DARTMOUTH COLLEGE

Department of Psychological and Brain Sciences

Graduate Course Offerings 2017-2018

All courses are 1 credit unless otherwise noted; PBS graduate students **must** enroll in a total of **3 credits per term** including at least one credit of research.

FALL 2017

PSYC 100. Proseminar (all faculty)
An introduction to the research program of PBS Faculty. Taken by students in their first year.

PSYC 110. Measurement and Statistics I (Wolford)
First section of Graduate level statistics. Taken by students in their second year.

PSYC 164: Computational Methods: Neural Code (Haxby)
This course will review current computational methods for understanding how information is coded in neural activity and how to decode patterns of neural activity to reveal the information that is being represented and processed. The course will cover topics such as multivariate pattern classification, representational similarity analysis, forward encoding models, and using hyperalignment to build common models of representational and connectivity spaces. The course will concentrate on applications to human functional neuroimaging data, but application to other methods of measuring neural activity in humans and animals will also be covered.

PSYC 175. Current Topics in Behavioral Neuroscience: Reward, Motivation & Addiction (Smith)
This course will explore historical and modern accounts of reward and motivation. We will also address what role these processes could play in addictions and what aspects of addiction might involve other processes. Equal focus will be paid to behavioral and neural components. The course will emphasize research using small animal models to understand them. Students will become familiar with broadly applicable concepts and research methods used in the behavioral neuroscience of reward and motivation.

WINTER 2017

PSYC 111. Measurement and Statistics II (Wolford)
Second term of Graduate level statistics. Typically taken by PBS students in their second year.

PSYC 126. Systems/Behavioral Neuroscience (Taube)
The goal of this course is to understand behavior as a product of the brain's neural activity. As we progress through the course you will see that scientists know a great deal about simple processes such as reflexes, sensory sensations, and simple motor movements, but we know much less about higher cognitive processes such as learning, memory, and emotional feelings.

But ultimately, even these "higher order processes" must be understood in terms of their underlying neural mechanisms. The course focuses on discussing three major systems within the brain – each of which is important for our underlying behavior. These systems are sensory, motor, and limbic. Some emphasis will be placed on how the brain is organized from an anatomical perspective and the connections between different brain structures. This emphasis will complement the first four laboratories where you will have a hands-on experience in examining a sheep's brain. In the second half of the course you will test animals in a spatial learning task and observe some of the techniques used by neuroscientists to study the brain.

The course is taught in conjunction with Psych 65. In addition to the undergraduate portion described above, the graduate students will meet once per week to discuss the covered topics in further depth. During the first month of the course we will also cover the basis of membrane potentials and synaptic transmission.

Note that PSYC 126 graduate students will attend PSYC 65 in the 10 hour (10:10-11:15am on Monday, Wednesday, and Friday) and an additional meeting once per week.

PSYC 167: Pedagogy with Purpose – not offered in 2017-18

PSYC 179: Topics in Learning and Behavior (Todd)
This course will provide students with a theoretical understanding of learning and behavior, primarily as instantiated in Pavlovian and Instrumental conditioning procedures. We will review historically important experiments that shaped and changed the field, as well as several prominent theories of conditioning. One goal of this course if for students to come into contact with experiments designed to explain behavior at the *psychological* level. In doing so, students should gain an appreciation for the complexity of behavior, and the experimental methods necessary to isolate mechanisms of behavior. In turn, this framework is expected to facilitate student's ability to isolate neural mechanisms of behavior; a sophisticated theoretical understanding of behavior is the required foundation for a sophisticated understanding of the neural mechanisms of behavior.

Topics include: the "content" of Pavlovian conditioning, excitatory and inhibitory conditioning, information value and surprise, Rescorla-Wagner model, Pearce-Hall model, prediction error (common and individual error terms), elemental vs. configural learning, extinction, occasion-setting, the "content" of instrumental conditioning, actions and habits.

SPRING 2017

PSYC 127. Functional Neuroanatomy (Cooper)
This course covers the structure of the brain from a functional perspective. We will trace key structural components of the brain at the levels of the system, circuit, and cell, with an emphasis on how these components combine to accomplish a specific functional goal. Course materials will focus on the human brain. Several lab activities throughout the quarter will include brain dissections and examinations of traditional and interactive atlases.

PSYC 171. Brain Evolution (Granger)
For the first 200 million years of mammalian evolution, animals' brain sizes were relatively predictable from their body size via a straightforward allometric relation. In the past four million years, an evolutionary blink of the eye, primates rapidly evolved brains that are four times larger than previously would have been predicted for their body size. What are the contents of our brains? How do they differ from the brains of other mammals (and non-mammals)? How did they acquire their enormous size? Evolution acts on genes, not on organisms; what are the genetic factors that have been identified in recent primate brain growth? What mechanisms are at play, including extrinsic factors and evolutionary "pressures"? What criteria must theories of brain evolution conform to, and what data are to be accounted for? What differential predictions arise from various theories and how are they tested? What relationships obtain between anatomical and functional brain characteristics? The class will cover a set of related topics including brain structure, anthropology, evolution, genetics, development, cognition, race, and intelligence.

PSYC 179: Data Mining (Bharucha)
How do we discover meaningful patterns in "big data"? We now have the computational capacity to collect and process troves of observational data at scales unimaginable until recently. Researchers and companies are seeking to understand patterns of behavior implicit in clicks on a website, digital sensors, digitized texts, or downloadable datasets. These data sets may include large numbers of variables that may or may not have been selected by the researcher and that may be interrelated in complex ways. Often the most meaningful information embedded in the data is not manifest by traditional statistical summaries, or the domain is not sufficiently well studied to suggest hypothesis to test. Techniques we will cover include visualization, association, classification, clustering, dimension reduction, statistical learning, neural nets. Students will program in R.
Prerequisite: PSYC 110. Recommended: PSYC 111.

RESEARCH AND TEACHING COURSES

These courses are offered every term.

PSYC 115. Supervised Teaching (1 credit): Taken while performing a TA.

PSYC 117. Specialist Requirement (1 credit): Taken while doing specialist reading and written exam, usually not awarded a grade until completed (so 'ON' appears in the grade column until exam is completed).

PSYC 118. **Research Presentation (1 credit):** For students who entered the program before 2015, taken while doing specialist grant proposal and defense; usually not awarded a grade until completed (so 'ON' appears in the grade column until exam is completed). For students who entered the program in 2015 or later, taken in the spring term of second year while completing the second year research presentation.

PSYC 188 (1 credit), 288 (2 credits), 388 (3 credits). Graduate Research: All active students must take at least one research credit every term.

HOW TO CHOOSE THE CORRECT NUMBER OF RESEARCH COURSE CREDITS

Remember that you must be enrolled for 3 total credits per term to be considered 'active'. If you are not sure about courses, check with Julia Abraham.

If you are enrolling in full time research (i.e. not taking any seminars, teaching assistantships, or specialist reading courses), enroll in PSYC 388 (3 credits). If you are enrolling in 1 seminar course as well as conducting research, enroll in PSYC 288 (2 credits). If you are enrolling in 2 courses as well as doing research, enroll in PSYC 188 (1 credit). You should be enrolled in at least 1 credit of research every term.

Example 1: you are a first year student taking the proseminar and doing research: you will sign up for PSYC 100 and PSYC 288.

Example 2: you are a second year student TA'ing a course, taking a Special Topics Seminar, and doing research: you will sign up for PSYC 115, PSYC 179, and PSYC 188.

Example 3: you are a third year student and you have completed the specialist requirement and are taking no seminars: you will sign up only for PSYC 388.

COURSES OFFERED BY OTHER DEPARTMENTS AND PROGRAMS

The following is list of courses that have been offered in the past by other departments or programs and are already approved for PBS graduate curriculum credit. Please refer to the current ORC to find out if/when they are being offered. If there is a course other than those listed below which you would like to take for PBS grad program credit, contact the Chair of the Graduate Committee to request approval before taking the course.

COSC 104. Artificial Intelligence
This course is a graduate-level survey of artificial intelligence. It covers the basic principles underlying artificial intelligence (search methods, knowledge representation and 'expert systems,' planning, learning, etc.) and examples of particular artificial intelligence applications areas (natural language understanding, vision, robotics).

PEMM 124. Ethical Conduct of Research
There will be approximately four one-and-a-half hour small group discussion sessions and four one hour lectures with the times to be arranged. Topics will include: mentoring, data collection, academic integrity, ethical use of human subjects and laboratory animals, authorship, sponsored research and intellectual property.

PEMM 129. Molecular Pharmacology
This course aims to provide a solid introduction into modern pharmacology, focusing on more mechanistic aspects of therapeutics. Topics will include: basic concepts in pharmacology, systems-level pharmacology and emerging therapies. The course will meet 4 hours per week.

PEMM 131. Current Approaches in Experimental Therapeutics
This course will present a survey of current methods and approaches in pharmacologic, molecular and experimental therapeutic research. Topics will include pharmacogenomics, pharmacokinetics, functional genomics, in vivo imaging, global gene expression, proteomics, gene targeting, gene therapy and drug screening and delivery. The class will be in lecture format with student discussion and participation. The class will meet for 3 hours each week.

PEMM 211. Neurobiology of Disease
This course will introduce students to the cellular and molecular processes that are pathologically altered in a variety of neurological diseases. Students will also learn by reading and presenting seminal papers on neurological disease topics how neuroscientists research the causes and potential treatments of the disease. The course will be team taught by experts from the neuroscience faculty who will give a one hour didactic lecture in the first session of the week. Then, in a 2 hour session later in that week, students will present and critique scientific papers on the topic chosen by the faculty for that week.

PEMM 212. Neurobiology of Disease.
The course is an intermediate/advanced course in neuroscience - from the molecular level on up through the cognitive and clinical levels. The course will be taught by medical school faculty and is intended for those students who have completed the medical neuroscience

course. Attached is the tentative syllabus. The course involves a combination of lecture/tutorials and reading/discussing journal articles.

PEMM 271. Advanced Biomedical Sciences

This course emphasizes the integration of molecular, cellular, and systems level information and the experimental approaches used to understand physiology and pathophysiology. It is designed to provide graduate students with a more sophisticated understanding of the major systems of an organism and how they act and interact in order for an individual to adapt and survive in the face of changing environmental resources and challenges. The course is organized into week-long, "stand alone" modules that cover integrative, translational topics in immunology, cardiovascular physiology, endocrinology, and neurobiology (eg. influenza, congestive heart failure, sleep disorders, drug addiction, space physiology). Course meetings are a mixture of lectures and in-class discussions led by the participating faculty, as well as laboratory exercises and demonstrations, including human brain dissections, visits to clinical laboratories and diagnostic centers, and "hands on" opportunities with state-of-the-art electrophysiological and cardiovascular techniques. Course activities are supplemented by primary research articles, reviews, and other on-line materials.