

Bio U545/G245

Neuroethology

Mechanisms of Animal Behavior

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<http://www.neurotechnology.neu.edu/ayers.html>

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Neuroethology attempts to explain simple behavior in terms of the properties and connections of central neural networks. The present course will explore such mechanisms in several representative marine invertebrates and lower vertebrates. A term paper will involve a synthesis of the mechanisms of control of a complex behavioral act from the primary research literature

Week.	Date	Topic
1	Sept 6	Overview of Neuroethology
2	11	Types of Animal Behavior
	13	Analysis of the Mechanisms of Animal Behavior
3	18	Anatomy of Neurons and Nervous Systems
	20	Origin of Bioelectricity
4	25	Bioelectric Integrative Phenomena
	27	Function of Synapses
5	Oct 2	Function of Neuronal Networks
	4	Mechanisms of Central Pattern Generation
6	9	<i>Columbus Day: No Class</i>
	11	CPG Systems
7	16	<i>Midterm Exam</i>
	18	Command and Coordinating System
8	23	Sensory Systems: Proprioceptors
	25	Sensory Systems: Exteroceptors
9	30	Proprioceptive Reflexes
	Nov. 1	Taxes Kineses and Navigation
10	6	Undulatory Locomotion
	8	Ambulatory Locomotion
11	13	Aerial Locomotion
	15	Escape Behavior
12	20	Feeding Behavior
	22	Behavioral Choice
13	27	<i>Thanksgiving: No Class</i>
	29	Behavioral Sequencing
14	Dec. 4	Development of Innate Behavior
	6	Learned behavior.
15		Finals Week

Textbook: Delcomyn, F. (1997) Foundations of Neurobiology W.H. Freeman
 A collection of PDF files will be made available from the research literature

GRADING

Course credit will be based on midterm and final exams as well as on a term paper. The term paper will involve the analysis of the neuronal circuitry and integrative events underlying the generation of a complex behavioral act in a model organism based on the primary research literature. The final grade will be weighted as follows:

Midterm exam (Oct 16)	35%
Final Exam (Week of December 11)	40%
Term Paper (Due December 6)	25%

Neuroethological Systems

Instructions - This term paper is to be Emailed, or surface mailed to the Marine Science Center (East Point, Nahant, MA 01908) by June 7, 2004. The manuscript is to be typed double-spaced. You can copy figures from the original publications. The relative weightings of the answers in the determination of your final mark of are indicated below. Use care in composing your answers correspondingly as this will be the schema by which your grade will be determined.

Based on your knowledge of the organization of nervous systems you are to review the applicability of the command neuron, coordinating neuron, central pattern generator model¹ to a model neuroethological system. The goal of this assignment is to assess how complete the description of the system is with regard to both the central, proprioceptive and exteroceptive mechanisms.

Your review should be about 8000 words and may include figures reproduced from the literature. Where necessary you may use a comparative approach to synthesize the overview from different species. Your review should be organized into the following 6 sections.:

(The numbers in parentheses indicate the relative weight of the section in the final mark)

- (1) An overview of the system describing its adaptive value to the organism its major functional parts and its overall organization as a reflex, modal action pattern or goal achieving behavior (15%)
- 2) An overview of the Exteroceptive sensors that participate in the behavior it controls. What is known about the labeled line and/or population coding and the nature of the releaser for the behavior. (20%)
- (3). An overview of the underlying commands for the behavior (10%)
- (4) An overview of the organization of the central pattern generators (25%)
- (5). An overview of the organization of any intersegmental coordinating systems and/or the pattern of coordination. (10%)
- (6) An overview of any segmental proprioceptive sensors and reflexes. (20%)

Examples of Appropriate Systems:

(not an inclusive list)

- 1) Molluscan Feeding
- 2) Synchronous Insect flight
- 3) Crayfish Escape
- 4) Insect Walking
- 5) Leech Feeding
- 6) Decapod Walking
- 7) Lamprey Swimming
- 8) Tadpole Swimming
- 9) Dipteran Flight

¹ Stein, P. S. G. (1978). "Motor Systems, with specific reference to the control of locomotion." *Ann. Rev. Neurosci.* 1: 61-81.