

Pleasure, pain and everything between: how touch encodes the world around us

Neurobiology 107
Full Year 2016-2017
Wednesdays, 7-8:30pm
Robinson 106/107

Instructor

Dr. Amanda Zimmerman
amanda_zimmerman@hms.harvard.edu

Office hours: by appointment via email

Course website: <https://canvas.harvard.edu/courses/4696>

Prerequisites: LS 1a, MCB 80, and permission of the instructor.

Course Description:

We rely on our sense of touch for essential tasks and behaviors, including feeding, object recognition, avoiding physical harm, mating behaviors, and child rearing. This course covers the neural components and circuitry that underlie our sense of touch. From skin to the cortex, we will explore touch and its role in development, diseases, and most importantly, in our everyday life.

Objectives:

This course will use the topic of touch processing to explore basic neurobiology principles and research design. Upon completion of this course, students should be able to critically read and present primary literature in the field, formulate scientific hypotheses and design experiments to test these hypotheses, and gain an overall understanding of the neurobiology of touch.

Course Design:

The study of touch will be broken down thematically into modules. Each module will consist of an introductory lecture and activities, followed by a more detailed reading and discussion of selected primary literature and review papers. As appropriate, we will integrate various touch related activities to demonstrate the topic at hand. We will study a wide range of topics from peripheral primary afferents to integration in the cortex, along the way building our basic scientific literacy skills.

Grading

Class participation: 20%

Problem sets: 25%

Presentations: 25%

Midterm & final paper: 30%

Graded work will be returned within 2 weeks of the due date. Students will be informed of their current grade twice per semester.

Evaluations

Periodically I will collect student evaluations of the course. This will allow us to assess students' level of comfort with the course design and material, as well as identify areas of particular interest to the group. These evaluations are critical to our course design and we therefore ask that students respond honestly and openly. Evaluations will be anonymous and have no bearing on students' grades.

Attendance

Weekly attendance is required. Two unexcused absences throughout the year will result in a drop of a letter grade. Unexcused absences will result in a class participation grade of zero for that class. If you are unable to attend class, you must contact the instructor IN ADVANCE and we will agree on a makeup assignment.

Academic Integrity

All Harvard College policies regarding plagiarism apply. In class we will review how to appropriately include citations in your papers, please follow the guidelines carefully. If you have any questions about how to properly reference the work of others, please contact me. While I encourage students to brainstorm ideas with other students and instructors, I have a zero tolerance policy for plagiarism. Copying of anyone else's work (other students, online sources, reference materials, etc) will result in a zero for the course.

Accommodations for Students with Disabilities

Students needing academic adjustments or accommodations because of a documented disability must present their Faculty Letter from the Accessible Education Office (AEO) and speak with the instructors by the end of the second week of the term (9/11/15). Failure to do so may result in the course head's inability to respond in a timely manner. All discussions will remain confidential, although instructors may contact AEO to discuss appropriate implementation

Assignments

Below, the course assignments are summarized. You will receive more information about these assignments and grading criteria in class. Reading assignments and course schedule are subject to change, but will be set 2 weeks before each class and will be available on the course website.

Class participation: Students are expected to participate in class discussions and activities, share ideas, and ask questions every class. Some class activities will require a group submission online for full marks.

Problem sets (one per week): Each week, students will be assigned 1-2 papers to read in advance of the course. The weekly problem sets will be related to that week's reading, and must be turned in by the start of the class. Problem sets should be no longer than one page, typed (double-spaced), and the specifics will be provided the week before.

Presentations (once per semester): Presenting published work in a journal club format is a crucial scientific skill that allows students to improve their skills in reading and interpreting data, and communicating that information. For the first semester, papers will be preselected by the instructors and related to the module topic. During the second semester, students will have the opportunity to select one of the papers suggested by the instructors or find one of their own related to the designated topic. Presentations are expected to be prepared in powerpoint and incorporate the most important figures from the paper; students should be prepared to lead a discussion of the main findings. Additional guidelines and information about expectations for each of these presentations will be provided in class and are posted on the course website.

Papers (one per semester): Papers are an opportunity for students to develop their scientific writing skills and are therefore an important aspect of this course. Students will be expected to meet with professor in the preparation stages so that they can be best guided in how to write effective scientific papers. For full marks, papers are expected to be well-researched (and cited), organized, coherent, and articulate. The fall paper will be in the style of a minireview, citing primary literature on the subfocus chosen, and should highlight a few areas for future research. The spring semester paper will take the format of a grant

proposal, and students can build on the topic from the fall paper or choose a new one. Milestones will be set throughout the semester to facilitate this process. Additional guidelines and information about expectations for each of these papers will be provided in class and are posted on the course website.

Summary of Assignments

- Each week: 1-2 papers to read in advance to be discussed in class as a group. Each week there will also be a short problem set related to the assigned paper.
- One presentation of primary literature per semester
- One written paper each semester
 - Fall semester: 5 page “mini-review” style
 - Spring semester: 8 page “grant proposal” style

Time commitment

The weekly expected time commitment to this course *outside of class* is ~3-5 hours. If you are new to reading primary literature, expect to spend at least 2-3 hours reading a single article. We will devote considerable time in the course to “navigating” primary literature readings, so over time each article should require slightly less time. Written responses to weekly problem sets should take no longer than 1-2 hours to prepare.

FALL SEMESTER 2016				
Date	Topic of Discussion	Required Reading (* denotes review)	Supplemental Reading	Assignments
9/7/16	Course overview and goals Science in the public eye What is touch?			Intro questionnaire/evaluation In class activities
9/14/16	Primary literature versus other scientific writing. Intro to reading primary literature and research design Touch in development	Infant touch; Ardiel et al., 2010 *		DUE: Touch in development problem set Student presentation preference ranking Assign figures for Fabrizi <i>et al.</i> discussion
9/21/16	Role of touch in development (<i>Fabrizi</i>) Skin anatomy and peripheral mechanoreceptors	Fabrizi et al., 2011		DUE: Fabrizi <i>et al.</i> problem set
9/28/16	Role of LTMRs (<i>Maksimovic</i>) Form and function of LTMRs	Maksimovic et al., 2014	Zimmerman et al., 2014 *	DUE: Maksimov <i>et al.</i> problem set DUE: Evaluation of primary lit reading (Fabrizi)
10/5/16	Discriminative touch (<i>Pruszyński</i>) Role of affective touch	Pruszyński et al 2014	Johnson, 2011 *	DUE: Pruszyński problem set
10/12/16	Affective Touch (<i>Olausson</i>)	Olausson et al., 2002 Lloyd et al., 2015 *	McGlone et al., 2014 *;	DUE: Olausson <i>et al.</i> problem set
10/19/16	Pain, temperature & itch (<i>Wainger</i>) Disruptions in pain circuitry	Wainger et al 2014	Basbaum et al., 2009 *; Todd 2010 *	DUE: Wainger <i>et al.</i> problem set
10/26/16	Mechanical allodynia and neuropathic pain (<i>Xu and Truini</i>)	Xu et al., 2015	Truini et al 2013 * Jensen et al 2014 *	Due: Xu <i>et al.</i> problem set
11/2/16	Neurodevelopmental	Orefice et al 2016	Cassico 2010 *	Due: Orefice et al problem set

	disorders in touch			DUE: Paper Outline
11/9/16	Touch/Pain processing disorders I			STUDENT PRESENTATIONS
11/16/16	Touch/Pain processing disorders II or specialized touch			STUDENT PRESENTATIONS
11/23/16	Thanksgiving recess			
11/30/16	Somatosensory and immune interactions (Major <i>et al.</i>)	Major et al 2015	Essik et al., 2010*	DUE: Major <i>et al.</i> problem set DUE: End of semester paper outline
12/7/16	Office Hours			(Reading Period) Evaluation & grades update
12/14/16				DUE: Final paper
SPRING SEMESTER 2017				
Date	Topic of Discussion	Required Reading	Supplemental Reading	Assignments & Activities
1/25/17	Review & welcome back! Grant writing and funding Ascending pathways of touch and pain	The Social Power of Touch		DUE: social power of touch problem set Sign-up for student presentations
2/1/17	Spinal processing of touch (comparison to Tuthill and Wilson)	Tuthill and Wilson, 2016	Abraira & Ginty, 2013*	DUE: Tuthill and Wilson problem set
2/8/17	Gate control of pain & itch Sensory-motor integration	Bourane et al., 2015	Braz et al., 2014 *	DUE: Bourane <i>et al.</i> problem set
2/15/17	Sensory-motor integration Spinal cord injury and sensory-motor dysfunction	STUDENT PRESENTATION 1: Azim et al., 2014	Johansson 2009* Azim et al., 2015 review*	DUE: Azim <i>et al.</i> problem set
2/22/17	Role of touch in motor rehabilitation Supraspinal touch processing circuits	STUDENT PRESENTATION 2: Donati et al 2016	Tidoni et al 2015*	DUE: Donati et al problem set Evaluation & grades update
3/1/17	Cortical integration of touch & proprioception	Student Presentation 3: Kim et al, 2015	Yau et al 2016* ;	Due: Kim et al problem set

3/8/17	Cortical processing of affective touch and modality integration	Student Presentation 4: Brecht et al 2016	Saal et al., 2014* ; Pei & Bensmaia 2014*	DUE: Brecht et al problem set DUE: Final paper topics, group discussion
3/15/17	NO CLASS - SPRING RECESS			
3/22/17	Ascending and injury induced cortical plasticity	Beauchamp & Ro, 2008 ; Zembrzycki et al., 2013	Erzurumlu and Gaslar 2012*	DUE: Plasticity problem set
3/29/17	Cross-modal integration and synesthesia	Ide and Hidaka 2013 ; Maravita et al., 2002	Macaluso and Maravia 2010* ; Bufalari et al 2015	DUE: problem set
4/5/17	Active versus passive touch	Krupa et al 2004 ; Yu et al 2016 :		DUE: Final paper outline, discussion DUE: problem set
4/12/17	Top down modulation of touch	Manita et al., 2015	Gilbert and Sigman 2007	
4/19/17	Attentional modulation of touch	Murphy & Dalton, 2016 and Forster...Jones 2016	Sambo & Forster, 2011* ; Gomez-Ramirez, 2016*	DUE: Problem set Evaluation & grades update
4/26/17	Course wrap up/ Guest lecturer			DUE: Final paper outline updates
5/3/17	Office hours offered for help with final paper			(Reading Period)
5/8/17				DUE: Final paper