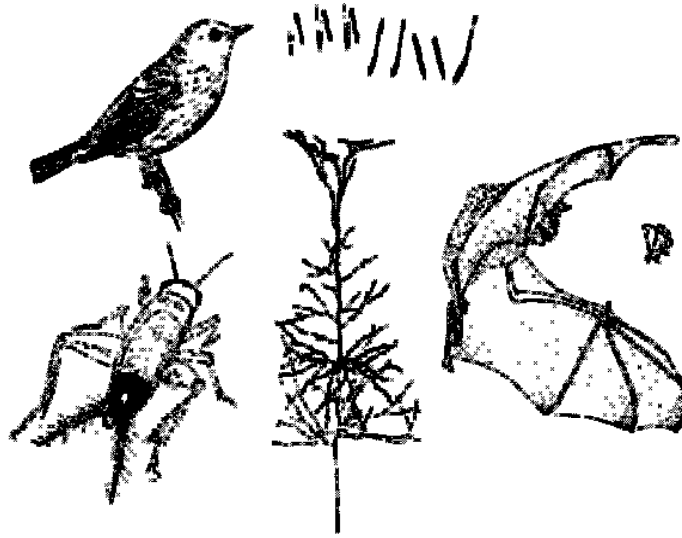


Neuroethology: Complex Animal Behaviors and Brains.



IB C147/PsychC115

Spring 2022

Instructors.

Prof. Frédéric Theunissen, Dept. of Psychology and Integrative Biology. theunissen@berkeley.edu

OH: By appointment (in person or zoom) and also from 10-11 AM on Fridays. BWB 3rd floor Lobby.

Time and Place.

FIRST TWO WEEKS:

<https://berkeley.zoom.us/j/97297026854?pwd=ZWpjQVR1cnRKSFIUTHFuTHkvckxIdz09>

The lectures are on Tu-Th from 2:10-3:30 PM in Physics 2 (PHYS2). The class will be in person except for the first two week of classes when they will be in Zoom with some pre-recorded material. Both the Zoom lectures the in-person lectures will be recorded to provide additional flexibility given that we are in the transition phase between pandemic and endemic Covid infection. I highly recommends in person lecture attendance for all students who are healthy, but attendance is not mandatory. For the students that are unable to attend the lecture please use the OH so that I can address additional questions you might have. You have the option to make an OH zoom appointment.

The discussion section are F 2-3 (VLSB 2070), F 3-4(VLSB 2066), F4-5(VLSB 2030). Discussion sections start the second week of classes. They will be on-zoom for that week and in-person the following week. The discussion sections are mandatory and you will need to excuse any absences due to health or other reasons with the GSI. In discussion section, you will 1. Have the opportunity to ask additional questions; 2. Get help on the homework, 3. Cover additional fun material, 4. Give one 10 minute oral presentation on an animal behavior of your choice that you think would be amenable to a neuroethological study or on a topic of science and society.

The spring 2021 undergraduate student deadline to add, drop, swap, and change class units is Wednesday, February 9 at 11:59 p.m. PST

Course Description.

Neuroethology and Systems Neuroscience. Neuroethologists study neural systems by combining behavior and neuroscience to understand the neural mechanisms that have evolved in various animals to solve particular problems encountered in their environmental niches. This comparative approach that emphasizes how information is processed and transformed by the brain is particularly powerful for gaining an understanding of systems neuroscience. In this course, you will learn core concepts in ethology, sensory systems, motor systems and neural plasticity and development by studying the behavior and brains of animals such as crickets, barn-owls, honey-bees, echolocating bats, electric fishes and songbirds. The findings and lessons that we have learned from studying these model systems will be compared to those that we have acquired in more traditional laboratory animals (rodents,

primates) and humans. For example, in sensory systems, the study of sound localization in the Barn Owl allowed us to understand how analyzing the time differences in amplitude differences in the sound between our ears allow all animals including humans to localize sounds. The neural implementation of a circuit for computing interaural time delays (initially proposed by Psychophysicist Llyod Jeffries in the 1950's) was first discovered in the Owl. In a second example, the cellular and genetic mechanisms underlying both short term and long term memory were first discovered in the California sea slug *Aplysia* and in *Drosophila* (E. Kandel, Nobel price 2000). Similar cellular and genetic mechanisms underlie the neural plasticity that is found in the hippocampus of mammals and humans and that is required for the formation of declarative memories and cognitive maps. In this course, you will therefore not only gain a deeper respect for the complexity of animal behaviors but learn principles of systems neurosciences and expertise in the computations performed by neural circuits.

Neuroethology and the History of Ethology, Psychology and Neuroscience. The course will also give you a historical perspective on key discoveries in Ethology, Psychology and Neuroscience. We will examine both theoretical contributions and empirical contributions to our understanding of the brain and the mind. We will also critically analyze the western and male dominated bias in this scientific endeavor.

Neuroethology and Global Change. In our last lecture, we will examine what is the role of neuroethology in mediating the effects of global change. Understanding animal behavior and its neural basis is going to be fundamental for determining how and to what extent are animals going to be affected by global warming and human activity in general.

Course Logistics, Assignments, Tests and Grading.

The course meets weekly for two 1.5 hours lectures that will be complemented by one 1 hour discussion section. Each discussion sections will focus on the weekly reading assignment and a series of questions that will constitute the weekly homework assignment. Homework will be due on Friday at 5 PM and needs to be uploaded to bCourses as an on-line submission.

The final course grade will be based on a total of 500 points:

- 200 points from the 2 midterms (100 points each)
- 200 points from a cumulative final
- 80 points from weekly homework assignments,
- 20 points for a single in section oral presentation.

The 'final' exam is cumulative but will emphasize the material taught in the third section of the course. For the oral presentation, you will be able to choose between two formats/topics: 1. A proposal for a new set of neuroethological experiments for the analysis of a particular animal behavior and its neural basis or 2. Neuroethology and Society (Bias in Science or Global Change and Science).

The following grading scheme will be used.

A+	100%	to 99%
A	< 99%	to 94%
A-	< 94%	to 90%
B+	< 90%	to 87%
B	< 87%	to 83%
B-	< 83%	to 80%
C+	< 80%	to 77%
C	< 77%	to 73%
C-	< 73%	to 70%
D+	< 70%	to 67%
D	< 67%	to 63%
D-	< 63%	to 60%
F	< 60%	to 0%

Prerequisites.

Biological and Neuropsychology lower division requirements for Psych students (<https://psychology.berkeley.edu/students/undergraduate-program/tier-i-prerequisites-freshmen-admitted-fall-2018-or-later-and>) or Integrative Biology lower division requirements (Bio 1A-1B) for IB students or Equivalent.

Textbook and Readings.

Required.

Behavioral Neurobiology: An Integrative Approach. Zupanc. Oxford University Press. Third Edition (2018). Additional reading (peer-reviewed papers) will be assigned for more specialized coverage of certain topics.

Additional Good resources.

Sociobiology. The New Synthesis. Edward O. Wilson.
Principles of Neural Science. Kandel et al. Sixth Edition.

Schedule of classes and reading.

Our schedule might be modified if I or you get really excited about one particular topic.

lecture #	Date	topic	reading
1	Jan 18 th	Introduction	
2	Jan 20 th	Basic Concepts in Ethology I	Ch 1 and 3
3	Jan 25 th	Basic Concepts in Ethology II	Ch 3.
4	Jan 27 th	Basic Concepts in Neuroscience	Ch 2.
5	Feb 1 st	Basic Concepts of Sensory Systems	p. 91 & 133-140
6	Feb 3 rd	Feature Detection in Frogs: Visual motion circuits.	p. 140-149
7	Feb 8 th	Barn Owl Sound Localization I	p. 149-169
8	Feb 10 th	Barn Owl Sound Localization II	
9	Feb 15 th	Bat Echolocation I	p. 93-111
10	Feb 17 th	Vocal Communication (Birds, Primates)	p. 259-262 Seyfarh and Cheney 2010
11	Feb 22 nd	Olfactory Processing (moths, locusts, rats)	Comparative Chemosensation. Nature 2006 Moth Olfaction Haupt et al. In the Neurobiology of Olfaction.
	Feb 24th	First Midterm	
12	Mar 1 st	Basic Concepts of Motor Systems and SMI	p. 114-119
13	Mar 2 nd	Escape Swimming in Tadpoles	p. 119-129
14	Mar 8 th	Primate Reaching	Georgopoulos 1996 Churchland 2012
15	Mar 10 th	Neuromodulation of motor and sensory processing	p192-93 p200-205 Caras et al. 2013
16	Mar 15 th	Cricket Song: Production and Perception	p. 263-281
17	Mar 17 th	Song Production in Oscines	p. 281-54 Long&Fee 2008 ElieTheunissen 2020 (p175-191)
		Spring Break	

18	Mar 29th	Electric Fish	p. 181-187 Bastian (1994) Clarke et al (2015)
19	Mar 31st	Electric Fish	
	April 5th	Second Midterm	
20	April 7 th	Basic Concepts of Learning and Memory	p. 298-301
21	April 12 th	Short Term and Long Term Memories.	p. 301-308
22	April 14 th	Spatial Memory and Spatial Navigation	p. 308-322
23	April 19 th	Bird Song Imitation - Behavior	p. 281-292
24	April 21 st	Bird Song Imitation – Neural Mechanisms	Sakata 2020 Xiao 2018
25	April 26 th	Large Scale navigation	p. 225-245 Wiltchko 2005
26	April 28 th	Neuroethology and Global change	Wong 2015
	Final's Week	FINAL EXAM	

Berkeley Honor Code

“As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others.”

The honor code also means that I expect you to work alone during all tests and without looking at your notes or material on the internet. The tests will be timed, and the questions randomized across students. We will also implement cheat traps.

Academic Integrity

You are a member of an academic community at one of the world’s leading research universities. Universities like Berkeley create knowledge that has a lasting impact in the world of ideas and on the lives of others; such knowledge can come from an undergraduate paper as well as the lab of an internationally known professor. One of the most important values of an academic community is the balance between the free flow of ideas and the respect for the intellectual property of others. Researchers don't use one another's research without permission; scholars and students always use proper citations in papers; professors may not circulate or publish student papers without the writer's permission; and students may not circulate or post materials (handouts, exams, syllabi--any class materials) from their classes without the written permission of the instructor.

Any test or homework submitted by you and that bears your name is presumed to be your own original work that has not previously been submitted for credit in another course unless you obtain prior written approval to do so from your instructor. In all of your assignments, including your homework, you may use words or ideas written by other individuals in publications, web sites, or other sources, but only with proper attribution. If you are not clear about the expectations for completing an assignment or taking a test or examination, be sure to seek clarification from your instructor or GSI beforehand. Finally, you should keep in mind that as a member of the campus community, you are expected to demonstrate integrity in all of your academic endeavors and will be evaluated on your own merits. The

consequences of cheating and academic dishonesty—including a formal discipline file, possible loss of future internship, scholarship, or employment opportunities, and denial of admission to graduate school—are simply not worth it.

Collaboration and Independence: Reviewing lecture and reading materials and studying for exams can be enjoyable and enriching things to do together with one's fellow students. We recommend this. You are also encouraged to work with fellow students to formulate answers for your homework questions. However, the homework written assignments should be completed independently.

Cheating: Anyone caught cheating on a quiz or exam will receive a failing grade and will also be reported to the University Office of Student Conduct. In order to guarantee that you are not suspected of cheating, please keep your eyes on your own materials and do not converse with others during the quizzes and exams.

Academic Integrity and Ethics: Cheating on exams and plagiarism are examples of violations in the realm of ethics and integrity. Honesty, integrity, and ethical behavior are of great importance in all facets of life. They are so important that it is generally assumed that one has learned and internalized these qualities at an early age. As a result, these issues rarely get explicitly addressed by the time one gets to be a university student. However, it cannot be overstated just how important honesty is to the academic enterprise.

Your success in this class is important to us: Each of us learns differently and we are here to accommodate these differences. If there are aspects of this course that prevent you from learning or exclude you, let us know. Together, we'll develop strategies to meet your needs and requirements of the course. If you are not clear about the expectations for completing an assignment or taking a test or examination, be sure to seek clarification from us beforehand.

Accommodations for Students with Disabilities

If you need official accommodations (DSP), you have a right to have these met. It is important that you inform the DSP office as soon as possible to arrange for these accommodations (dsp.berkeley.edu). The DSP office will let me know about these accommodations but you are also (of course) welcome and encouraged to talk to us so that we can have time to work out the necessary arrangements.

Scheduling Conflicts

Please notify me in writing by the second week of the term about any known or potential extracurricular conflicts (such as religious observances, graduate or medical school interviews, or team activities). I will try my best to help you with making accommodations but cannot promise them in all cases. In the event there is no mutually workable solution, you may be dropped from the class.