

Bio74 Advanced Neurobiology:

Fall 2019: T, TH 10-11:50am with Professor Michael Hoppa

Description:

Seminar class on selected topics in neurobiology focusing on the connection between molecule and malady in diseases ranging from Dystonia, to ALS (Lou Gerig Disease) to Parkinson's. We will focus on connecting basic research with outstanding questions in the field relevant to neurological disease and human health with an emphasis on synaptic transmission, neural excitability, channelopathies and gliopathies.

Over the course of the class we will delve into the most advanced techniques in current cellular neurobiology research including: optogenetics, inducible genetic manipulations, live cell microscopy, electron microscopy, super-resolution and electrophysiology. The course will include presentations of primary literature as well as live conversations and interviews with off-campus research labs.

Preference will be given to upper level neuroscience and biology majors. Prerequisites one of the following: Bio34, Psych46, Bio49 or permission from the instructor (Prof. Michael Hoppa).

Learning Objectives

- Gain an appreciation for how neurobiologists approach answering questions using a variety of modern techniques including live cell imaging, super-resolution microscopy, optogenetics, electrophysiology and advanced fluorescent biosensors
- Students will develop skill in critically evaluating data presented in the primary literature. This skill requires understanding the advantages and limitations of the experimental techniques used to generate the data.
- Students will be able to express their ideas clearly and succinctly in both written and verbal format.

The success of this course depends on your reading the assigned papers **BEFORE** class.

Grading:

Grading will be, in part, based on two out-of-class take home open note written assignments and one oral presentation. The assignments will consist first of writing a scientific abstract, and the second will consist of analyzing a paper in the primary literature as a mid-term exam (open book). The final presentation will be a 25 minute oral presentation in class on a paper of the student's choice with consent of the instructor. In addition, there will be a class participation grade, which will include contributions to the discussions. Written assignment 30%, Oral Presentation 25% and Class Participation 45%.

Reading Syllabus Advanced Neurobiology Fall 2019 BELOW

9/17 | Tuesday

Discussion How to read a scientific paper and synaptic transmission lecture.

9/19 | Thursday

Preview: “The mystery of the fusion pore” Sharma et al 2016

<https://www.nature.com/articles/nsmb.3157>

Article: “Dynamics and number of *trans*-SNARE complexes determine nascent fusion pore properties”

Bao et al 2018 <https://www.nature.com/articles/nature25481>

Further Reading Review: <https://febs.onlinelibrary.wiley.com/doi/epdf/10.1002/1873-3468.13270>

9/20 FRIDAY 4PM Lecture with Ed Chapman in LSC 201 -- **NOTE SPECIAL TIME AND PLACE**

9/24 | Tuesday

*****No Class *** Assignment Number 1 Due by Midnight**

9/26 | Thursday

*****No Class *** READING ASSIGNMENT – REVIEW**

10/1 | Tuesday

Preview: Nanocolumns at the heart of the synapse. Nature 2016

Article: Article: A trans-synaptic nanocolumn aligns neurotransmitter release to receptors. Nature. 2016 Aug 11;536(7615):210-4.

10/3 | Thursday

Preview: Munc13 marks the spot. Nature Neuroscience volume 21, pages5–6 (2018)

Article: Synaptic weight set by Munc13-1 supramolecular assemblies. Nature Neuroscience volume 21, pages41–49 (2018)

10/8 Tuesday

Preview: Unc13 Aligns SNAREs and Superprimed Synaptic Vesicles. *Neuron*, Volume 95, Issue 3, 2 August 2017, Pages 473-475

Article: Molecular Mechanisms of Synaptic Vesicle Priming by Munc13 and Munc18. *Neuron*, Volume 95, Issue 3, 2 August 2017, Pages 591-607.e10

10/10 | Thursday

Preview: NO PREVIEW

Article: Synaptic UNC13A protein variant causes increased neurotransmission and dyskinetic movement disorder. *J Clin Invest*. 2017;127(3):1005–1018.

<https://www.jci.org/articles/view/90259>

10/15 | Tuesday

Preview: Neurodegenerative disease: The plot thickens. *Nat Rev Neurosci*. 2015 Dec;16(12):701

Preview 2: Liquids, Fibers, and Gels: The Many Phases of Neurodegeneration. *Dev Cell*. 2015 Dec 7;35(5):531-532.

Article: ALS/FTD Mutation-Induced Phase Transition of FUS Liquid Droplets and Reversible Hydrogels into Irreversible Hydrogels Impairs RNP Granule Function. *Neuron*. 2015 Nov 18;88(4):678-90.

10/17 | Thursday

Preview: A Presynaptic Liquid Phase Unlocks the Vesicle Cluster. *Science*. 2018 Aug 10;361(6402):548-549.

Preview 2: Phase changes in neurotransmission. *Trends Neurosci*. 2018 Nov;41(11):772-774.

Article: A liquid phase of synapsin and lipid vesicles. *Science*. 2018 Aug 10;361(6402):604-607.

******HAND OUT MIDTERMS END OF CLASS******

10/22 | Tuesday MIDTERMS DUE AT *NOON*****

10/24 | Thursday

Preview: Sabotage by the brain's supporting cells. *Nature*. 2018 May;557(7706):499-500.

Article: Cellular milieu imparts distinct pathological α -synuclein strains in α -synucleinopathies. *Nature*. 2018 May;557(7706):558-563.

10/29 | Tuesday

Preview: Exploring the Peripheral Initiation of Parkinson's Disease in Animal Models. *Neuron*. 2019 Aug 21;103(4):547-549.

Article: Transneuronal Propagation of Pathologic α -Synuclein from the Gut to the Brain Models Parkinson's Disease. *Neuron*, Volume 103, Issue 4, 21 August 2019, Pages 627-641.e7

10/30 – **Meet about final presentations!******

10/31 | Thursday

Preview: A gut feeling. *Science*. 2018 Sep 21;361(6408):1203-1204.

Article: A gut-brain neural circuit for nutrient sensory transduction. *Science*. 2018 Sep 21;361(6408).

11/5 | Tuesday

Preview: The diverse culinary habits of microglia. *Nat Neurosci*. 2018 Aug;21(8):1023-1025.

Article: Epigenetic regulation of brain region-specific microglia clearance activity. *Nat Neurosci*. 2018 Aug;21(8):1049-1060.

11/7 | Thursday

Preview: Swelling Gliotransmission by SWELL1 Channels. *Neuron*. 2019 May 22;102(4):711-713.

Article: Glutamate-Releasing SWELL1 Channel in Astrocytes Modulates Synaptic Transmission and Promotes Brain Damage in Stroke. *Neuron*. 2019 May 22;102(4):813-827.e6.

11/12-11/14 | * Final Presentations *****