

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

Neurobiology 101MA
2020 Fall/Full Term



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.

Instructors

Kathryn Lehigh, PhD

kathryn_lehigh@hms.harvard.edu

Virtual office hours: TBD: Zoom, by email appointment, or Slack channel.

I will regularly check and respond to class related emails at 7:30 pm on weeknights, expect to hear back from me within 48 business hours.

Yasmin Escobedo Lozoya, PhD

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Virtual office hours: TBD: Zoom, by email appointment, or Slack channel.

I will regularly check and respond to class related emails at 7:30 am on weekdays, expect to hear back from me within 48 business hours.

Course Information

This class will be taught virtually for the Fall 2020 semester.

Meetings: Synchronous meetings on Zoom **Tuesdays 6:00-7:15pm**

URL: <https://harvard.zoom.us/j/91930746814?pwd=SWFEYTFCWXNyMIJmZXJrdnRaWXRHZz09>

Passcode: 1k087d

Canvas Course Page: <https://canvas.harvard.edu/courses/77371>

Please frequently visit the course website for course announcements and updates. All assignments will be handed in via the website.

Slack workspace: neuro-101ma-f20-aqf.slack.com

We will use the Slack workspace to post extra resources of interest, answer questions you may have about readings or assignments as they come up throughout the week, and to create and foster a community environment.

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

Course Goals and Objectives

Course goals: 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. The first semester will focus on main concepts and science communication with the final project a “podcast” showcasing students’ understanding and ability to communicate findings of papers related to a somatosensory topic. The second semester will emphasize inquiry-based thinking, experimental design and analysis, culminating in a paper critically evaluating a somatosensory topic.

Course Design: The study of touch will be broken down thematically into modules. Each module will consist of introductory concepts and class participation activity, 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, all the while building basic scientific literacy skills.

Virtual Learning: Rather than lecturing during our synchronous meeting times, students will be asked to review pre-recorded lectures or various other resources that present introductory touch processing concepts and read primary literature papers. Quizzes to test basic comprehension of these concepts will be given each week, to be completed by the Sunday preceding class. Class meeting time will be designated for provocative discussion, touch related learning activities, detailed reading of primary literature, and student presentations and peer review.

Course objectives:

1. List the neurons and tissues involved in touch circuits
2. Define the tracts associated with ascending touch information and diagram touch circuitry from periphery to cortex
3. Describe the different touch receptors at the skin and their signaling properties
4. Compare and contrast the different modalities of touch
5. Explain the fundamental concepts of touch perception within the cortex
6. Summarize the main concepts of primary literature papers related to touch
7. Discuss the findings and conclusions of touch experiments
8. Create science communication media to share informed opinions about current work in the field of touch with a broad audience.
9. Propose experiments to advance our knowledge of how touch information is processed
10. Be able to critically evaluate primary literature articles within the field of somatosensation with regards to the rationale, hypothesis, research design, source of bias or variability and significance of the work.

Course Readings

Required Readings: This course is designed primarily to convey concepts of the somatosensory system by using seminal and recent primary research literature. For each class, the student is expected to have thoroughly read the assigned research paper as well as have read the assigned reference literature and/or textbook chapters (see calendar). Reading assignments and course schedule are all subject to change but will be set 2 weeks before each class and will be available on the course website. Links to PDFs of the literature articles will be provided on the course website.

Reference Textbook: Reading the highlighted chapters from the reference textbook may be helpful to understanding complex topics covered in primary literature articles. This textbook is available on the [library website](#) and can be rented or bought as an e-book from Amazon.com.

Kandel, Schwartz, and Jessell. (2013) Principles of Neural Science (*Fifth edition*). New York, New York: McGraw-Hill.

- **15:** [The Organization of the Central Nervous System](#)
- **16:** [The Functional Organization of Perception and Movement](#)
- **19:** [Cognitive Functions of the Premotor Systems](#)
- **21:** [Sensory Coding](#)
- **22:** [The Somatosensory System: Receptors and Central Pathways](#)
- **23:** [Touch](#)
- **24:** [Pain](#)
- **35:** [Spinal Reflexes](#)
- **36:** [Locomotion](#)
- **45:** [The Sensory, Motor, and Reflex Functions of the Brain Stem](#)
- **46:** [The Modulatory Functions of the Brain Stem](#)
- **48:** [Emotions and Feelings](#)
- **56:** [Experience and the Refinement of Synaptic Connections](#)

Supplementary Reading: These readings are not required but are great options for those interested in learning more about somatosensation!

David J. Linden. (2015) Touch: The Science of Hand, Heart, and Mind. New York, New York: Penguin Books.

<p style="text-align: center;">FALL SEMESTER 2020 Focus: Reading primary literature and science communication</p>				
Date	Topic of Discussion	Required Reading (* denotes review)	Supplemental Reading	Assignments
9/8/20	Course overview and goals Science in the public eye What is touch?			Intro questionnaire/evaluation
9/15/20	Primary literature versus other scientific writing. Intro to reading primary literature and research design Touch in development	Social touch and human development (Cascio et al. 2019) *		DUE: Touch in development quiz Student podcast topic preference ranking Assign figures for Fabrizi <i>et al.</i> discussion
9/22/20	Development of innocuous touch (<i>Fabrizi</i>) Skin anatomy and peripheral mechanoreceptors	Fabrizi et al., 2011	Kandel Ch 23	DUE: Weekly quiz
9/29/20	Role of LTMRs (<i>Bai</i>) Form and function of LTMRs	Bai et al 2015	Zimmerman et al., 2014 *	DUE: Weekly quiz
10/6/20	Discriminative touch (<i>Pruszynski</i>) Role of affective touch	Pruszynski et al 2014	Johnson, 2011 *	DUE: Weekly quiz Summary of topic paper
10/13/20	Affective Touch (<i>Olausson</i>)	Olausson et al., 2002 Lloyd et al., 2015	McGlone et al., 2014 *; Ellingsen et al 2016 *	DUE: Weekly quiz
10/20/20	Pain, temperature & itch (<i>Wainger</i>) Disruptions in pain circuitry	Wainger et al 2014	Basbaum et al., 2009 *; Todd 2010 * Kandel Ch 24	DUE: Weekly quiz
10/27/20	Mechanical allodynia and neuropathic pain (<i>Peirs</i>)	Peirs et al 2015	Truini et al 2013 * Jensen et al 2014 *	Due: Weekly quiz

11/3/20	Neurodevelopmental disorders in touch	Orefice et al 2016	Social touch and human development (Cascio et al. 2019) *	Due: Weekly quiz Midterm podcast write-up
11/10/20	Neurodevelopmental disorders			STUDENT PRESENTATIONS
11/17/20	Specialized touch			STUDENT PRESENTATIONS
11/24/20	Thanksgiving recess			
12/1/20	Somatosensory and immune interactions (Major et al.)	Major et al 2015	Essik et al., 2010*	Due: Weekly quiz May submit first pass audio podcast for feedback
12/8/20	Reading Period			Evaluation & grades update
12/15/20				Due: Final audio podcast

Homework and Grading Policies

Assignments: Below, the course assignments are summarized. You will receive more information about these assignments and grading criteria in class.

Class participation: Students are expected to participate in class discussions and activities, share ideas, and ask questions every class. Students will take turns leading class discussion surrounding a primary literature article. Some class activities will require a group submission online for full marks. Peer review of student written assignments and presentations will be included in class participation grade.

Weekly discussion groups about the primary literature reading of the week will also be strongly encouraged. These sessions are meant to foster a collaborative spirit among classmates, help engage students with the material, as well as to prepare for class discussion. Specific questions and topics for each week will be posted on the Slack workspace. Work put in at the discussion groups will be reflected in the participation grade.

Main concepts quiz: At the start of a new module (every 1-3 classes), students will be given links to short lectures or online tutorials about the module topic and will be expected to review the material on their own before that week's class. A short online quiz will be given on each topic to assess understanding of the main concepts.

Podcast project: The first semester will culminate with a podcast in which students communicate scientific concepts surrounding a somatosensory topic accurately and precisely to a lay audience. We will build up to this project throughout the semester with assignments: 1) read and summarize a

designated primary literature article on the topic 2) write up background information and preliminary “script” with minimum 3 additional resources on the topic (Midterm) 3) 10 min presentation on podcast to the class for peer review 4) Draft audio version of the podcast 5) Final audio version of the podcast. A rubric and examples will be given to make expectations for the podcast clear.

2nd semester Grant proposal: The second semester will include a similarly scaffolded grant proposal assignment in which students will be critically evaluating scientific literature and proposing experiments to advance the specific field of somatosensation. A rubric and examples will be given to make expectations for the proposal clear.

Summary of Assignments (1st semester)

- Weekly:
 - 1-2 papers to read in advance to be discussed in class as a group. Each week there will also be a discussion group meeting relevant to the literature.
 - Review of main concept material and quiz
- Journal club discussion leader (1-2 times a semester)
- Written summary of primary literature paper
- Podcast “paper” (Midterm)
- Podcast description and presentation to peers
- Audio podcast (Final)

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. Review of main concept information should take 1 hr per week and peer review discussion sections should take 1 hr per week.

Missing or Late Assignments: Students are expected to turn in all work on time. Papers that are handed in late will result in point deductions (1 day late = 50% max points, 2 day late = 25% max points and 3 day late = 0%). Unexcused missed presentations will result in 0 points. Missed quizzes or discussion board posts will result in 0 points, 1 of each can be dropped per semester. Please contact the instructors as soon as possible if there is a valid reason for why you cannot complete an assignment on time and we will evaluate a new due date or a make-up assignment.

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

Class participation: 25%
Discussion leader: 15%
Main concept quizzes: 15%
Paper summary &
presentation of podcast ideas: 15%
Midterm & final: 30%

Grading scale:

A: > 93%; A-: 90-92.9%

B+: 85-89.9%; B: 80-84.9%; B-: 75-79.9%
C+: 70-74.9%; C: 65-69.9%; C-: 60-64.9%
D+: 55-59.9%; D: 50-54.9%; D-: 45-49.9%; E: < 50

Available support services:

[Academic resource center at Harvard University](#)

[Counseling and Mental Health Services](#)

[Learning Remotely](#)

Course Policies

Class environment: This class is for you to learn and develop science inquiry skills! We want you to understand main concepts of somatosensation as well as be able to evaluate the data that informs our thinking of how we process touch information from periphery to brain. Collaboration and scientific discourse are fundamental to the process of research science, therefore, our hope is that through your own study and reading you formulate questions and ideas to be shared and discussed with the class. All ideas are welcomed, and we expect all students to respectfully listen. The more you communicate about the topic to us and to your classmates the more comfortable you will be with the material--and with using your scientific voice!

Attendance: The university is expecting students to maintain synchronous online learning, and therefore, 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. If there is a valid reason for why you may not be able to regularly attend our virtual synchronous sessions please email me and we will discuss options with the Neuro tutorial coordinator, Ryan Draft.

Academic Integrity: Harvard College policy: <https://handbook.fas.harvard.edu/book/academic-integrity>
Discussion and the exchange of ideas are essential to academic work. For assignments in this course, you are encouraged to consult with your classmates on the choice of paper topics and to share sources. You may find it useful to discuss your chosen topic with your peers or course instructional staff (TF/TAs, course assistants, faculty), particularly if you are working on the same topic as a classmate. However, you should ensure that any written work you submit for evaluation is the result of your own research and writing and that it reflects your own approach to the topic. You must also adhere to standard citation practices in this discipline and properly cite any books, articles, websites, lectures, etc. that have helped you with your work. If you received any help with your writing (feedback on drafts etc from peers or course instructional staff), you must also acknowledge this assistance. Collaboration in the completion of quizzes is always prohibited. You are responsible for understanding all Harvard College [policies on academic integrity](#).

Students are expected to be familiar with the [Harvard Guide to Using Sources](#). Students who are in any doubt about the preparation of academic work should consult their instructor before the work is prepared or submitted. Students who, for whatever reason, submit work either not their own or without

clear attribution to its sources will be subject to disciplinary action, up to and including requirement to withdraw from the College. Students who have been found responsible for any violation of these standards will not be permitted to submit a course evaluation of the course in which the infraction occurred.

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, <http://aeo.fas.harvard.edu>) and speak with the instructor by the end of the second week of the term. Failure to do so may result in the instructors' inability to respond in a timely manner. All discussions will remain confidential.

Academic courtesy:

- Please address the instructors as Dr. Lehigh and Dr. Escobedo-Lozoya.
- We appreciate the distractions surrounding students during remote learning, but we are expecting students to give their undivided attention to us and to their classwork just as we pledge to give our undivided attention to you and our instruction. Any use of student technology should be intentional. Please no texting, checking email or working on assignments for another class during our time together. Remember, class participation is a significant part of your grade!
- Class starts promptly at 6pm and students are expected to be logged in and ready to learn. Without advance notice and approval of the instructors, being more than 10 minutes late will result in an unexcused absence, as will leaving class early. Lateness due to internet problems will be discussed and assessed on a case by case basis.
- In all discourse relating to classwork and assignments, students are expected to behave respectfully and courteously towards the instructors and their fellow students. Read [this article](#) for appropriate online etiquette.
- Email policy: please include NeuroTutorial101M in the subject line and be sure to include your first and last name within the message.
- All assignments submitted should include assignment name and student first initial, last name, like this: LiteratureReview_KLehigh