

MCB 148: The Neurobiology of Pain

Spring 2016
Biolabs 1075 Tu/Th 2-3:30 PM

Instructor: Dr. Ryan W. Draft

Course website: <https://canvas.harvard.edu/courses/5751>

Prerequisites: MCB 80

Instructor Contact Info

Ryan W. Draft, Ph.D.

Biolabs 1082 A, 16 Divinity Ave.

draft@fas.harvard.edu (preferred method of contact)

Office: 617-496-9908

Personal Page: <http://www.people.fas.harvard.edu/~draft/>

Office Hours: W: 11 AM -12 PM; F: 4-5 PM (by appointment when needed)

Course description

MCB 148 will explore the neurobiological systems and mechanisms underlying both acute and chronic pain. Topics will include nociceptive/sensory systems, molecular basis and modulation of pain, neuroanatomy of peripheral and central pain circuits, pain pathologies, pharmacological and non-pharmacological treatments. The emphasis will be on understanding basic neurobiological concepts underlying pain systems and reading/discussing the primary scientific research in the field.

Course Aims and Objectives

In this course we will follow the theme of 'Pain' from molecules to brain states to explore and learn the fundamentals of neurobiology.

Each Thursday, Dr. Draft will cover a different subfield in pain research by presenting classical research results to build-up to our current understanding. In doing so, we will cover critical content in neurobiology generally (e.g., molecular signaling, neural coding, neural modulation, central and peripheral anatomy, plasticity, immune and glial interactions, etc). Content from the lectures will be assessed through two quizzes and two exams (see 'grading' below).

Each Tuesday, a different student will lead a discussion of a high-impact recent paper related to the previous lecture. The goal is to build critical skills in reading and deconstructing a research article, as well as to learn common methods used in different levels of neurobiological research (from RNAseq to fMRI). Content from the research articles will be assessed in pre-class homework questions but will not appear on quizzes/exams (see 'grading' below).

Course Policies and Expectations



Attendance: Students are expected to attend all classes. Participation credit will be given for in class discussion and activities on a pass/fail basis (see ‘grading’ below).

Excused Absences: Please make every attempt to inform Dr. Draft in advance of any planned absences (travel/interviewing, family/health emergencies, religious days, sports/extra-curriculars). Make up assignments can be given for up to three excused absences.

Unexcused Absences: One unexcused absence of a non-quiz/exam class may be made up for full credit. Beyond that, no credit will be given for missed classes. Make Up Exams/quizzes will not be given for unexcused absences and students will receive no credit if missed.

Late Assignments will not be accepted; no credit will be given. For credit, please have all assignments in prior to posted deadlines (see ‘schedule’ below).

Readings/Materials

Suggested reviews and readings will be posted before Tuesday lecture (see ‘schedule’ below). The reference textbook for the course can be accessed for free via this link:

Wall and Melzack. **Textbook of Pain** 6th Ed. (2013)
http://nrs.harvard.edu/urn-3:hul.ebook:ELMED_20090526712

Assignments and Grading Procedures

Grading Scale	Assignment	Number of Assignments per Semester	Number of Points per Assignment	% total grade (weighting)
P/F	Participation: Lecture Class	12	1	16
P/F	Participation: Paper Discussion Class	10	1	16
v+, v, v-	Paper Presentation	1	2 (v=100%)	16
v+, v, v-	Pre-Class HW Assignment	10	2 (v=100%)	16
Numeric	Quiz 1	1	12	3
Numeric	Quiz 2	1	12	3
Numeric	Exam 1	1	25	6
v+, v, v-	Compositions - Rough draft	1	2 (v=100%)	6
Numeric	Compositions - Final draft	1	20	6
Numeric	Exam 2	1	50	12

As shown, 32% of your grade can be earned by attending and participating in class. 16% is based on your presentation, 16% on your homework questions, 12% is based on your mini-review composition, and 24% based on your exam scores. The weighting of the grades ensures missing a few points on short quizzes does not disproportionately impact grades.

Rubrics for grading paper presentation and mini-review will be discussed in class.

Total % Letter Grade

> 93	A
90-93	A-
85-90	B+
80-85	B
75-80	B-
70-75	C+
65-70	C
60-65	C-
55-60	D+
50-55	D
45-50	D-
< 45	E

Academic Integrity

The Harvard College Honor Code

Members of the Harvard College community commit themselves to producing academic work of integrity – that is, work that adheres to the scholarly and intellectual standards of accurate attribution of sources, appropriate collection and use of data, and transparent acknowledgement of the contribution of others to their ideas, discoveries, interpretations, and conclusions. Cheating on exams or problem sets, plagiarizing or misrepresenting the ideas or language of someone else as one’s own, falsifying data, or any other instance of academic dishonesty violates the standards of our community, as well as the standards of the wider world of learning and affairs.

Pre-Class Homework Assignments (for assigned research articles; due midnight before class they will be discussed – usual Tuesday; see ‘schedule’ below).

Students are required to work entirely independently on research article pre-class assignments. No collaboration is allowed; evidence of collaboration will result in a zero for the assignment. Students will have a chance to discuss the articles in office hours with Dr. Draft and in class with other students.

Mini-Review Assignment

Students are required to work entirely independently on the mini-review assignment. No collaboration is allowed; evidence of collaboration will result in a zero for the assignment. Dr. Draft will review/provide feedback on your rough draft and the [writing center](#) is available for consultation/help with mechanics, structure, organization, and grammar.

Expectations for citation/reference formatting will be discussed in class. For a review of using sources in written assignments, please check out the guide to using sources: <http://usingsources.fas.harvard.edu/icb/icb.do>

Quizzes/Exams

All quizzes/exam will be in-class (see schedule), closed notes/books, and done individually.

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 professor by the end of the second week of the term, (*fill in specific date*). Failure to do so may result in the Course Head's inability to respond in a timely manner. All discussions will remain confidential, although Faculty are invited to contact AEO to discuss appropriate implementation.

Tentative Course Schedule*

* Subject to change. A more detailed schedule will be posted before the start of class.

WEEK 1 -----

Tuesday Jan 26: Course Structure and Logistics. Overview and History of Pain Research.

Thursday Jan 28: Why it Hurts: Pain Signals and Receptors.

- reference: [TP] Ch1 p1-12; Ch2 p31-47
- **suggested review: Julius, D. 2013 (ARCD)**

WEEK 2 -----

Tuesday Feb 2: Student Presentation #1

- **HW questions due Monday 11:59 AM before class.**
- Caterina et al, 1997 (Nature)

Thursday Feb 4: The Enchanted Loom: Spinal Circuitry.

- reference: [TP] Ch5 p77-93; Ch 12 p 182-190
- **suggested review: Todd 2010 (NRN)**

WEEK 3 -----

Tuesday Feb 9: Student Presentation #2

- **HW questions due Monday 11:59 AM before class.**
- Duan et al 2014 (Cell)

Thursday Feb 11: Why Does it Hurt So Much? Supraspinal Pain Areas.

- reference: [TP] Ch7 p 111-118; Ch 20 p 283-298
- **suggested review: Chapter 7 p111-117 Textbook of Pain**

WEEK 4 -----

Tuesday Feb 16: Student Presentation #3

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- Wager et al 2013 (NEJM)

Thursday Feb 18: Feeling Good: Descending Modulation of Pain.

- **In class Quiz on material up to (not including) Feb 18**
- reference: [TP] Ch5 p92; Ch7 p 120-121; Ch 8
- **suggested review: Ossipov 2010 (JCI)**

WEEK 5 -----

Tuesday Feb 23: Student Presentation #4

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- Kim et al 2014 (Neuron)

Thursday Feb 25: Inflammatory Pain Dynamics.

- reference: [TP] Ch 1 p11-27; Ch3; Ch 4; Ch 6
- **suggested review: Chapter 3 Textbook of Pain**

WEEK 6 -----

Tuesday Mar 1: Student Presentation #5

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- Coull et al 2003 (Nature); Coull et al 2005 (Nature)
- Hanack et al 2015 (Cell)

Thursday Mar 3 – Exam 1 (in-class).

WEEK 7 -----

Tuesday Mar 8: Not All Created Equal: Gender and Genetics of Pain.

- reference: [TP] Ch 10 and Ch 15
- **suggested review: Bennett and Woods, 2014 (Lancet)**

Thursday Mar 10 – Student Presentation #6

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- Leipold, 2013 (Nature Genetics)
- Minett 2015 (Nature Communications)

WEEK 8 -----

Tuesday Mar 15: SPRING BREAK

Thursday Mar 17: SPRING BREAK

WEEK 9 -----

Tuesday Mar 22: Ghosts in the Machine: Neuropathic Pain.

- reference: [TP] Ch 1 p27-30; 61; 65;
- **suggested review: Costigan et al, 2009 (ARN)**

Thursday Mar 24 – Special Lecture with Jacinthe Gringras from Amgen

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- Gringras et al 2014 (PLoS)

WEEK 10 -----

Tuesday Mar 29: Student Presentation #7

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- Coull et al 2003 (Nature); Coull et al 2005 (Nature)

Thursday Mar 31 – A Mere Curse: Central Effects of Chronic Pain.

- reference: [TP] Ch 7 p122-127; Ch 64; Ch 69
- **suggested review: Schweinhardt and Bushnell 2010 (JCI)**

WEEK 11 -----

Tuesday Apr 5: Student Presentation #8

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- **Baliki et al 2011 (Plos One)**

Thursday Apr 7: A Pain Free World – Pain Pharmacology.

- **Mini-Review Rough Draft due by 11:59 PM Apr 7**
- reference: [TP] Ch 26; Ch 30; Ch 32; Ch 34-35; Ch 38-39; Ch 70
- **suggested review: Brown 2011 (ARN); Trang et al 2015 (J Neurosci)**

WEEK 12 -----

Tuesday Apr 12: Student Presentation #9

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- **Corder et al 2013 (Science)**

Thursday Apr 14: Mind Over Matter: Non-Drug Therapies and Placebos.

- **In class Quiz on new material: Mar 8 up to (not including) April 14**
- reference: [TP] Ch 25; Ch 27; Ch 42; Ch 43
- **suggested review: Wager and Atlas et al 2015 (NRN)**

WEEK 13 -----

Tuesday Apr 19: Student Presentation #10

- **HW questions due Monday 11:59 AM (or before Tues 6 AM) before class.**
- **deCharms et al 2005 (PNAS); Guan et al 2015 (Plos One)**

Thursday Apr 21 – I Feel Your Pain: Empathy and Pain.

- **suggested review: Bernhardt and Signer 2012 (ARN)**

WEEK 14 -----

Tuesday Apr 26: **Exam 2 (in-class).**

READING PERIOD (April 28-May 4) & FINAL EXAM PERIOD (May 5-14)

1) An optional field trip to the MGH Ether Dome will happen during reading period. Time to be determined.

2) Mini-Review will be due May 5th by 11:59 PM (end of the first day of final exam period).