

Fundamentals of Neuroscience

Discussion Section

BIO154/NBI154/PSY135/NEUROSCI114

Section 1: Thursday, 3:05-3:55PM Room: Old Chem 101

Section 2: Thursday, 4:40-5:30PM Room: Old Chem 101

Instructor: Lauren Williamson
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Office Hours: Thursdays, 3:55-4:40PM
Fridays, 3:30-4:30PM
By appointment (via e-mail)

Course Description: The discussion section for Fundamentals of Neuroscience is meant to accompany and to expand upon the lecture portions of the course as taught by Dr. Meck. Each session will address empirical research that relates to the topics that Dr. Meck has outlined on his syllabus.

Student Objectives: By the end of the semester, students should be able to do the following:

- Read empirical scientific articles without fear
- Identify the hypothesis of a scientific paper
- Identify the components of a data figure (e.g. X-axis, Y-axis) and the data that the figure represents
- Explain (succinctly) the finding(s) shown in a single figure
- Summarize the findings from a paper as a whole and assess if they adequately supported their hypothesis
- Extend the findings from an empirical work with suggestions of continuing or follow-up experiments
- Assess validity and strength of findings from empirical studies

Teaching Methods: Discussion section will be predominantly filled by *discussion*. However, short lectures at the beginning of the class will place each empirical work in a broader context, connecting it to the larger literature in the field as well as topics covered in class.

Readings: Empirical articles will come from a variety of sources. All articles will be available as PDFs on Blackboard in folders labeled for each week. There will occasionally be a review paper assigned as well for increased depth and breadth. Take-home questions for each week will also be available in the same folder on Blackboard. These questions are designed to guide your reading and thinking as it relates to the empirical article for the week.

Student Responsibilities and Participation: The class period will be used to *discuss* empirical work related to class/lecture topics. There will only be *one* empirical work discussed each period; therefore, attention to detail on these works should be a priority. These discussions will include a combination of the following:

- Summary: Following the short lecture, two or three students will be selected at random to summarize/identify 1) the hypothesis, 2) the findings and 3) the implications of the day's assigned paper. Each student will do a summary twice during the semester.

- Comprehension: For example, “minute papers,” no-penalty quizzes, etc. will be given following the summary
- Small-Group Discussion: students will get into small groups of 2-4 students and discuss *one* of the figures in the paper. These groups will be established by me at the beginning of the semester and may be combined with other groups or split up if the length of the paper requires it. You will know about group adjustments ahead of class time.
- Full-Class Discussion: following small-group discussion, students will be asked to explain their figure to the class. I will decide which student from each group is the “speaker” for the group, so prepare yourselves to be “cold-called” during this portion of the class. You will be able to help one another once the “speaker” has had his/her chance to speak.
- Implications and Take-Home Points: The whole class can brainstorm new experiments to expand on the findings of the paper or experiments that might improve on shortcomings seen in the paper. Also, I will finish class with some of the important points from the reading(s) and your discussion.

Grading: The discussion section grade is 50% of your total grade for the class.

Exams (3): 25% each [75% total]

- Exams will be taken at the same time as Dr. Meck’s lecture portion of the exam. They will include fill-in-the-blank, multiple choice, short answer and essay questions

Summary (2): 5% each [10% total]

- You will each be allowed *one* pass on the Summary portion of the course. Use it wisely. Your summaries will not need to be extensive; try to take less than 5 minutes among the summarizers to tell the class about the three main points. Grading on the summary will be binary – if you have read the paper, you will receive credit and if you have not, you won’t.

Participation: 15%

- Participation will be based on three things: your participation as I perceive it during small-group discussion, your “speaker” responsibilities *and* ratings of participation by your classmates at 3 time points throughout the semester. There are 10 weeks of empirical discussion – each week will be worth 1.5% of your grade with some combination of small-group, “speaker” and classmates’ ratings making up that grade. Obviously, if you are not selected as “speaker” on a given day, that will not be part of your grade that week.

Schedule and Readings

Week 1 (9/2/10) Introduction to Discussion Section

- Introducing ourselves
- Code of conduct for the class
- Reading through the syllabus
- Questions? Concerns?

Week 2 (9/9/10) Neuroanatomy

- “Talking about the brain”

- Basic brain structures
- Characteristics of neurons
- Case studies from neurological patients

Week 3 (9/16/10) Ion Channels

- How the action potential happens
- Role of ion channels in maintaining communication abilities of neurons
- **Read** Cannon & Strittmatter, 1993 (*Neuron*) “Functional expression of sodium channel mutations identified in families with periodic paralysis”
- First week of discussion

Week 4 (9/23/10) Neurotransmitters and Receptors

- Types of neurotransmitters and their receptors
- NTs roles in learning and drug addiction
- Long-term potentiation (LTP)
- **Read** Saal, *et al.* 2003 (*Neuron*) “Drugs of abuse and stress trigger a common synaptic adaptation in dopamine neurons”

Week 5 (9/30/10) Neuroinflammation: Role of Microglia

- Relationship between the nervous and the immune systems
- Neuroinflammation – how do we define it? How do we measure it?
- **Read** Hains, *et al.*, 2010 (*J Pain*) “Pain intensity and duration can be enhanced by prior challenge: initial evidence suggestive of a role of microglial priming”

Week 6 (10/7/10) Exam Review

- Please come prepared with questions

Week 7 (10/14/10) Visual Development and Sensitive Periods

- Defining sensitive and critical period
- Normal visual development
- Disruption of critical periods and later outcomes
- **Read** Daw, *et al.*, 1992 (*J Neurophys*) “Critical period for monocular deprivation in the cat visual cortex”

Week 8 (10/21/10) The Auditory System: Sound Localization

- Development and organization of the auditory system
- Neuroethology – how distinct species help us understand our own brain development
- **Read** Sullivan 1982 (*J Neurophys*) “Neural representation of target distance in auditory cortex of the echolocating bat *Myotis lucifugus*”

Week 9 (10/28/10) The Olfactory System

- Organization of the olfactory system
- Neurogenesis – what is it important for?
- **Read** Gheusi, *et al.*, 1999 (*PNAS*) “Importance of newly generated neurons in the adult olfactory bulb for odor discrimination”

- **Read** review: Carleton, *et al.*, 2002 (*J Phys*) “Making scents of olfactory neurogenesis”

Week 10 (11/4/10) The Basal Ganglia

- Normal role of basal ganglia in movement
- Dysfunction in the basal ganglia – Huntington’s, Parkinson’s
- **Read** Gradinaru, *et al.* 2009 (*Science*) “Optical deconstruction of Parkinsonian neural circuitry”
- Please also be sure to look at the supplemental figures (found in the folder on Blackboard)

Week 11 (11/11/10) Functions of the Cerebellum

- Importance of the cerebellum in eye movements (saccades)
- Non-invasive disruption of human brain function (TMS)
- **TWO READINGS THIS WEEK** (both short with very few figures)
- **Read** Lee, *et al.* 1988 (*Nature*) “Population coding of saccadic eye movements by neurons in the superior colliculus”
- **AND Read** Jenkinson & Miall 2010 (*Cerebellum*) “Disruption of saccadic adaptation with repetitive transcranial magnetic stimulation of the posterior cerebellum in humans”

Week 12 (11/18/10) Exam Review

Week 13 Thanksgiving Week

Week 14 (12/2/10) Attention and the Associational Cortices

- Organization of association cortices
- What is attention? How can we reliably measure it?
- **Read** McAdams & Maunsell, 1999 (*J Neurosci*) “Effects of attention on orientation-tuning functions of single neurons in macaque cortical area V4”

Week 15 (12/9/10) Stress, Hormones and the Brain

- HPA axis
- Hormonal communication to and within the brain
- Role of maternal care in offspring outcomes
- **Read** Liu, *et al.*, 1997 (*Science*) “Maternal care, hippocampal glucocorticoid receptors and hypothalamic-pituitary-adrenal responses to stress”