

NEUROSCIENCE

Contact Information

Neuroscience

<http://neuroscience.rice.edu/>

W100 George R. Brown Hall

713-348-4015

Behnaam Aazhang

Program Director

aaz@rice.edu

The Neuroscience program, housed in the BioSciences Department, provides a strong interdisciplinary education covering the breath of fundamental disciplines on which neuroscience is based and includes multiple opportunities for experiential learning. Neuroscience uses diverse methodologies to investigate the brain and its relationship to the mind, and includes the analysis of brain structures related to specific cognitive processes and representations, investigations of the biochemical processes that occur in brain functions, and the interactions and correlations among the brain, behavior, and biology that can be observed and modeled. The primary aim of the neuroscience program is to provide an understanding of how the cognition and behavior of organisms are encoded in neural processes. Such an understanding of the brain, bringing to bear many types of knowledge, is necessary as a basis for understanding and solving many practical problems including but not limited to: neurophysiology of disease; treatment for pathologies related to aging, stroke, autism, and hearing and other impairments; human behavior relating to risk, addiction, and social pathologies; memory, learning, and acquisition of literacy; neural basis of emotion and its relation to human perception and behavior.

The Neuroscience program offers a broad range of introductory and advanced courses that lead to either a Bachelor of Arts (BA) Degree with a Major in Neuroscience or a Minor in Neuroscience. The BA degree is designed with the intent that all majors will gain a robust foundation in science and engineering basics and additional experience in the multidisciplinary core areas that contribute to the breadth of modern neuroscience. Project-based laboratory courses are required, and students will have the opportunity to pursue independent research. This program is appropriate for students with interests in pursuing advanced degrees in the future. The minor is available for students who choose other majors but desire strong foundational knowledge of the diverse aspects of how the brain functions. Neuroscience students are encouraged to participate in undergraduate research, and numerous students have already availed themselves of the neuroscience research opportunities at Rice and within the Houston community.

Bachelor's Program

- [Bachelor of Arts \(BA\) Degree with a Major in Neuroscience \(https://ga.rice.edu/programs-study/departments-programs/natural-sciences/neuroscience/neuroscience-ba/\)](https://ga.rice.edu/programs-study/departments-programs/natural-sciences/neuroscience/neuroscience-ba/)

Minor

- [Minor in Neuroscience \(https://ga.rice.edu/programs-study/departments-programs/natural-sciences/neuroscience/neuroscience-minor/\)](https://ga.rice.edu/programs-study/departments-programs/natural-sciences/neuroscience/neuroscience-minor/)

Neuroscience does not currently offer an academic program at the graduate level.

Advisors

Behnaam Aazhang
David R. Caprette
J. David Dickman
Simon J. Fischer-Baum
Jonathan Flynn
Caleb Kemere
Peter Y. Lwigale

Professors

Behnaam Aazhang
Richard G. Baraniuk
Kathleen M. Beckingham
Janet Braam
Anthony K. Brandt
James L. Dannemiller
Michael W. Deem
J. David Dickman
Suzanne E. Kemmer
Herbert Levine
Randi C. Martin
James A. McNew
Marcia K. O'Malley
Timothy Schroeder
Charles Siewert
Michael Stern
Devika Subramanian
Marina Vannucci
Rick K. Wilson

Associate Professors

Genevera I. Allen
Peter Y. Lwigale
Robert M. Raphael
Jacob Robinson

Assistant Professors

Simon J. Fischer-Baum
Caleb Kemere
Alexander Morgan
Ankit Patel
Xaq Pitkow
Amina Qutub
Julia Saltz
Rosa Uribe

Teaching Professor

David R. Caprette

Lecturer

Jonathan Flynn

Adjunct Professors

Fabrizio Gabbiani
Harel Shouval

For Rice University degree-granting programs:

To view the list of official course offerings, please see Rice's Course Catalog (https://courses.rice.edu/admweb!/SWKSCAT.cat?p_action=cata)

To view the most recent semester's course schedule, please see Rice's Course Schedule (<https://courses.rice.edu/admweb!/SWKSCAT.cat>)

Neuroscience (NEUR)

NEUR 111 - SCIENCE AND ART IN DIALOGUE: EXPERIMENT, IMAGINATION, AND THE INVENTION OF NEUROSCIENCE

Short Title: SCIENCE AND ART IN DIALOGUE

Department: Neurosciences

Grade Mode: Standard Letter

Course Type: Seminar

Credit Hour: 1

Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.

Course Level: Undergraduate Lower-Level

Description: We will take up the argument that "Proust was right about memory, Cezanne was uncannily accurate about the visual cortex, and Woolf pierced the mystery of consciousness," as we discuss aspects of the brain revealed by the texts, paintings, dishes and compositions of eight modern artists.

NEUR 238 - SPECIAL TOPICS

Short Title: SPECIAL TOPICS

Department: Neurosciences

Grade Mode: Standard Letter

Course Type: Seminar, Lecture, Laboratory, Internship/Practicum

Credit Hours: 1-4

Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.

Course Level: Undergraduate Lower-Level

Description: Topics and credit hours may vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

NEUR 304 - CELLULAR NEUROPHYSIOLOGY I&II

Short Title: CELLULAR NEUROPHYSIOLOGY I&II

Department: Neurosciences

Grade Mode: Standard Letter

Course Type: Seminar

Credit Hours: 3

Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.

Course Level: Undergraduate Upper-Level

Prerequisite(s): PHYS 125 and (MATH 101 or MATH 105)

Description: Properties of excitable nerve membranes and chemical synapses; theory of ions in solutions, ion conduction through membranes, ion transport, linear cable theory, nonlinear properties of neurons, + stochastic properties of single ion channels, synaptic transmission, the role of calcium and transmitter release, + postsynaptic mechanism. Taught at Baylor College of Medicine; check NEUR website. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 504. Mutually Exclusive: Cannot register for NEUR 304 if student has credit for NEUR 504. Repeatable for Credit.

NEUR 305 - OPTICAL IMAGING

Short Title: OPTICAL IMAGING

Department: Neurosciences

Grade Mode: Standard Letter

Course Type: Lecture

Credit Hours: 3

Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.

Course Level: Undergraduate Upper-Level

Description: This course includes a theoretical portion which will introduce the fundamentals of optical imaging of neural activity, present the devices that are employed, and review applications and discuss their results. In addition, in a practical part, students will design, set up, and perform simple in vitro experiments to gain practical experience with this exciting and powerful technology. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 505. Mutually Exclusive: Cannot register for NEUR 305 if student has credit for NEUR 505.

Course URL: www.ruf.rice.edu/~neurosci/ (<http://www.ruf.rice.edu/~neurosci/>)

NEUR 306 - CONCEPTS OF LEARNING AND MEMORY

Short Title: CONCEPT LEARNING&MEMORY

Department: Neurosciences

Grade Mode: Standard Letter

Course Type: Lecture

Credit Hours: 3

Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.

Course Level: Undergraduate Upper-Level

Description: This course is designed to introduce students to the field of learning and memory. This field has exploded in the last few years with the introduction of new techniques, new approaches, and new concepts. The course will introduce the student to classical and modern concepts of learning and memory across all levels at which learning and memory is studied, including behavioral, anatomical, cellular, molecular and genetic levels of analysis. The basic concepts of learning and memory will also be related to known diseases of learning and memory. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 506. Mutually Exclusive: Cannot register for NEUR 306 if student has credit for NEUR 506.

Course URL: www.ruf.rice.edu/~neurosci/ (<http://www.ruf.rice.edu/~neurosci/>)

NEUR 308 - INTRODUCTION TO COGNITIVE NEUROSCIENCE

Short Title: INTRO COGNITIVE NEUROSCIENCE

Department: Neurosciences

Grade Mode: Standard Letter

Course Type: Lecture

Credit Hours: 3

Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.

Course Level: Undergraduate Upper-Level

Description: 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. This course is usually taught at the Texas Medical Center. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 508. Mutually Exclusive: Cannot register for NEUR 308 if student has credit for NEUR 508.

NEUR 310 - INDEPENDENT RESEARCH FOR NEUROSCIENCE UNDERGRADUATES**Short Title:** IND RES FOR NEUR UNDERGRADS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Research**Credit Hours:** 1-4**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Independent research in Rice Neuroscience faculty laboratories (or other Texas Medical Center laboratories.) Students spend at least 3 hours per week in the laboratory for each semester hour of credit. If taken for 3 or more hours, counts as one required 300+ level lab course. Requires a proposal abstract, weekly reports, and a final project that summarizes your activities in the lab. Students wishing to perform their research in an off-campus lab must submit a completed application to the NEUR 310 instructor at least 2 weeks prior to the start of classes. Students are strongly advised to secure research advisors and register for the class well in advance of the start of classes. More information on finding a lab, as well as the general application crisis, can be found at www.neur310.rice.edu. Repeatable for Credit. Instructor Permission Required. Repeatable for Credit.**NEUR 318 - INTRO TO NEUROSCIENCE METHODS****Short Title:** INTRO TO NEUROSCIENCE METHODS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** This course provides an introduction to the recording of signals from live neurons using microscopic and electrophysiologic methods. The course introduces the basics of instrumentation in the recording of real time biologic signals. The course is designed to run in parallel with a lab course. Course taught at Baylor College of Medicine. Graduate/Undergraduate Equivalency: NEUR 518. Mutually Exclusive: Cannot register for NEUR 318 if student has credit for NEUR 518.**NEUR 319 - INTRODUCTION TO NEUROSCIENCE METHODS LAB****Short Title:** NEUROSCIENCE METHODS LAB**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Laboratory**Credit Hours:** 2**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** This is the laboratory course that is designed to run in parallel with the Introductory Neuroscience Methods lecture course. The Lab is designed to give students hands-on experience applying the ideas for real time recording of microscopic and neurophysiological signals. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 519. Mutually Exclusive: Cannot register for NEUR 319 if student has credit for NEUR 519.**NEUR 321 - ANALYSES OF NEURONAL FUNCTION****Short Title:** ANALYSES OF NEURONAL FUNCTION**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** This course will cover all basic aspects of the intrinsic electrophysiological properties of neurons and of synaptic transmission. It will also introduce principles of synaptic integration and plasticity. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 521. Mutually Exclusive: Cannot register for NEUR 321 if student has credit for NEUR 521.**NEUR 322 - BRAIN CELL BIOLOGY AND DEVELOPMENT****Short Title:** BRAIN CELL BIOL & DEVELOPMENT**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Anatomy and development of the nervous system is designed to introduce the student to the basic structure and function of the nervous system, and describe its rough development. It is intended for first year students without any specific advanced knowledge of neuroscience. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 522. Mutually Exclusive: Cannot register for NEUR 322 if student has credit for NEUR 522. Repeatable for Credit.**NEUR 323 - GENETICS FOR NEUROSCIENCE****Short Title:** GENETICS FOR NEUROSCIENCE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** This course integrates genetics into neuroscience and is intended to teach neuroscience students how to tackle neurobiological problems using genetic strategies and tools. In the introduction, students will be exposed to the basic concepts in genetics. Strategies using model organisms from *C.elegans* to mice will be covered. Finally we will discuss genetic approaches in humans. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 523. Mutually Exclusive: Cannot register for NEUR 323 if student has credit for NEUR 523.

NEUR 335 - CELLULAR NEUROPHYSIOLOGY**Short Title:** CELLULAR NEUROPHYSIOLOGY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** This course provides an upper level graduate treatment on the physiology and biophysics of nerve cell signaling. Topics to be covered include measurement and analysis of single events from ion channels to synaptic vesicle fusion, synaptic transmission and the relationship between calcium signaling and synaptic vesicle dynamics, short-term synaptic plasticity, and postsynaptic integration. This course is taught at the University of Texas Health Sciences Center. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 535. Mutually Exclusive: Cannot register for NEUR 335 if student has credit for NEUR 535.**NEUR 350 - MOLECULAR NEUROBIOLOGY****Short Title:** MOLECULAR NEUROBIOLOGY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** This course covers the molecular, cellular, and biochemical events that underlie neuronal function. Emphasis is placed on the basic chemistry and biology of cells residing the nervous system. The course also covers the structure and function of receptors, channels and pumps necessary for neuronal function and the neurochemistry of specific transmitter systems. The unique demand of neurons as specialized secretory cells is also covered. This course is taught at UTHSC. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 550. Mutually Exclusive: Cannot register for NEUR 350 if student has credit for NEUR 550. Repeatable for Credit.**NEUR 362 - COGNITIVE NEUROSCIENCE: EXPLORING THE LIVING BRAIN****Short Title:** COGNITIVE NEUROSCIENCE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Distribution Group:** Distribution Group II**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Prerequisite(s):** PSYC 203**Description:** Survey of theory and research on how mental processes are carried out by the human brain, with an emphasis on relating measures of brain activity to cognitive functioning, methods surveyed included electro physiological recording techniques, functional imaging techniques and methods that involve lessening or disrupting neural activity. Cross-list: PSYC 362.**NEUR 364 - COGNITIVE NEUROSCIENCE LAB****Short Title:** COGNITIVE NEUROSCIENCE LAB**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Laboratory**Credit Hour:** 1**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Prerequisite(s):** PSYC 362 (may be taken concurrently) or NEUR 362 (may be taken concurrently)**Description:** The objective is to equip the students of PSYC/NEUR 362 the tools on how to apply cognitive neuroscience techniques to health or clinical topics and to investigate sensorimotor and cognitive measures in a human model. The prereq may be taken the same semester as this class. Instructor Permission Required. Cross-list: PSYC 364. Graduate/Undergraduate Equivalency: NEUR 564. Mutually Exclusive: Cannot register for NEUR 364 if student has credit for NEUR 564.**NEUR 376 - NEUROBIOLOGY OF DISEASE****Short Title:** NEUROBIOLOGY OF DISEASE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Covers some of the most important disorders of nervous system function. Exposes students to incidence, clinical manifestations, pathophysiology, current scientific models of causes/mechanisms of disorders of the adult brain: stroke, Parkinson's disease, Alzheimer's disease, seizure disorders, brain tumors, multiple sclerosis, amyotrophic lateral sclerosis, brain/spinal cord injury, addiction, depression, and schizophrenia. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 576. Mutually Exclusive: Cannot register for NEUR 376 if student has credit for NEUR 576.**NEUR 377 - NEUROANATOMY: FUNCTIONAL ORGANIZATION OF THE CENTRAL NERVOUS SYSTEM****Short Title:** FUNCTIONAL NEUROANATOMY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 2-3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Anatomy and function of components of the nervous system with an emphasis on the central nervous system. This course is offered for Rice psychology graduate undergraduate students. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 577. Mutually Exclusive: Cannot register for NEUR 377 if student has credit for NEUR 577.

NEUR 379 - NEUROBIOLOGY OF SENSATION AND MOVEMENT**Short Title:** NEUROBIO OF SENSATION/MOVEMENT**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Overview of basic systems neuroscience. The course covers sensory transductions, development, and motor programming. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 579. Mutually Exclusive: Cannot register for NEUR 379 if student has credit for NEUR 579.**NEUR 380 - FUNDAMENTAL NEUROSCIENCE SYSTEMS****Short Title:** NEUROSYSTEMS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** This course will provide a broad overview of the brain's neural systems that subserve perception, learning, and behavior. The course will be highly integrative with thematic content including functional organization of the nervous system, neural encoding and decoding, sensory systems, motor systems, and high-level concept processing. Cross-list: PSYC 380. Recommended Prerequisite(s): PSYC 101.**NEUR 381 - PHYSIOLOGY OF VISUAL SYSTEM****Short Title:** PHYSIOLOGY OF VISUAL SYSTEM**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Course provides an advanced level and comprehensive coverage of the physiology of the retina and visual cortex. Useful for graduate students and postdocs in neuroscience, physiology, biochemistry, cell biology, and molecular genetics who are interested in visual information processing and brain function. Offered even years only. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 580. Mutually Exclusive: Cannot register for NEUR 381 if student has credit for NEUR 580.**NEUR 382 - INTRODUCTION TO COMPUTATIONAL NEUROSCIENCE****Short Title:** INTRO COMPUTATIONAL NEURSCI**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Introduction to methods and theories used to describe and understand neural information processing in the brain. Models covered will range from single neuron to networks for sensory, motor and learning tasks. Programming exercises will be done using Matlab. Cross-list: ELEC 382. Graduate/Undergraduate Equivalency: NEUR 582. Recommended Prerequisite(s): CAAM 210. Mutually Exclusive: Cannot register for NEUR 382 if student has credit for NEUR 582.**NEUR 383 - INTRODUCTION TO NEUROENGINEERING: MEASURING AND MANIPULATING NEURAL ACTIVITY****Short Title:** INTRO TO NEUROENGINEERING**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Prerequisite(s):** (PHYS 101 or PHYS 111 or PHYS 125 or PHYS 141) and (PHYS 102 or PHYS 112 or PHYS 126 or PHYS 142)**Description:** This course will serve as an introduction to quantitative modeling of neural activity and the methods used to stimulate and record brain activity. Cross-list: BIOE 380, ELEC 380.**NEUR 401 - UNDERGRADUATE HONORS RESEARCH****Short Title:** UNDERGRADUATE HONORS RESEARCH**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Research**Credit Hours:** 5**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Prerequisite(s):** NEUR 310 or NEUR 485**Description:** The Neuroscience Honors Research Program is a suite of courses offering our seniors and advanced juniors the opportunity to perform a two-semester, individual research project in a research laboratory in Neuroscience. Students having performed NEUR 310 research in an off-campus laboratory in the Texas Medical Center will also be eligible to apply to perform honors research in that laboratory. The Honors Research Program courses function as a set and must all be taken in the same academic year. Registration for any of the courses requires a commitment to register for all three. Requires at least 15 hours of laboratory research per week, a proposal (revised from application), monthly reports, and a formal progress report (abstract, aims, progress toward aims, discussion of results, plans for the spring semester). Prerequisites: strong performance in NEUR 310 or NEUR 485. Research professor recommendation required. Application for admission required. Instructor Permission Required. Repeatable for Credit.

NEUR 402 - UNDERGRADUATE HONORS RESEARCH**Short Title:** UNDERGRADUATE HONORS RESEARCH**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Research**Credit Hours:** 5**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Prerequisite(s):** (NEUR 310 or NEUR 485) and NEUR 401**Corequisite:** NEUR 412

Description: The Neuroscience Honors Research Program is a suite of courses offering our seniors and advanced juniors the opportunity to perform a two-semester, individual research project in a research laboratory in Neuroscience. Students having performed NEUR 310 research in an off-campus laboratory in the Texas Medical Center will also be eligible to apply to perform honors research in that laboratory. Registration for any of the courses requires a commitment to register for all three. Requires at least 15 hours of laboratory research per week, monthly reports, a thesis (substantial research paper) and a poster presentation at the Rice Undergraduate Research Symposium. Must register for corequisite: NEUR 412. Instructor Permission Required. Repeatable for Credit.

NEUR 411 - NEUROLINGUISTICS**Short Title:** NEUROLINGUISTICS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level

Description: Study of language and the brain. Includes localization of speech, language, and memory functions, hemispheric dominance, pathologies of speech and language associated with brain damage, and hypotheses of the representation and operation of linguistic information in the cortex. Cross-list: ANTH 411, LING 411.

NEUR 412 - UNDERGRADUATE RESEARCH SEMINAR**Short Title:** UNDERGRADUATE RESEARCH SEMINAR**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hour:** 1**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Prerequisite(s):** (NEUR 310 or NEUR 485) and NEUR 401**Corequisite:** NEUR 402

Description: This companion seminar requires attendance at course meetings and a formal scientific presentation of research performed while enrolled in the Honors Research Program. Must register for corequisite: NEUR 402. Instructor Permission Required. Repeatable for Credit.

NEUR 415 - THEORETICAL NEUROSCIENCE: FROM CELLS TO LEARNING SYSTEMS**Short Title:** THEORETICAL NEUROSCIENCE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level

Description: We present the theoretical foundations of cellular and systems neuroscience from distinctly quantitative point of view. We develop the mathematical and computational tools as they are needed to model, analyze, visualize and interpret a broad range of experimental data. This course is independent, but complementary to NEUR 416. Cross-list: CAAM 415, ELEC 488. Graduate/Undergraduate Equivalency: NEUR 615. Recommended Prerequisite(s): CAAM 210 or MATH 211 or CAAM 335 or MATH 355. Mutually Exclusive: Cannot register for NEUR 415 if student has credit for NEUR 615.

NEUR 416 - NEURAL COMPUTATION**Short Title:** NEURAL COMPUTATION**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level

Description: How does the brain work? Understanding the brain requires sophisticated theories to make sense of the collective actions of billions of neurons and trillions of synapses. Word theories are not enough; we need mathematical theories. The goal of this course is to provide an introduction to the mathematical theories of learning and computation by neural systems. These theories use concepts from dynamical systems (attractors, oscillations, chaos) and concepts from statistics (information, uncertainty, inference) to relate the dynamics and functions of neural networks. We will apply these theories to sensory computation, learning and memory, and motor control. Students will learn to formalize and mathematically answer questions about neural computations, including "what does a network compute?", "how does it compute?", and "why does it compute that way?" Prerequisites: knowledge of calculus, linear algebra, and probability and statistics. Cross-list: CAAM 416, ELEC 489.

NEUR 430 - FUNDAMENTALS OF HUMAN NEUROIMAGING**Short Title:** HUMAN NEUROIMAGING**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level

Description: A survey of methods and results for human brain imaging. Describes the physical and physiological mechanisms of image formation. Provides examples from clinical and basic research, particularly in visual cortex. Emphasis on magnetic resonance imaging, but surveys other imaging modalities including PET, optical, and EEG/MEG source localization. Course taught at Baylor College of Medicine. Cross-list: ELEC 484. Graduate/Undergraduate Equivalency: NEUR 584. Mutually Exclusive: Cannot register for NEUR 430 if student has credit for NEUR 584.

NEUR 450 - ELECTRICAL SIGNALING IN THE BRAIN**Short Title:** ELECTRICAL SIGNALING IN BRAIN**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Electrical Signaling in the Brain covers the basics concepts of electrical signaling from the proteins involved, biophysical principles and computational methods required to understand measure and characterize electrical signaling in the brain. Instructor Permission Required. Repeatable for Credit.**NEUR 477 - SPECIAL TOPICS****Short Title:** SPECIAL TOPICS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Internship/Practicum, Seminar, Lecture, Laboratory**Credit Hours:** 1-4**Restrictions:** Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.**Course Level:** Undergraduate Upper-Level**Description:** Topics and credit hours may vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.**NEUR 501 - ADVANCED COGNITIVE NEUROSCIENCE: ATTENTION AND PERCEPTION****Short Title:** ATTENTION AND PERCEPTION**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** Overview of neuropsychological and cognitive neuroscience approaches to higher mental functions including sensation and perception, attention, motor control, and neuroplasticity. Other topics include basic neuroanatomy, experimental and clinical investigative methods, and the historical and philosophical context of contemporary neuroscience. Instructor Permission Required. Cross-list: PSYC 575. Mutually Exclusive: Cannot register for NEUR 501 if student has credit for NEUR 301.**Course URL:** www.ruf.rice.edu/~neurosci/ (<http://www.ruf.rice.edu/~neurosci/>)**NEUR 502 - ADVANCED COGNITIVE NEUROSCIENCE: HIGHER MENTAL FUNCTIONS****Short Title:** HIGHER MENTAL FUNCTIONS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** Overview of neuropsychological and neuroimaging approaches to higher mental functions, including language, memory, executive functions, reasoning, and numerical processing. Instructor Permission Required. Cross-list: PSYC 576. Mutually Exclusive: Cannot register for NEUR 502 if student has credit for NEUR 302.**Course URL:** www.ruf.rice.edu/~neurosci/ (<http://www.ruf.rice.edu/~neurosci/>)**NEUR 504 - CELLULAR NEUROPHYSIOLOGY I & II****Short Title:** CELLULAR NEUROPHYSIOLOGY I&II**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Prerequisite(s):** PHYS 125 and (MATH 101 or MATH 105)**Description:** Properties of excitable nerve membranes and chemical synapses; theory of ions in solutions, ion conduction through membranes, ion transport, linear cable theory, nonlinear properties of neurons, + stochastic properties of single ion channels, synaptic transmission, the role of calcium and transmitter release, + postsynaptic mechanism. Taught at Baylor College of Medicine; check NEUR website. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 304. Mutually Exclusive: Cannot register for NEUR 504 if student has credit for NEUR 304. Repeatable for Credit.**NEUR 505 - OPTICAL IMAGING****Short Title:** OPTICAL IMAGING**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** This course includes a theoretical portion which will introduce the fundamentals of optical imaging of neural activity, present the devices that are employed, and review applications and discuss their results. In addition, in a practical part, students will design, set up, and perform simple in vitro experiments to gain practical experience with this exciting and powerful technology. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 305. Mutually Exclusive: Cannot register for NEUR 505 if student has credit for NEUR 305.**Course URL:** www.ruf.rice.edu/~neurosci/ (<http://www.ruf.rice.edu/~neurosci/>)**NEUR 506 - CONCEPTS OF LEARNING AND MEMORY****Short Title:** CONCEPT LEARNING&MEMORY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** This course is designed to introduce graduate students to the field of learning and memory. This field has exploded in the last few years with the introduction of new techniques, new approaches, and new concepts. The course will introduce the student to classical and modern concepts of learning and memory across all levels at which learning and memory is studied, including behavioral, anatomical, cellular, molecular and genetic levels of analysis. The basic concepts of learning and memory will also be related to known diseases of learning and memory. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 306. Mutually Exclusive: Cannot register for NEUR 506 if student has credit for NEUR 306.**Course URL:** www.ruf.rice.edu/~neurosci/ (<http://www.ruf.rice.edu/~neurosci/>)

NEUR 508 - INTRODUCTION TO COGNITIVE NEUROSCIENCE**Short Title:** INTRO COGNITIVE NEUROSCIENCE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: 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. This course is usually taught at the Texas Medical Center. Instructor Permission Required. Cross-list: PSYC 574. Graduate/Undergraduate Equivalency: NEUR 308. Mutually Exclusive: Cannot register for NEUR 508 if student has credit for NEUR 308.

NEUR 510 - NEUROPHARMACOLOGY**Short Title:** NEUROPHARMACOLOGY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: The objectives of this course are to examine how pharmacological agents have been used to elucidate the function of neurotransmitter systems in the central nervous system. In addition, the mechanism of some clinically effective drugs are reviewed in terms of the structure and function of the brain. Instructor Permission Required. Repeatable for Credit.

NEUR 515 - NEURAL DEVELOPMENT**Short Title:** NEURAL DEVELOPMENT**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: An advanced graduate course focusing on molecular genetic studies. Integrates molecular patterning of nervous system with developmental neuroscience using a cross-species approach, with an emphasis on the visual system. Topics include the biochemical and genetic basis for neural plasticity, neurotrophic factors in neural development, and the molecular mechanism of growth cone guidance and synapse formation. Course taught at Baylor College of Medicine. Instructor Permission Required.

Course URL: www.ruf.rice.edu/~neurosci (<http://www.ruf.rice.edu/~neurosci/>)

NEUR 516 - SENSORY SYSTEMS**Short Title:** SENSORY SYSTEMS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: A two-part course covering sensory transduction in audition, touch, and the chemical senses, and a detailed coverage of the visual system, including retinal structures and central pathways, photo transduction, receptive fields, and functional organization in the cortex. Course taught at Baylor College of Medicine. Instructor Permission Required.

Course URL: www.ruf.rice.edu/~neurosci (<http://www.ruf.rice.edu/~neurosci/>)

NEUR 517 - MECHANISMS OF MEMORY**Short Title:** MECHANISM OF MEMORY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: Synthesizes our understanding of the mechanism of higher-order memory formation covering learning theory, cellular physiology and biochemistry and discussing memory disorders. Instructor Permission Required.

Course URL: www.ruf.rice.edu/~neurosci (<http://www.ruf.rice.edu/~neurosci/>)

NEUR 518 - INTRODUCTION TO NEUROSCIENCE METHODS**Short Title:** INTRO TO NEUROSCIENCE METHODS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course provides an introduction to the recording of signals from live neurons using microscopic and electrophysiologic methods. The course introduces the basics of instrumentation in the recording of real time biologic signals. The course is designed to run in parallel with a lab course. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 318. Mutually Exclusive: Cannot register for NEUR 518 if student has credit for NEUR 318.

NEUR 519 - INTRODUCTION TO NEUROSCIENCE METHODS LAB**Short Title:** NEUROSCIENCE METHODS LAB**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Laboratory**Credit Hours:** 2**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This is the laboratory course that is designed to run in parallel with the Introductory Neuroscience Methods lecture course. The Lab is designed to give students hands-on experience applying the ideas for real time recording of microscopic and neurophysiological signals. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 319. Mutually Exclusive: Cannot register for NEUR 519 if student has credit for NEUR 319.

NEUR 520 - TEN UNSOLVED QUESTIONS IN NEUROSCIENCE**Short Title:** TEN UNSOLVED QUESTIONS IN NEUR**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: Neuroscience has yet to establish its general principles. This course introduces the major topics including memory, sleep, consciousness, information in neural activity, emotions, plasticity, and intelligence. Each week's lecture introduces a new problem, addressing why the question is important, its history, current thinking, and what we have learned. Course taught at Baylor College of Medicine. Instructor Permission Required.

Course URL: www.ruf.rice.edu/~neurosci (<http://www.ruf.rice.edu/~neurosci/>)

NEUR 521 - ANALYSES OF NEURONAL FUNCTION**Short Title:** ANALYSES OF NEURONAL FUNCTION**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course will cover all basic aspects of the intrinsic electrophysiological properties of neurons and of synaptic transmission. It will also introduce principles of synaptic integration and plasticity. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 321. Mutually Exclusive: Cannot register for NEUR 521 if student has credit for NEUR 321.

NEUR 522 - BRAIN CELL BIOLOGY AND DEVELOPMENT**Short Title:** BRAIN CELL BIOL & DEVELOPMENT**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 1-3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: Anatomy and development of the nervous system is designed to introduce the graduate student to the basic structure and function of the nervous system, and describe its rough development. It is intended for first year graduate students without any specific advanced knowledge of neuroscience. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 322. Mutually Exclusive: Cannot register for NEUR 522 if student has credit for NEUR 322.

NEUR 523 - GENETICS FOR NEUROSCIENCE**Short Title:** GENETICS FOR NEUROSCIENCE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course integrates genetics into neuroscience and is intended to teach neuroscience students how to tackle neurobiological problems using genetic strategies and tools. In the introduction, students will be exposed to the basic concepts in genetics. Strategies using model organisms from C.elegans to mice will be covered. Finally we will discuss genetic approaches in humans. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 323. Mutually Exclusive: Cannot register for NEUR 523 if student has credit for NEUR 323.

NEUR 525 - NEUROSCIENCE AND LAW**Short Title:** NEUROSCIENCE AND LAW**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course addresses how the modern understanding of brain function will intersect with the making of law, the punishment of criminals, and the development of new rehabilitation strategies. The readings will bring together a unique conjunction of neurobiology, legal scholarship, and policy making. The goals of the course will be to facilitate an understanding of the neurobiological underpinnings of behaviors that are subject to legal consequences for individuals and groups, and using this emerging base of scientific information to design modern, evidence-based policy.

NEUR 530 - THEORY, CONTENT, AND EXECUTION IN COGNITIVE NEUROSCIENCE**Short Title:** COGNITIVE NEUROSCIENCE THEORY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course is designed to provide students with the skills necessary to become successful cognitive neuroscientists. Students will receive instruction in designing experiments and analyzing data, selecting research topics, relating theory to their work and how to stay up to date on current research. This course is taught at the University of Texas Health Sciences Center. Instructor Permission Required. Repeatable for Credit.

NEUR 535 - CELLULAR NEUROPHYSIOLOGY**Short Title:** CELLULAR NEUROPHYSIOLOGY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course provides an upper level graduate treatment on the physiology and biophysics of nerve cell signaling. Topics to be covered include measurement and analysis of single events from ion channels to synaptic vesicle fusion, synaptic transmission and the relationship between calcium signaling and synaptic vesicle dynamics, short-term synaptic plasticity, and postsynaptic integration. This course is taught at the University of Texas Health Sciences Center. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 335. Mutually Exclusive: Cannot register for NEUR 535 if student has credit for NEUR 335. Repeatable for Credit.

NEUR 540 - GRADUATE NEUROANATOMY**Short Title:** GRADUATE NEUROANATOMY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course covers a broad overview of the structure and function of the central nervous system. The general architecture of the nervous system and its function systems are present in a series of online exercise. MRIs of brain anatomy, as commonly presented in the scientific literature, will be presented using a computerized learning system. This course is taught at the University of Texas Health Sciences Center. Instructor Permission Required. Repeatable for Credit.

NEUR 550 - MOLECULAR NEUROBIOLOGY**Short Title:** MOLECULAR NEUROBIOLOGY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: This course covers the molecular, cellular, and biochemical events that underlie neuronal function. Emphasis is placed on the basic chemistry and biology of cells residing the nervous system. The course also covers the structure and function of receptors, channels and pumps necessary for neuronal function and the neurochemistry of specific transmitter systems. The unique demand of neurons as specialized secretory cells is also covered. This course is taught at UTHSC. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 350. Mutually Exclusive: Cannot register for NEUR 550 if student has credit for NEUR 350. Repeatable for Credit.

NEUR 564 - COGNITIVE NEUROSCIENCE LAB**Short Title:** COGNITIVE NEUROSCIENCE LAB**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Laboratory**Credit Hour:** 1**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: The objective is to equip the students of PSYC/NEUR 362 the tools on how to apply cognitive neuroscience techniques to health or clinical topics and to investigate sensorimotor and cognitive measures in a human model. Instructor Permission Required. Cross-list: PSYC 564. Graduate/Undergraduate Equivalency: NEUR 364. Mutually Exclusive: Cannot register for NEUR 564 if student has credit for NEUR 364.

NEUR 576 - NEUROBIOLOGY OF DISEASE**Short Title:** NEUROBIOLOGY OF DISEASE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: Covers some of the most important disorders of nervous system function. Exposes students to incidence, clinical manifestations, pathophysiology, current scientific models of causes/mechanisms of disorders of the adult brain: stroke, Parkinson's disease, Alzheimer's disease, seizure disorders, brain tumors, multiple sclerosis, amyotrophic lateral sclerosis, brain/spinal cord injury, addiction, depression, and schizophrenia. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 376. Mutually Exclusive: Cannot register for NEUR 576 if student has credit for NEUR 376.

NEUR 577 - NEUROANATOMY: FUNCTIONAL ORGANIZATION OF THE CENTRAL NERVOUS SYSTEM**Short Title:** FUNCTIONAL NEUROANATOMY**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 2-3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** Anatomy and function of components of the nervous system with an emphasis on the central nervous system. This course is offered for Rice psychology graduate undergraduate students. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 377. Mutually Exclusive: Cannot register for NEUR 577 if student has credit for NEUR 377.**NEUR 578 - HIGHER BRAIN FUNCTION****Short Title:** HIGHER BRAIN FUNCTION**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Seminar**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** Aspects of systems' neuroscience related to higher brain function: (1) role of limbic system in higher brain functions, (2) role of the extended amygdala and the mesolimbic system in reward and addiction, (3) discussion of human brain processes including decision making, goal directed learning and representation of self and others. Course taught at Baylor College of Medicine. Instructor Permission Required. Mutually Exclusive: Cannot register for NEUR 578 if student has credit for NEUR 378.**Course URL:** www.ruf.rice.edu/~neurosci (<http://www.ruf.rice.edu/~neurosci/>)**NEUR 579 - NEUROBIOLOGY OF SENSATION AND MOVEMENT****Short Title:** NEUROBIO OF SENSATION/MOVEMENT**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** Overview of basic systems neuroscience. The course covers sensory transductions, development, and motor programming. Course taught at Baylor College of Medicine. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 379. Mutually Exclusive: Cannot register for NEUR 579 if student has credit for NEUR 379.**NEUR 580 - PHYSIOLOGY OF VISUAL SYSTEM****Short Title:** PHYSIOLOGY OF VISUAL SYSTEM**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** Course provides an advanced level and comprehensive coverage of the physiology of the retina and visual cortex. Useful for graduate students and postdocs in neuroscience, physiology, biochemistry, cell biology, and molecular genetics who are interested in visual information processing and brain function. Offered even years only. Instructor Permission Required. Graduate/Undergraduate Equivalency: NEUR 381. Mutually Exclusive: Cannot register for NEUR 580 if student has credit for NEUR 381.**NEUR 582 - INTRODUCTION TO COMPUTATIONAL NEURSCIENCE****Short Title:** INTRO COMPUTATIONAL NEURSCI**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** Introduction to methods and theories used to describe and understand neural information processing in the brain. Models covered will range from single neuron to networks for sensory, motor and learning tasks. Programming exercises will be done using Matlab. Additional coursework required beyond the undergraduate course requirements. Graduate/Undergraduate Equivalency: NEUR 382. Mutually Exclusive: Cannot register for NEUR 582 if student has credit for ELEC 382/NEUR 382.**NEUR 583 - COMPUTATIONAL NEUROSCIENCE AND NEURAL ENGINEERING****Short Title:** COMP/NEUROSCIENCE/NEURAL ENGNR**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** An introduction to the anatomy and physiology of the brain. Includes basic electrophysiology of nerve and muscle. Develops mathematical models of neurons, synaptic transmission and natural neural networks. Leads to a discussion of neuromorphic circuits which can represent neuron and neural network behavior in silicon. Recommendation: Knowledge of electrical circuits, operational amplifier circuits and ordinary differential equations. Involves programming Matlab. Cross-list: BIOE 583, ELEC 583. Recommended Prerequisite(s): Knowledge of basic electrical and operational amplifier circuits; and ordinary differential equations. Mutually Exclusive: Cannot register for NEUR 583 if student has credit for NEUR 481.

NEUR 584 - FUNDAMENTALS OF HUMAN NEUROIMAGING**Short Title:** HUMAN NEUROIMAGING**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate**Description:** A survey of methods and results for human brain imaging.

Describes the physical and physiological mechanisms of image formation. Provides examples from clinical and basic research, particularly in visual cortex. Emphasis on magnetic resonance imaging, but surveys other imaging modalities including PET, optical, and EEG/MEG source localization. Course taught at Baylor College of Medicine. Cross-list: ELEC 584. Graduate/Undergraduate Equivalency: NEUR 430. Mutually Exclusive: Cannot register for NEUR 584 if student has credit for NEUR 430.

NEUR 615 - THEORETICAL NEUROSCIENCE: FROM CELLS TO LEARNING SYSTEMS**Short Title:** THEORETICAL NEUROSCIENCE**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Lecture**Credit Hours:** 3**Restrictions:** Enrollment is limited to Graduate level students.**Course Level:** Graduate

Description: We present the theoretical foundations of cellular and systems neuroscience from distinctly quantitative point of view. We develop the mathematical and computational tools as they are needed to model, analyze, visualize and interpret a broad range of experimental data. Additional course work required beyond the undergraduate course requirements. Cross-list: CAAM 615, ELEC 588. Graduate/Undergraduate Equivalency: NEUR 415. Mutually Exclusive: Cannot register for NEUR 615 if student has credit for NEUR 415.

NEUR 677 - SPECIAL TOPICS**Short Title:** SPECIAL TOPICS**Department:** Neurosciences**Grade Mode:** Standard Letter**Course Type:** Internship/Practicum, Seminar, Lecture, Laboratory**Credit Hours:** 1-4**Restrictions:** Enrollment is limited to Graduate or Visiting Graduate level students.**Course Level:** Graduate**Description:** Topics and credit hours vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

Description and Code Legend

Note: Internally, the university uses the following descriptions, codes, and abbreviations for this academic program. The following is a quick reference:

Course Catalog/Schedule

- Course offerings/subject code: NEUR

Program Description and Code

- Neuroscience: NEUR

Undergraduate Major Description and Code

- Major in Neuroscience: NEUX

Undergraduate Minor Description and Code

- Minor in Neuroscience: NEUR

CIP Code and Description ¹

- **NEUX** Major/Program: CIP Code/Title: 26.1501 - Neuroscience
- **NEUR** Minor: CIP Code/Title: 26.1501 - Neuroscience

¹ Classification of Instructional Programs (CIP) 2020 Codes and Descriptions from the National Center for Education Statistics: <https://nces.ed.gov/ipeds/cipcode/>