 1020. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration. Instructor permission required.

NEUR 1930F. Brain Interfaces for Humans.

Seminar course will cover developing and existing neurotechnology to restore lost human neurological functions. It will cover stimulation technologies to restore hearing, vision and touch, recording technologies to return function for persons with paralysis. The course will also cover devices to modulate brain function (e.g. deep brain stimulators). We will discuss early brain technologies, the present state neural sensors and decoders and future technology developments (e.g. brain-machine hybrids, human augmentation), as well as ethical implications. A final paper will be required. Instructor permission required. Prerequisites: NEUR 0010, NEUR 1020, and NEUR 1030; 1 year of physics, calculus. Enrollment restricted to 20 Neuroscience Concentrators and Graduate Students. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration.

NEUR 1930G. Disease, Mechanism, Therapy: Harnessing Basic Biology for Therapeutic Development.

The recent surge in understanding the cellular and molecular basis of neurological disease has opened the way for highly targeted drug discovery and development. In this course we will use several case studies to illuminate how mechanistic insights are being translated into novel therapeutic approaches. Please request an override through C@B. Please keep in mind that decisions on overrides may not be made until the first meeting of the course.

NEUR 1930H. Neurological Disorders: Neural Dynamics + Neurotechnology.

A seminar course on neural dynamics and therapeutic approaches based on open-/closed-loop Brain-Computer Interfaces (BCIs) and neuromodulation for neurological and neuropsychiatric disorders. Topics include: (1) Disorders of consciousness: loss-of-consciousness in generalized epileptic and psychogenic seizures; closed-loop seizure control; Coma, medically induced coma and general anesthesia; Neuromonitoring of consciousness; (2) BCIs for auditory/visual/somatosensory disorders; (3) Movement disorders: BCIs for restoring movement/communication; adaptive-DBS for Parkinson's disease and essential tremor. (4) Neuropsychiatric disorders: DBS for major depression and obsessive compulsive disorder. To sign up, add this course to your cart. Enrollment is based on a variety of factors such as: seniority, concentration requirement.

NEUR 1930I. Neural Correlates of Consciousness.

This course will consider the neuroscience of consciousness from a variety of perspectives, using examples from behavior, neurophysiology, neuroimaging and neurology. The course content will focus on primary literature, using review articles for background. Students will lead discussions. Sign-up required by Google Docs (link below). Please keep in mind that overrides may not be given until after the first meeting. Overrides are given based on seniority, concentration requirements, etc. Strongly Recommended: NEUR 1030. Enrollment limited to 15.

Spr NEUR1930I S01 24721 M 4:00-6:30 (J. Sanes)

NEUR 1930J. C2S Neurotech: From Concept to Startup- Translating Neurotechnology.

To provide an understanding of the process of translating neurotechnology concepts into applications that can benefit people with nervous system disorders. Emphasizing principles useful to (1) recognize viable neuroscience concepts that can be applied to human nervous system disorders and (2) implement the essential engineering and clinical steps to translate concepts into real world, useful solutions. This is for students interested in translational neuroscience research in academia or in entrepreneurship and commercialization of neurotech innovations. Please request override via Courses@Brown.

Spr NEUR1930JS01 24723 T 4:00-7:00 (J. Donoghue)

NEUR 1930L. Neurobiology of Love.

The goal of this course is to explore the underlying neurobiological principles of love and attachment. Topics include the relevant brain areas, the role of sensation and perception in love and attachment; how love and attachment influence action and behavior; plasticity and learning in these systems; and relevant neurodiversity related to love and attachment. You will gain a deeper understanding of concepts and principles that apply throughout the brain. You will gain experience with primary literature and learn about the relevant experimental techniques. There will be an emphasis on how the neurobiology of love is portrayed in the popular press.

Spr NEUR1930LS01 26916 TTh 1:00-2:20(08) (M. Linden)

NEUR 1930N. Region of Interest: An In-Depth Analysis of One Brain Area.

An in-depth exploration of one region of the brain. Topics will include: cell types and properties; synaptic properties; plasticity; connections to other brain areas; sub-divisions within the area; the region's role in sensation and perception; the region's role in action and behavior; the region's role in learning and memory; and diseases and disorders. Students will gain a deeper understanding of concepts and principles that apply throughout the brain. Students will gain experience with primary literature and learn about techniques for studying the area. Topic Fall 2020: Amygdala. Please request the override during pre-registration. Students will not match with this course during the initial match phase, but students who request overrides will get additional information about how to gain a spot in this course by the end of August.

Fall NEUR1930NS01 16063 TTh 1:00-2:20(08) (M. Linden)

NEUR 1930Z. Cells and Circuits of the Nervous System.

Selected topics on the biology of neurons and neuronal networks emphasizing primary research literature about neuronal excitability, synaptic mechanisms and plasticity, and diverse sensory, motor, and cognitive functions of neural circuits in vertebrate brains. Offered alternate years. Limit 15. To sign up, add this course to your primary cart. Enrollment decision will be made based on seniority, concentration requirement, etc.

NEUR 1940B. Deep Learning in Neuroethology.

Critical readings class will examine neural mechanisms for natural behavior (neuroethology) through reading classic studies and following current research. The course will emphasize the application of deep learning methods to movement patterns, spatial orientation, and social communication. DeepLabCut is one of several new programs that empower students and researchers to take advantage of deep learning methods for behavioral neuroscience. The course will teach how to replace single-parameter data analysis with deep learning methods to identify underlying patterns. Prerequisites are Introductory Neuroscience (NEUR0010) and prior training in Matlab or computer programming languages. Request override through C@B.

NEUR 1940C. Topics in Visual Physiology.

Selected topics in visual physiology are examined through a close and critical reading of original research articles. Emphasizes the anatomical and physiological bases of visual function. Appropriate for graduate students and undergraduates with a strong neuroscience background. Offered in alternate years. (Previously offered as NEUR 2120.)

NEUR 1940D. Higher Cortical Function.

This reading course examines a series of high-level neurocognitive deficits from the perspectives of popular science and basic neuroscience. Prerequisite: NEUR 1030. Instructor permission required. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration.

NEUR 1940E. Molecular Neurobiology: Genes, Circuits and Behavior.

In this seminar course, we will discuss primary research articles, both recent and classical, covering topics ranging from the generation of neuronal diversity to the control of behavior by specific neural circuits. Instructor permission required; enrollment limited to 15. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration.

NEUR 1940G. Drugs and the Brain.

This is a seminar course devoted to the reading and analyzing of original research articles dealing with the interaction between drugs and the brain. This will include drugs used to analyze normal brain function, as well as drugs of abuse and drugs used for therapeutic purposes. This course is intended for undergraduate and graduate students with a strong background in neuropharmacology. To express interest, please add this course to your primary cart. The decision will be made based on a variety of factors including, but not limited to seniority, concentration requirement. Limited to 15.

NEUR 1940I. Neural Correlates of Consciousness.

This course will consider the neuroscience of consciousness from a variety of perspectives, using examples from behavior, neurophysiology, neuroimaging and neurology. The course content will focus on primary literature, using review articles for background. Students will lead discussions. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration. Prerequisite: NEUR 0010, 1020, and 1030. Enrollment limited to 15. Instructor permission required.

NEUR 1970. Independent Study.

Laboratory-oriented research in neuroscience, supervised by staff members. A student, under the guidance of a neuroscience faculty member, proposes a topic for research, develops the procedures for its investigation, and writes a report of the results of his or her study. Independent study may replace only one required course in the neuroscience concentration. Prerequisites include NEUR 0010, 1020 and 1030. Section numbers vary by instructor. Please check Banner for the correct section number and CRN to use when registering for this course. Permission must be obtained from the Neuroscience Department.

NEUR 2010. Graduate Proseminar in Neuroscience.

A study of selected topics in experimental and theoretical neuroscience. Presented by neuroscience faculty, students, and outside speakers. A required course for all students in the neuroscience graduate program.

Fall NEUR2010 S01 18648 Arranged (D. Sheinberg)

NEUR 2020. Graduate Proseminar in Neuroscience.

See Graduate Pro-Seminar In Neuroscience (NEUR 2010) for course description.

NEUR 2030. Advanced Molecular and Cellular Neurobiology I.

Focuses on molecular and cellular approaches used to study the CNS at the level of single molecules, individual cells and single synapses by concentrating on fundamental mechanisms of CNS information transfer, integration, and storage. Topics include biophysics of single channels, neural transmission and synaptic function. Enrollment limited to graduate students.

Fall NEUR2030 S01 16064 TTh 10:30-11:50(13) (A. Hart)

NEUR 2040. Advanced Molecular and Cellular Neurobiology II.

This course continues the investigation of molecular and cellular approaches used to study the CNS from the level of individual genes to the control of behavior. Topics include patterning of the nervous system, generation of neuronal diversity, axonal guidance, synapse formation, the control of behavior by specific neural circuits and neurodegenerative diseases. Enrollment is limited to graduate students.

Spr NEUR2040 S01 24725 Arranged (G. Barnea)

NEUR 2050. Advanced Systems Neuroscience.

Focuses on systems approaches to study nervous system function. Lectures and discussions focus on neurophysiology, neuroimaging and lesion analysis in mammals, including humans. Cognitive neuroscience approaches will become integrated into the material. Topics include the major sensory, regulatory, and motor systems. Enrollment limited to graduate students.

Fall NEUR2050 S01 16065 MW 3:00-4:20(10) (T. Desrochers)

NEUR 2060. Advanced Systems Neuroscience.

Focuses on cognitive approaches to study nervous system function. Lectures and discussions focus on neurophysiology, neuroimaging and lesion analysis in mammals, including humans. Computational approaches will become integrated into the material. Topics include the major cognitive systems, including perception, decisions, learning and memory, emotion and reward, language, and higher cortical function. Instructor permission required.

Spr NEUR2060 S01 24727 Arranged (D. Sheinberg)

NEUR 2110. Statistical Neuroscience.

A lecture and computing lab course for senior undergraduate and graduate students with background in either systems neuroscience or applied math/biomedical engineering on the statistical analysis and modeling of neural data, with hands-on Matlab(Octave)/Python-based applications to real and simulated data. Topics will include signal processing, hypothesis testing and statistical inference, modeling of multivariate time series and stochastic processes in neuroscience and neuroengineering, neural point processes, time and spectral domain analyses, and state-space models. Example datasets include neuronal spike trains, local field potentials, ECoG/EEG, and fMRI. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration. Instructor permission required.

Fall NEUR2110 S01 16066 TTh 1:00-2:20(08) (W. Truccolo)

NEUR 2120. Topics in Visual Physiology.

Selected topics in visual physiology are examined through a close and critical reading of original research articles. Emphasizes the anatomical and physiological bases of visual function. Primarily for graduate students with a strong background in neuroscience and a working knowledge of the anatomy and physiology of the mammalian visual system. Offered in alternate years. Instructor permission required.

NEUR 2160. Neurochemistry and Behavior.

Examines behavior from a neurochemical perspective via readings and discussions based on original research articles. Intended primarily for graduate students with a strong background in neurochemistry and neuropharmacology and advanced undergraduates with an appropriate background. Offered alternate years. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration.

NEUR 2920. Behavior: A Genetic and Molecular Perspective.

Many of the cellular and molecular mechanisms that underlie behavior are conserved across species. This seminar course draws on work in invertebrate and vertebrate species to examine the genes and molecules that have been implicated in diverse behaviors. Topics to be discussed include circadian rhythms, pair bonding, migration, and aggression. Each week, students will read two to three papers from the primary literature and actively participate in class discussion. Prerequisites: NEUR 0010 and NEUR 1020 (undergraduate students) or NEUR 2030 (graduate students). Enrollment limited to 13. Instructor permission required.

NEUR 2930C. Historical Foundations of the Neurosciences.

Two year sequence starting Fall 2010; students register for one year at a time. The first year (2010-2011) will examine the history of basic neuroscientific concepts from the late Greeks (Galen) to the later 19th century, up to Cajal (neuron doctrine) and Sherrington (reflexes and integration). Since the seminar meets only monthly, it must be taken in the Fall and Spring semesters to receive a semester's credit. For credit, a substantial paper (approximately 15 pages) is required at the end of the Spring semester. Primarily for graduate students in neuroscience, cognitive science, and psychology. Others may be admitted after discussion with the instructor. Auditors are welcome if they share in the rotating duty of presenting seminars. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration.

NEUR 2930E. Bench to Bedside: Unraveling Diseases of the Nervous System.

Enrollment restricted to graduate students.

NEUR 2930F. Disease, Mechanism, Therapy: Harnessing Basic Biology for Therapeutic Development.

The recent surge in understanding the cellular and molecular basis of neurological disease has opened the way for highly targeted drug discovery and development. In this course we will use several case studies to illuminate how mechanistic insights are being translated into novel therapeutic approaches. Instructor permission required. Enrollment limited to 15 Graduate students. Sign-up sheet in Sidney Frank Hall, Room 315 beginning on the first day of registration.

NEUR 2940A. Advanced Molecular Neurobiology.

No description available.

NEUR 2940G. Historical Foundations of the Neurosciences II.

Continuation of a two year sequence focusing on the conceptual foundations in the history of neuroscience, from the late nineteenth century to the present. Primarily for graduate students in neuroscience, cognitive science, and psychology, but senior undergraduates may be admitted with written permission from the instructor. Seminar meets monthly, and must be taken for the full year to receive one semester credit.

NEUR 2940H. Ethics and Skills Workshop.

The ethics and skills workshops will be lead by faculty trainers in the Neuroscience Graduate Program. We will cover the following or similar topics over a two year period: Plagiarism, scientific accuracy, data ownership, expectations of advisory committees and mentors, authorship disagreements, and conflicts among lab members. Enrollment restricted to graduate students.

NEUR 2940I. Neural Correlates of Consciousness.

Will consider the neuroscience of consciousness from a variety of perspectives, using examples from behavior, neurophysiology, neuroimaging and neurology. The course content will focus on primary literature, using review articles for background. Students will lead the discussions. Primarily for graduate students. Senior undergraduates neuroscience concentrators and others may be admitted after discussion with the instructor. Instructor permission required. S/NC

NEUR 2970. Preliminary Examination Preparation.

For graduate students who have met the tuition requirement and are paying the registration fee to continue active enrollment while preparing for a preliminary examination.

Fall NEUR2970 S01 15511 Arranged (D. Sheinberg)

Spr NEUR2970 S01 24305 Arranged (D. Sheinberg)

NEUR 2980. Graduate Independent Study.

Section numbers vary by instructor. Please check Banner for the correct section number and CRN to use when registering for this course. S/NC

NEUR 2990. Thesis Preparation.

For graduate students who have met the residency requirement and are continuing research on a full time basis.

Fall NEUR2990 S01 15512 Arranged (D. Lipscombe)

Spr NEUR2990 S01 24306 Arranged (D. Lipscombe)

Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

Helvetica was used instead of Arial.

The editor may contact Leepfrog for a draft with the correct fonts in place.