

Sensory Physiology

Bi353

Fall Term 2021

Lectures 1300-1350 MWF (CRN 11342)

Discussion Sections

Mondays: 1400-1450

1500-1550

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Text (recommended): Kandel et al. *Principles of Neural Science* (4th Edition)

Sensory physiology is the study of how information arriving through the sensory organs is processed to produce perception and guide behavior. As you can see from our course schedule below, the emphasis is on the sensory systems that are best understood – somatosensory, auditory, and visual. For each sense modality, we start with the process of transduction, whereby physical energy is converted into neural impulses, and then, attempt to understand the neural basis of perception. In studying perception, we will concentrate on those that are best understood in terms of neural mechanisms.

If you passed this course, you should be able to explain basic sensory transduction and processing in the auditory, somatosensory, electrosensory and visual systems.

The discussion section, held on Mondays, will be spent discussing journal articles and reviewing for tests. The journal articles that we will cover are listed below (see schedule and journal listing below). You are responsible for all material covered in the discussions.

PowerPoint slides are available online. You are encouraged to bring them to class so you can coordinate your notes with the slides.

Your grade is based on an average of the scores of three tests. The questions will be of the short-answer and multiple-choice types. Materials covered in lecture, readings, and discussions will be covered in the tests. To be successful in this class, you must keep up with the material. If you

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have any questions, ask immediately. Exams will require a calculator that is not part of a communication device such as a smart phone or tablet.

The grading scale is as follows:

A	100 - 90
B	89 - 80
C	79 - 70
D	69 - 60
F	Below 59

The exam dates on the schedule (below) are approximate and should *not* be used to plan trips or events that will cause you to miss class. Exams *must* be taken at the time and place scheduled. There are no early or make-up exams, except in the case of a medical emergency.

<i>Approximate Schedule</i>			
Lec #	Date	Topic	Text chapter
1	Monday, September 27, 2021	Class intro	
2	Wednesday, September 29, 2021	Basic neurobiology	
3	Friday, October 1, 2021	Basic neurobiology	
Disc.	Monday, September 27, 2021	Primary sensory pathways	
4	Monday, October 4, 2021	Basic neurobiology	
5	Wednesday, October 6, 2021	Somatosensory system	Ch 21-24 pg 384-92
6	Friday, October 8, 2021	Somatosensory system	
Disc.	Monday, October 4, 2021	Clark et al. '88; Wang et al. '95	
7	Monday, October 11, 2021	Somatosensory system	
8	Wednesday, October 13, 2021	Somatosensory system	
9	Friday, October 15, 2021	Auditory system	
Disc.	Monday, October 18, 2021	Review for Test 1	
10	Monday, October 18, 2021	Test 1 (approx date)	
11s	Wednesday, October 20, 2021	Auditory system	
12	Friday, October 22, 2021	Auditory system	Ch 30, 31
Disc.	Monday, October 18, 2021	Dean et al. 2005	
13	Monday, October 25, 2021	Auditory system	
14	Wednesday, October 27, 2021	Auditory system	
15	Friday, October 29, 2021	Auditory system	
Disc.	Monday, October 25, 2021	Blunden et al. 2017	

16	Monday, November 1, 2021	Auditory system	
17	Wednesday, November 3, 2021	Auditory system	
18	Friday, November 5, 2021	Auditory system	
Disc.	Monday, November 1, 2021	Review for Test 2	
19	Monday, November 8, 2021	Test 2 (approx date)	
20	Wednesday, November 10, 2021	Electrosensory system	
21	Friday, November 12, 2021	Visual system	Ch 25-29
Disc.	Monday, November 8, 2021	Knudsen et al.'82; '89	
22	Monday, November 15, 2021	Visual system	
23	Wednesday, November 19, 2021	Visual system	
24	Friday, November 21, 2021	Visual system	
Disc.	Monday, November 15, 2021	Jay & Sparks 1984	
25	Monday, November 22, 2021	Visual system	
26	Wednesday, November 24, 2021	Visual system	
	Friday, November 26, 2021	Thanksgiving	
Disc.	Monday, November 22, 2021	Visual system	
27	Monday, November 29, 2021	Visual system	
28	Wednesday, December 1, 2021	Visual system	
29	Friday, December 3, 2021	Visual system	
Disc.	Monday, November 29, 2021	Review for final exam	
	Test 3: Wed, December 8, 2021	Test 3 10:15 am	

Journal Articles (*to be updated*)

Articles are available as PDFs on *Canvas*.

1. Clark SA, Allard T, Jenkins WM, Merzenich MM 1988 Receptive fields in the body-surface map in adult cortex defined by temporally correlated inputs. *Nature* 332:444-445.
2. Cury KM, Uchida N 2010 Robust odor coding via inhalation-coupled transient activity in the mammalian olfactory bulb. *Neuron* 68:570-585
3. Britten KH, Shadlen MN, Newsome WT, Movshon JA 1992 The analysis of visual motion: A comparison of neuronal and psychophysical performance. *J. Neurosci.* 12: 4745-4765.

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4. Dean I, Harper NS, McAlpine D 2005 Neural population coding of sound level adapts to stimulus statistics. *Nat. Neurosci* 8:1684-1689.
5. Fritz J, Shamma S, Elhilali M, Klein D 2003 Rapid task related plasticity of spectrotemporal receptive fields in primary auditory cortex. *Nat. Neurosci* 6:1216-1223.
6. Jay MF, Sparks DL 1984 Auditory receptive fields in primate superior colliculus shift with changes in eye position. *Nature* 309:345-347.
7. Knudsen EI, Knudsen PF, Esterly SD 1982 Early auditory experience modifies sound localization in barn owls. *Nature* 295:238-240
8. Knudsen EI, Knudsen PF 1989 Vision calibrates sound localization in developing owls. *J. Neurosci.* 9:3306-3313.
9. Polley DB, Chen-Bee CH, Frostig D 1999 Two directions of plasticity in the sensory deprived auditory cortex. *Neuron* 24:623-637
10. Polley DB, Kvasnak, Frostig D 2004 Naturalistic experience transforms sensory maps in the adult cortex of caged animals. *Nature* 429:67-71.
11. Salzman CD, Britten KH, Newsome WT 1990 Cortical microstimulation influences perceptual judgments of motion direction. *Nature* 346:174-177.
12. Sullivan WE, Konishi M 1984 Segregation of stimulus phase and intensity coding in the cochlear nucleus of the barn owl. *J. Neurosci.* 4:1787-1799.
13. Wang X, Merzenich MM, Sameshima, K, Jenkins WM 1995 Re-modeling of hand representation in adult cortex determined by timing of tactile stimulation. *Nature* 378:71-75.
14. Whitchurch EA, Takahashi TT 2006 Combined auditory and visual stimuli facilitate head saccades in the barn owl (*Tyto alba*) *J. Neurophysiol.*, 96:730-745