

INSTRUCTOR: Dr. Sharri Zamore
OFFICE HOURS: W,F, 2-4pm

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TEXTBOOK:

Thomas Carew, *Behavioral Neurobiology: The Cellular Organization of Natural Behavior, 1st Edition*, Oxford University Press, 2000.

We will also be drawing heavily from other textbooks and outside sources, particularly scientific journal articles.

PREREQUISITE: Intro Biology, Animal Locomotion (preferred)

CONCEPTS TO BE INTRODUCED:

nervous systems	comparative physiology	epigenetics
neural networks	comparative biology	gene therapy & transcriptomics
neural encoding, decoding	comparative anatomy	
brain-computer interface	ethics of bodily modification	

COURSE RULES:

Brief Overview

This course is designed to be an applied systems neuroscience course, with extensive focus on comparative biology and biomechanics. Comic book super powers will be used as a motivation to 1) compare physiology, nervous systems and behavior across Animalia, and 2) survey current technological developments that may help modify human physiology and nervous systems.

You are expected to develop skills to hypothesize nervous system roles and locomotor system components required to achieve a particular behavior with a given body form. You will learn about current bioengineering and neuroengineering methods and techniques, and exercise researching these fields. Finally, you will gain practice in science communication, by participating in managing the course twitter account and blog, with the aim of communicating to readers with a high school education.

There will be two 75 minute classes per week. The first class of each week will cover the physical ability, descriptions of its use, and limits of its probability of existence. We may also begin to look at examples of similar functions in the animal kingdom. The second class of each week will focus on examples of similar function in the animal kingdom; specifically exploring nervous systems and physiological traits that allow the function to occur. We will finish the second class discussing genetic and technological developments that are related to creating such a function in humans. This course is a mixed lecture/seminar/project type class, so the classes will not be purely a traditional sit-and-take-notes type of class.

The class is organized by super ability; focusing on each one's function, physical and control system requirements. List of abilities included in class: Super strength/speed, Heightened vision, Shapeshifting, Regeneration and rapid healing, Invisibility, Precognition, Immortality, Psionics.

Learning Objectives

Upon completion of the course, students will be able to:

- Compare physiology and nervous systems of a singular behavior between species
- Research behavioral functions across organisms, to aide in bioinspired design
- Describe basic control/nervous system demands for a given behavioral function and physical form
- Understand population and timing encoding in nervous systems, and examples of both
- Identify limitations of control, based on constraints of nervous and physical systems
- Research current bioengineering developments for specific applications.

Writing Assignments

Early in the course, the class will be broken up into teams. Each week, student teams will be responsible for the course twitter handle, and at least one blog post on the course blog. Twitter posts will involve sharing popular

science papers with short descriptions, or describing primary papers. Blog posts will involve describing potential technology that could be used to grant abilities to given animals or humans, with ethical considerations.

Participation

During lectures, I will describe concepts, ask questions of the class, lead discussions and encourage questions. Additionally, in some sessions a student group will lead the class in a discussion on an assigned topic. In either case, when you're not leading, your role is to participate by thinking, asking questions and interacting actively, and not only listen passively.

Conversations on subject matter is generally encouraged, however conversations should include the class, not a select few. Feel free to ask questions! All questions are welcome; no genuine question is a bad one.

The students in this class are expected to be inclusive, supportive and kind. Bullying, exclusion, and derision will not be tolerated.

Reading Assignments

There will be weekly reading assignments. It is important that you read the material before the associated lecture, as not all relevant background cannot be covered in class.

Course Projects

Students will be grouped over the first or second week, and will be assigned to do a project throughout the semester. Each group will give submit a proposal for their presentation topic, and present content on the topic at the end of the semester. Each group should also write a report about their project in the format of a journal or conference paper.

Tests

The only tests in this class will be in-class quizzes that will focus primarily on the readings, and also lecture material and topics discussed in the course blog.

Electronic Devices

The use of cell phones, smart phones, or other mobile communication devices is disruptive, and is therefore prohibited during class. Devices should be silenced *before* entering the room. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. In this case laptops must be in tablet mode. Those using computers during class for work not related to that class must leave the classroom for the remainder of the class period.

Attendance

Attendance in classes is mandatory. Attending classes will help ensure that you obtain the best return for your educational expenditures. You should be in the classroom promptly on the hour, ready to begin work. All parties MUST arrive for class on time. If there is an occasional reason to be late, please enter as quietly as possible. There is to be no photography of any kind during class, except with prior permission. Note that all materials written by the instructor are her academic property and should not be reproduced elsewhere without permission.

Accessibility

This course is aimed to be accessible to any and all students. If you require any specific considerations or accommodations, please visit or email me early in the semester.

Grade Calculation:

Homework	10%
In-class quizzes, blog posts	30%
Participation	15%
Final Project	45%
Total	100%

<u>Date</u>	<u>Day</u>	<u>Topic</u>	<u>HW</u>	<u>Notes</u>
8/21	T	Introduction, Biology overview I	--	
8/22	R	Physiology overview I – anatomy, sensing and feedback		GL: Joel Garrett
8/28	T	Neuroscience overview I – computational neuroscience & organic computation		
8/30	R	Tech overview II – strategies to augment human form UNIT I – <i>Physics-dependent abilities</i>		
9/4	T	Heroes, abilities and limitations (HAL) Super strength/speed	Reading	
9/6	R	Examples in nature and science (N&S) Super strength/speed	Blog update	Review Quiz
9/11	T	HAL – Heightened Vision		
9/13	R	N&S – Heightened Vision	Blog update	
9/18	T	HAL – Shapeshifting		
9/20	R	N&S – Shapeshifting	Blog update	
9/25	T	HAL – Invisibility	Problem set 1	
9/27	R	N&S – Invisibility	Blog update	GL: Dr. Johnson
		UNIT II – <i>Extrasensory abilities</i>		
10/2	T	HAL – Telepathy		
10/4	R	N&S – Telepathy	Blog update	Unit I Quiz
10/9	T	HAL – Precognition	Proposals due	
10/11	R	N&S – Precognition	Blog update	GL: Dr. Prendergast
10/16	T	HAL - Psionics		
10/18	R	N&S - Psionics	Problem set 2	
		UNIT III – <i>Immune system abilities</i>		
10/23	T	HAL – Healing & regeneration	Presentation outline due	GL: Dr Muñoz
10/25	R	N&S – Healing & regeneration	Blog Update	Unit II Quiz
10/30	T	HAL. - Immortality	Problem set 3	
11/1	R	N&S - Immortality	Blog Update	
11/6	T	Ethics of human modification		
11/8	R	Review		
11/13	T	Review	Presentations due	
11/15	R	Review		Unit III Quiz
11/27	T	Review		
11/29	R	Presentations		
12/4	T	Presentations		