

**Biol/Neur 444-1 Sensory Biology**  
**Fall 2016 Lecture: 4:00 pm to 5:15 pm**

**All material in this course will be available on D2L**

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**Course description:**

Sensory Biology is a discipline in which we attempt to gain an understanding of how organisms extract information from their environment. One of the key characteristics of life is the ability to respond to environmental stimuli. Organisms must be able to interface with the stimulus, transduce the information into a neural signal, interpret the neural input, and initiate behavioral responses that are appropriate to the stimulus. This course will focus on each aspect of this process for each sensory modality. The discussion of a sensory system will begin with the physical nature of the stimulus (sensory systems will be divided into chemical, mechanosensory, and electromagnetic senses). This will be followed by the biological interface between the stimulus and the receptor organ, and will focus on the physics of stimulus detection. Then the transduction and neural encoding of the stimulus will be discussed, followed by discussions on central projections, behavioral outputs (psychophysics), and artificial sensory systems. Thus the course will encompass a broad spectrum of biological disciplines (biophysics, anatomy, neuroscience, psychophysics, and artificial intelligence) using sensory systems as a unifying theme. In addition, the class will engage in discussions on the ecological and evolutionary constraints on sensory system design.

To simplify the scope of the course, material will center on the sensory biology of terrestrial vertebrates, with occasional comparisons to systems found in aquatic animals (when relevant).

**Goals and Objectives for Biology 444**

The overall goal of this course is for students to gain both an understanding of how sensory systems function as well as experience with integrating knowledge from various scientific disciplines. Upon completion of this course, students will be expected to:

1. Enumerate and characterize the four basic aspects of stimuli: quality, intensity, spatial distribution, and temporal properties, and how they differ across stimulus modalities.
2. Describe the properties of matter and their relevance for each sensory system.
3. Discuss how each sensory stimulus interacts with biological structures of the different sensory modalities.
4. Describe and compare the process of sensory transduction for each major sense.
5. Discuss how aspects of mechanical, chemical, and electromagnetic stimuli are represented in a neural code, and their similarities/differences across the different sensory modalities.
6. Discuss how specific psychophysical phenomena arise as a result of stimulus transmission, reception, and/or central processing.

## Course information

### Format of the course

The course will be delivered as a problem-based learning course. This means that the first portion of the course will follow the approximate sequence of events:

1. Prior to each lecture topic, students will be assigned a primary literature paper to read PRIOR to coming to class. Students should have a clear understanding of this paper.
2. The lectures for each major topic will begin with a presentation of the major concepts pertaining to the sensory system. These concepts will include the physics of the stimulus, the physical interface between the stimulus and the biological structures, signal transduction, and basic neural stimulus encoding
3. A discussion of the primary literature article will then ensue
4. The instructor will then present a “new question” based on the discussion (for example, “How would these properties change if we moved this whole scenario into an aquatic system?” or “How would these principles differ in animals that cannot see color?”)
5. Students will either discuss the question in class, or will formulate their own answers and discuss them in the next lecture.

The second portion of the course will then allow the students to generate their own version of format shown above.

### Textbook

For this course, we will not have a textbook. Readings will be distributed throughout the semester via D2L.

### Grading Policy

Grades will be based upon the total points earned versus the total points possible over the course of the semester, and will be determined by the following scale:

<u>Percentage</u>	<u>Grade earned</u>	<u>Percentage</u>	<u>Grade earned</u>
94-100	A	73-76.99	C
90-93.99	A-	70-72.99	C-
87-89.99	B+	67-69.99	D+
83-86.99	B	60-66.99	D
80-82.99	B-	<60	F
77-79.99	C+		

Course grades will be determined by performance on the following assignments:

Unit Exams I - III	100 pts. each
Oral Report/Discussion/Participation	100 pts.
TOTAL	400 pts.

Exams I, II, and III will be unit exams covering material presented in the lectures indicated on the course syllabus. Each unit exam will only cover matter discussed after the previous exam (or from the beginning of the course, for Exam I). The Comprehensive Final Exam will be given during the final examination period and will cover the major concepts taken

during the entire semester. Exam questions will only be related to topics covered in lecture, but will require students to integrate material from sections presented independently in class. Exams will test the students' comprehension of the material covered by requiring them to apply knowledge to situations not directly discussed during lecture. The exam is generally broken down into "chunks" that center on a common theme/topic/study. You will be given passages to read, and you will need to answer both objective and essay questions within the context of the information in the passage. Exams will test your comprehension of the material covered by asking you to apply your knowledge to situations not directly discussed during lecture. The exact point value of all questions will be clearly indicated on the exam so that you can determine which questions to spend the most time answering.

All exams will follow roughly the same format.

**Students missing an exam must contact Dr. Gomez within 48 hours of the exam period or receive a failing grade for the exam.** In order for an absence to be excused, the student must provide a written excuse from the Student Health Service or a parent or guardian, and the excuse must contain a phone number for contacting the person who authored it. **Each case involving an excused absence will be dealt with on an individual basis.**

### **Oral Reports**

The last few lecture slots of the course are reserved for YOU students to study and present topics that are of interest to you. You will select primary journal articles that discuss a sensory phenomenon (at any level – molecular, cellular, anatomical, or behavioral) and present these articles in class. Detailed instructions will be given at a later date.

### **Attendance Policy**

Attendance will not be taken for lecture, but it is important that you remember that class participation and open discussion are important parts of the learning process this course. Attendance at all lectures certainly works to your benefit, as exam questions will be based primarily on material covered in lecture. Also, part of your grade includes participation. In addition, for this course, attendance is a clear sign of enthusiasm and dedication. If you miss class, don't expect me to help you by answering your questions outside of class. If you sit on the border between two grades, I reserve the right to give you the lower grade if your attendance record is poor.

## **Important Course Resources**

### **Academic Code of Honesty**

You are reminded of the [Academic Code of Honesty](#) in place at the University of Scranton. All tests and other graded assignments fall under the auspices of this policy. All graded materials (including laboratory notes and write-ups) must contain only work that you have completed yourself.

**I HAVE A ZERO TOLERANCE POLICY FOR ACADEMIC DISHONESTY!** That means that if you are caught violating the Academic Code (cheating, plagiarism, false reporting), **YOU AUTOMATICALLY FAIL THE COURSE.**

### **Seeking outside help:**

Do not wait to seek help or tutoring. One major mistake that students make is that they do not seek outside help PRIOR to “getting in trouble”. Try to seek help from outside sources as early as possible. Take advantage of my office hours.

This semester, I have assembled a team of students who have all taken the class before and who will also serve as teaching assistants for the laboratory. They are all registered as tutors through [The Center for Teaching and Learning Excellence \(CTLE\)](#). Seek their assistance early.

I am generally available by email, and will happily answer your questions electronically. However, when you ask me a question by email, you MUST include what you think is the correct answer to your question (and provide a brief rationale). If your email has a request for me, you must also provide a brief rationale behind your request. Otherwise, your question/request will be ignored.

### **Students with Disabilities**

In order to receive appropriate accommodations, **students with disabilities must register with the [Center for Teaching and Learning Excellence](#) and provide relevant and current medical documentation.** Students should contact Mary Ellen Pichiarello (570-941-4039, LSC 580) for an appointment. For more information, please visit [www.scranton.edu/disabilities](http://www.scranton.edu/disabilities).

### **Writing Center Services/CTLE**

The [Writing Center](#) focuses on helping students become better writers. Consultants will work one-on-one with students to discuss students’ work and provide feedback at any stage of the writing process. Scheduling appointments early in the writing progress is encouraged.

To meet with a writing consultant, stop by during the [Writing Center’s](#) regular hours of operation, call (570) 941-6147 to schedule an appointment, or complete the Writing Assistance Request Form online. You can also schedule an online appointment using [Google Docs and Google Talk](#).

### **My Reporting Obligations as a Responsible Employee**

As a faculty member, I am deeply invested in the well-being of each student I teach. I am here to assist you with your work in this course. Additionally, if you come to me with other non-course-related concerns, I will do my best to help.

It is important for you to know that all faculty members are required to report incidents of sexual harassment or sexual misconduct involving students. That means that I cannot keep information about sexual harassment, sexual assault, sexual exploitation, dating or domestic violence or stalking confidential if you share that information with me. I will keep the information as private as I can but am required to bring it to the attention of the University’s Title IX Coordinator, Jennifer LaPorta, or Deputy Title IX Coordinator/Dean of Students, Lauren Rivera, who in conversation with you will explain available support, resources and options. I will not report anything to anybody without first letting you know and discussing choices as to how to proceed. The University’s Counseling Center (570-941-7620) is available to you as a confidential resource; counselors (*in the counseling center*) do not have an obligation to report to the Title IX Coordinator.

### **Non-discrimination Statement**

The University of Scranton is committed to providing a safe and nondiscriminatory employment and educational environment. The University does not discriminate on the basis of

race, color, national origin, sex, disability, religion, age, veteran status, gender identity or expression, sexual orientation, or other status protected by law. Sexual harassment, including sexual violence, is a form of sex discrimination prohibited by Title IX of the Education Amendments of 1972. The University does not discriminate on the basis of sex in its educational, extracurricular, athletic, or other programs or in the context of employment.

Students who believe they have been subject to sexual harassment, sexual misconduct or sex or gender discrimination should contact Ms. Jennifer LaPorta, Title IX Coordinator, (570) 941-6645 [Jennifer.laporta@scranton.edu](mailto:Jennifer.laporta@scranton.edu) or Ms. Lauren Rivera, AVP for Student Formation & Campus Life and Dean of Students, at (570)941-7680 [lauren.rivera@scranton.edu](mailto:lauren.rivera@scranton.edu).

The University of Scranton Sexual Harassment and Sexual Misconduct Policy can be found online at [www.scranton.edu/diversity](http://www.scranton.edu/diversity). All reporting options and resources are available at [www.scranton.edu/CARE](http://www.scranton.edu/CARE).

### **Counseling Department Faculty and Staff**

Counseling Department Faculty and Staff will not be considered “responsible employees” when they are acting in a clinical capacity that would require confidentiality consistent with the ethics and expectations of the counseling profession. *This applies to faculty and staff who are acting in a supervisory capacity with counseling students who are practicing and developing counseling skills.* During this time a professional and ethical expectation of confidentiality is assumed.

<https://www.counseling.org/resources/aca-code-of-ethics.pdf>

### **Schedule of topics (subject to change)**

This syllabus is merely a rough guideline for lecture topics for each lecture. Subject matter will be adjusted to fit the available time. Remember that during the spring semester, classes tend to get cancelled due to snowstorms, and I will adjust the lectures accordingly. I make it a point to give the exams as scheduled, even if I do not finish the scheduled subject matter.

Schedule of topics (subject to change)

Day	Date	Topic
T	Aug 23	Course introduction and introduction to signal detection theory
Th	Aug 25	Aspects of sensory stimuli: quality, intensity, spatial, and temporal properties
T	Aug 30	Cell Signal transduction and neural coding
Th	Sep 1	
T	Sep 6	Mechanoreceptors and touch
Th	Sep 8	Sound
T	Sep 13	Hair cells and the detection of movement and sound
Th	Sep 15	
T	Sep 20	catch-up
Th	Sep 22	
T	Sep 27	<b>EXAM I</b>

Th	Sep 29	Properties of chemical Stimuli
T	Oct 4	Chemical Senses
Th	Oct 6	
T	Oct 11	FALL BREAK
Th	Oct 13	Properties of light
T	Oct 18	The vertebrate retina and the physiology of photoreceptor cells
Th	Oct 20	Electroreceptors
T	Oct 25	catch-up
Th	Oct 27	
T	Nov 1	<b>EXAM II</b>
Th	Nov 3	Spatial Orientation
T	Nov 8	Temporal Processing
Th	Nov 10	Central circuitry
T	Nov 15	Reports
Th	Nov 27	
T	Nov 22	Thanksgiving
Th	Nov 24	
T	Nov. 29	Reports
Th	Dec 1	
<b>Finals week</b>		<b>EXAM III</b>