

**Neuroethology: From Neurons to Behavior**  
**LIFS4000A, Room 2503**  
**Tuesday/Thursday 10:30 - 11:50 a.m., Fall 2018**

Instructor: Professor Cynthia Moss  
Email: [moss@ust.hk](mailto:moss@ust.hk)  
Office hours: By appointment

**Text:** *Behavioral Neurobiology. The Cellular Organization of Natural Behavior*, 2000  
Thomas J. Carew, Sinauer Associates, Sunderland, Mass., ISBN 0-87893-084-1

**Additional Readings:** Additional assigned readings and a selection of research articles are posted on CANVAS.

**3 Credits, 2 weekly meetings:** Lecture, student presentations and discussion

**Prerequisites:** LIFS 3240 Introduction to neurobiology or LIFS 4950 Neurochemistry or LIFS 3040 Animal Physiology

### **Overview of themes, questions and methods of inquiry**

This course will introduce the exciting discoveries by neuroscientists who investigate the biological foundations of behavior. Much success in this arena has come from the study of animals whose behavioral requirements for survival can be clearly specified and whose nervous systems reveal characteristics to support species-specific behaviors. Noteworthy examples include echolocation in bats, prey localization in barn owls, and communication in songbirds. Our goal will be to integrate data from studies at different levels of the system, and our weekly discussions will center on themes such as ecological constraints on behavior and dedicated neural systems.

In this course, we will begin with some basics ethology, the study of behavior, and nervous system organization and function, covering material that will enable students with different academic backgrounds to read original research articles and design experiments to study questions about brain and behavior. Students will engage in small group and class discussions, write critiques of original scientific articles and complete a final research project proposal.

### **Goals:**

- To impart the importance of behavioral studies to a complete understanding of nervous system function
- To demonstrate that the study of specialized animal systems can lead to a broad and deep understanding of nervous system function
- To foster critical analysis of original research and hypothesis testing

### **Expected Learning outcomes:**

- Students will have a strong understanding of nervous system functions that support species-specific behaviors.
- Students will develop knowledge and skills to critically assess research design, data collection, analysis and interpretation.

## Course organization and assignments

In this course, we will read and discuss book chapters and review articles in conjunction with original research articles.

Students will sign up for research article topics at the beginning of the semester, and they will choose articles from a list provided by the instructor and posted on CANVAS. For each topic we cover, students will work in groups to discuss target research articles. Over the course of the semester, each participant in the class will present **detailed oral and written reports on two different research articles**.

### Overview of course requirements

- **Weekly readings** from texts and original research articles. NOTE: All reading assignments are to be completed before the class date listed on the syllabus.
- **Weekly Q&A and Think-Pair-Share;** Class participation; written questions on readings are due at noon on the day before lecture. Questions should be submitted by email to the instructor. For introductory lectures (September 4-20), along with each of the six Neuroethology topics we'll cover in the course of the semester, please submit 2-3 of the following categories of questions: 1) informational (e.g. what does xxx mean?) and 2) discussion (e.g. how does research finding x change our understanding of y?).
- **Two research article summaries and critiques:** Students will work in small groups to discuss selected research articles; each group will summarize a target article for the class, raise questions and lead discussion. Over the course of the semester, each student will be responsible for reading, discussing and critiquing three original research articles on selected topics. Short (1-2 pages) written reports on the research articles are due by 5:00 p.m., one week following the presentations. Reports should be submitted by email. Each written report should include:
  - 1) A concise summary of the conceptual framework for the research report
  - 2) A clear description of the experimental design and methods
  - 3) A summary of the results
  - 4) An overview of the interpretation of the research findings
  - 5) A critical assessment of points discussed in 1-4
  - 6) Some concrete suggestions for future experiments on topics covered in the article
- **Two exams: September 27 and October 30, 2018**
- **Final research project proposal. Oral presentation on Nov. 29 and written proposal due Dec. 12, 2018**

Observations of an animal's natural behavior and research proposal (6-10 pages) for an experiment in the field of neuroethology. The research proposal format will parallel an original research article, containing an introduction (2-3 pages), methods section (2-3 pages), predicted results (1 page) and discussion (1-3 pages). You will have the opportunity to develop your ideas for the project in class and in discussion with the instructor. The project will involve:

  - 1) Behavioral observation of an animal (outdoors in your backyard, in a local park, at a zoo or the National Aquarium) and identification of a specific behavior important to this animal's survival
  - 2) Framing a question about the development, function or mechanism of the specific behavior you identify
  - 3) A review of past research on the question you pose, which serves to motivate a specific research project you propose
  - 4) A detailed description of the experimental design and methods of your study to help advance knowledge of the animal behavior you've detailed
  - 5) Predicted results and interpretation
  - 6) List of references cited in the proposal

### Course grading is assigned based on students' performance in the following assessment tasks/activities:

- Two 1-2 page research article summaries/critiques: 10% each = 20%
- Two in-class group presentations/discussions of research articles: 5% each = 10%
- Think-pair-share: submit informational and discussion questions; participate in discussion: 15%
- Two exams, 15% each = 30%

- Final Project Research Proposal; oral (5%) and written (20%): 25%

## Overview of course schedule, assignments and due dates

Date	Topic	Organization	Assignments
Sept 4	Introduction	Overview of class	
Sept 6	Ethology	Lecture and discussion; Q&A	Questions on readings
Sept 11	Building blocks of the nervous system I	Lecture and discussion; Q&A	Questions on readings
Sept 13	Building blocks of the nervous system II	Lecture and discussion; Q&A	Questions on readings
Sept 18	Sound and hearing I	Lecture and discussions; Q&A	Questions on readings
Sept 20	Sound and hearing II	Lecture and discussion;, Q&A	Questions on readings
Sept 25	Holiday	No class	
Sept 27	Exam 1	Ethology, Nervous system, sound and hearing	
Oct 2	Research article critique I	Critique Hauser and Andersson, 1994	
Oct 4	Research article critique II	Critique of 2 <sup>nd</sup> research article	
Oct 9	Echolocation in bats	Lecture/Discussion questions	Questions
Oct 11	Echolocation in bats	+Research paper presentations Think-Pair-Share Discussion	*Research article critique
Oct 16	Sound localization in owls	Lecture/Discussion questions	Questions
Oct 18	Sound localization in owls	+Research paper presentations Think-Pair-Share Discussion	*Research article critique
Oct 23	Prey capture in toads	Lecture/Discussion questions	Questions
Oct 25	Prey capture in toads	+Research paper presentations Think-Pair-Share Discussion	*Research article critique
Oct 30	Exam 2	Echolocation in bats, sound localization in owls and prey capture in bats	
Nov 1	Final Project planning	Present ideas for final projects: Questions, hypotheses and research design	Submit final project topic ideas
Nov 6	Communication and learning in songbirds	Lecture/Discussion questions	Questions
Nov 8	Communication and learning in songbirds	+Research paper presentations Think-Pair-Share Discussion	*Research article critique
Nov 13	Communication, learning and memory in honeybees	Lecture/Discussion questions	Questions
Nov 15	Communication, learning and memory in honeybees	+Research paper presentations Think-Pair-Share Discussion	*Research article critique
Nov 20	Learning and memory in Aplysia	Lecture/Discussion questions	Submit final project outline/references
Nov 22	Learning and memory in Aplysia	+Research paper presentations Think-Pair-Share Discussion	*Research article critique
Nov 27	Special topics	Student selected readings	Research article discussion
Nov 29	Final project presentation	Oral presentations	
Dec 12		Final project reports due	Final written project

^ Refer to next page for reading assignments  
\* Applies to those students who have signed up for this topic

### **Course Schedule and Reading Assignments**

Sept 4-13	Behavioral Biology, Chapter 1 ^Zupanc's Behavioral Neurobiology, Chapters 1 and 3
Sept 18-20	^Cahmi Chapter 6
Oct 2	^Left hemisphere dominance for processing vocalizations in adult, but not infant, rhesus monkeys: Field experiments, <i>Proc. Nat. Acad. Sci.</i> Vol. 91, pp. 3946-3948.
Oct 4	^Research article
Oct 9-11	Behavioral Neurobiology, Chapter 2 and ^selected research articles
Oct 13-15	Behavioral Neurobiology, Chapter 3 and ^selected research articles
Oct 23-25	Behavioral Neurobiology, Chapter 4 and ^selected research articles
Nov 6-8	Behavioral Neurobiology, Chapter 8 and ^selected research articles
Nov 13-15	Behavioral Neurobiology, Chapter 9 and ^selected research articles
Nov 20-22	Behavioral Neurobiology, Chapter 10 and ^selected research articles
Nov 27	^Student selected research articles

^ Readings posted on CANVAS

## REQUIREMENTS AND EXPECTATIONS IN THIS COURSE:

- All students are responsible for turning in questions on the week's readings and actively participating in discussions on the readings. Questions for each topic are graded and must be submitted by email to the instructor before noon on the day before lecture.
- Students will sign up to present/critique research articles in class on two of the special topics (e.g. echolocation in bats, prey localization in barn owls, etc.). A collection of original research articles for each special topic will be posted on CANVAS, and presenting students, working in groups, will select one of these papers for presentation/critique. At least one week in advance of the scheduled research article presentation/critique, presenting students are required to meet with the instructor to discuss the details of the selected paper and key themes for the presentation.
- For the weekly research article presentations/critiques, papers selected by presenters will be announced to the class one week in advance. All students are required to read the abstracts of presented papers. Reading the full papers is encouraged. Presenters will go over details of the articles and prepare discussion questions for the class.
- All questions and papers will be marked down a half letter grade for each day they are late, unless there are documented extenuating circumstances (severe illness or family emergency).
- Students may collaborate in groups of 2-3 on final research project proposals, but each student must contribute to the oral presentation in the research symposium on November 29 and submit an independent, written project proposal by 5 p.m. on December 12, 2018.
- All questions, research article critiques and final projects are to be submitted to the instructor by email: [cynthia.moss@ust.hk](mailto:cynthia.moss@ust.hk)