Psychology G9425. Neuroethology. Spring 2011

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I. Course description, as it appears in the Bulletin:

G9425y. Neuroethology
3 pts. S. Woolley and D. Kelley. Tuesdays 6:10-8:00 P.M. 900 Fairchild.
Prerequisites: instructor permission
Neuroethology is the study of the neural bases for natural animal behaviors. Behavior and brain are studied using an evolutionary approach. The focus of this course is on the neurobiology and behavior of animal communication and other natural behaviors, and the relation between sensory processing and motor output. The course consists of a weekly student-led seminar during which classic and current data papers are presented and discussed.

II. Rationale for giving the course

Many of our graduate students in Psychology, Neurobiology and Behavior, E3B and Biology are interested in the neuroscience of natural behaviors in animals. This seminar will bring those students and the neuroethology faculty at Columbia together to discuss some classic but mostly current studies in the area of neuroethology. This seminar will give our graduate students a theoretical foundation for understanding the evolutionary principles and neural mechanisms that explain why and how animals behave as they do. It will also serve as of forum for students from different graduate programs to share ideas and knowledge.

PSYC G9425 will fulfill the seriously graded seminar requirement of the Psychology M. Phil. Degree, and will serve as an elective course for graduate students who have completed the M.Phil or who are not in Pyschology.

Enrollment will be 6 to 12 students.

III. A full description of the content of the course

This course will focus on the neural bases of natural animal behavior, approached at both the ultimate (why) and proximate (how) levels. The study of neuroethology seeks to explain how the structure and functioning of the brain and body direct the ways in which animals interact with the physical environment and each other to promote fitness (the successful passing of genes to the next generation). It uses the principles of evolution through natural selection to understand adaptive neural function and behavior. Animal communication will be emphasized. Neuroethology merges the fields of ethology, cellular and systems neuroscience and

neuroendocrinology. Neuroethology is also closely tied with the fields of behavioral ecology, evolutionary biology, organismal biology and psychology.

We will begin by discussing classical models in neuroethology, such as birdsong, vocal communication in frogs, generation and reception of electrical fields in fish, and echolocation in bats. We will present an overview of principles of studying the brain and behavior from an evolutionary standpoint, and an overview of the most well-studied neuroethological model systems in the initial meeting(s).

IV. Course requirements

Students will complete all assigned readings and will participate in weekly discussions. Following the first two meetings, students will give oral presentations and lead discussions of data papers.

V. Course Topics in Spring 2011

Organization and introduction: Jan 18

Sensory coding

Jan 25 sensory circuits for spatial navigation and hunting
bats

Feb 1 sensory circuits for spatial localization and hunting
barn owls
guest expert: Jose Luis Pena

Feb 8 neurons and circuits integrating experience for navigation
rats

Feb 15 sensory circuits for spatial navigation and mate localization
weakly electric fish
guest expert: Nate Sawtell

Simple motor circuits and behavior

Feb 22 simple motor learning - gill/siphon withdrawl reflex
Aplysia

Mar 1 acoustic pattern generation and detection - mate calling
Crickets

Mar 8 basic circuits controlling escape behavior
Crayfish

Spring break: Mar 15

Hormones

Mar 22 development, sexual differentiation, sexually dimorphic behavior
aquatic frogs
expert: Darcy Kelley

Mar 29 hormonal control of circuits mediating mating, pair bonding
voles
guest expert: Zoe Donaldson

Communication - sensory and motor coordination

Apr 5 sensory coding of acoustic patterns
terrestrial frogs

Apr 12 vocal pattern generation and recognition
aquatic frogs
expert: Darcy Kelley

Apr 19 sensorimotor learning - vocal learning
songbirds
expert: Sarah Woolley

Apr 26 behavioral plasticity - electric discharges
weakly electric fish
guest expert: Nate Sawtell