

SENSORY BIOLOGY

Biology 103	Prof. Nancy Kleckner
Sensory Biology	Office: 312 Carnegie, ext 8201
Course usually offered fall semester	Email: nkleckne@bates.edu

OBJECTIVES AND EXPECTATIONS:

Course Description: This course examines the biology of sensation in humans and other organisms. The focus of the course will be on the chemical (taste, olfaction) and mechanical (touch, hearing) senses, and will include other topics such as electroreception in fish, magnetoreception in migrating animals and vision in vertebrates vs. invertebrates. Laboratory exercises include examination of our own senses (why do peppers seem hotter in some humans than others?) as well as those of other organisms (aversive behaviors to chemical or tactile stimuli in invertebrates).

Objectives: The primary goals of this course are 1) to make science fun for all students by examining sensory systems within the context of our own experience, 2) to make connections between the senses we know (because we experience them) and the senses other organisms use that are novel to us as humans, and 3) to understand how knowledge of science fits into a liberal arts education and informs civic engagement and responsibility.

Expectations: Students are expected to attend (on time) most or all of the lecture/discussion sessions and ALL of the laboratory sessions unless a Dean's excuse is obtained. Excused labs must be made up with prior arrangement of the lab partners and instructors. If lecture or laboratory materials are missed, it is the student's responsibility to obtain notes and other materials (handouts, additional reading assignments) from other students and/or from the course web page. It is recommended that students see the instructor with specific questions about the missed material after the notes/readings have been studied. It is also expected that the students will attend all of the exams, and turn in all assignments on time unless a Dean's excuse is obtained and alternate arrangements are made in advance (when possible) with the instructor. Likewise, the instructor will provide all assignments and laboratory exercises in writing, and try to return these assignments to students in a timely fashion. Just remember there are 40 of you and only one of me to grade each assignment.

Virtual Classroom: I am in the process of creating a virtual classroom for sensory biology on WebCT. The address is webct.bates.edu. Currently, only a syllabus exists, but keep your eyes out for lecture notes and labs.

COURSE READINGS:

Required Texts:

- 1) (S) *Sensory Processes*, by David R. Soderquist, Sage Publications, Thousand Oaks, CA (2002).
 - 2) (HH) *Sensory Exotica*, by Howard C. Hughes, MIT Press, Cambridge, MA (2001)
- Both texts are available for purchase in the bookstore

Additional Readings will be announced (TBA) and put on reserve in Ladd Library:

Amrein, H. and Bray, S. Bitter-sweet solution in taste transduction. Cell 112, 283-284, 2003.

Lindemann, B., et al., The Discovery of Umami, *Chemical Senses* 27, 843-844, 2002.

Olabi, A.A. et al., The effect of microgravity and space flight on the chemical senses, *Journal of Food Science* 67, 468-478, 2002.

Smith, C.U.M., Evolution and Classification of Organisms, Chapter 4 in Biology of Sensory Systems, John Wiley and Sons, Ltd, 2000, pp. 35-43.

Smith, D.V. and Margolskee, R.F., Making sense of taste, *Scientific American*, 284, 32-39, March 2001. Also available as online reserve item at Ladd Library.

LECTURE/DISCUSSION SCHEDULE:

Week	Section/Topic	Reading/Homework
	Preliminaries	
1	Introduction to sensory systems	
	Nervous system structure and function	S1, S2
2	Evolution and classification of animals	Smith, C.U.M., 2000
	Discussion: Perceptions of science	HH 1
	The Mechanosensory System	
	The Somatosensory System: mechanosensitivity and kinesthesia	S 3
3	The Somatosensory System: central processing of touch	S 3
	Pain: receptors and processing	S 4
	Hour Exam #1 (Intro through pain)	
4	Vestibular system	S 7
	Auditory stimuli	S 8
	The Ear and Auditory processing	S 9
5	Biosonar in bats: the nature of signals	HH 2, 3
	Biosonar in bats: reception and processing	HH 4, 5
	Chemoreception	
	Olfaction: receptors and processing in humans	S 5
6	Olfaction: comparisons between non-human animals	TBA
	Gustation: peripheral components of taste	S 6, pp. 155-168 Smith, D.V., 2001
	Hour Exam #2 (Vestibular through olfaction)	
	October Recess	
7	Gustation: central processing of taste	S 6, pp. 168-184 Smith, D.V., 2001
	Umami: The “new” taste	Amrein, H., 2003 Lindemann, B, 2002
	Discussion: Space flight and the chemical senses	Olabi, A.A., 2002

8	Pheromones in the animal world	HH 17
	Pheromones in mammals	HH 18
	Discussion: do humans use pheromones?	HH 19
	Electromagnetic reception and migration	
9	Discovery and reception	HH 12-14
	Electric organs and discharge	HH 14, 16
	Discussion: Issues of migration	TBA
10	Hour Exam #3 (Gustation through electromagnetic)	
	No Class - Society for Neuroscience Meeting	
	Report from Neuroscience meeting	TBA
11	Vision	
	Invertebrate vision	TBA
	The human eye and retina	S10
	Visual pathways	S10
	Thanksgiving recess	
12	Discussion: Lasik and “normal” vision	TBA
	Group Projects (Group 1, all attend)	
	Group Projects (Group 2, all attend)	
	Final Exam (Hour Exam #4 plus cumulative for previous concepts)	

COURSE GRADING:

Item	Percent of grade
Exams (3 @ 15 %)	45 %
Final Exam	20 %
Lab Write-ups (5 @ 5 %)	25 %
Group Project	10 %
Total	100 %

The basis for grading all assignments will be explained for each type of assignment. All exams are a combination of objective and essay format and are to be completed individually in class. Group studying is recommended, as each student brings a unique perspective to the material. A written description of the expectations and grading of group projects will be handed out in class before October Break. These groups may be the same as your lab groups, but need not be. Students are expected to seek out other students with similar interests for this project.

Biology 103	Instructors:
Sensory Biology Laboratory	Prof. Nancy Kleckner
	Assistant in Instruction: TBA

Laboratory handouts describing exercises will be provided prior to lab days. Lab worksheets will be provided in laboratory, are designed to be completed by lab groups, and must be handed in before the group leaves lab. Because many laboratories have two lab sections, all students are expected to sign an honor code indicating they will not provide information to another student or obtain information from another student about the content of laboratory worksheets.

LABORATORY SCHEDULE -- read lab handouts before coming to lab – attendance at laboratory is mandatory

		Lab # / Group	Topic
Week 1		Orientation / All students	Introduction/Library/Laboratory safety
Week 2		Lab 1 Group A 1:05 pm Group B 2:30 pm	Reflexes
Week 3		Lab 2 / Group A	Somatosensory and pain
Week 4		Lab 2 / Group B	Somatosensory and pain
Week 5		Lab 3 / Group A	Hearing and biosonar
Week 6		Lab 3 / Group B	Hearing and biosonar
Week 7		Lab 4 / Group A	Taste and smell
Week 8		Lab 4 / Group B	Taste and smell
Week 9		Lab 5 / Group A	Electromagnetic detection
Week 10		Lab 5 / Group B	Electromagnetic detection
Week 11		Lab 6 / Group A	Vision
Week 12		Lab 6 / Group B	Vision