

The Neurobiology of Memory

KHC NE 101

Spring 2013

Tuesdays/Thursdays 11-12:30pm; Lab Mondays 9-12pm; Behavioral testing
Mondays/Tuesdays/Wednesdays/Thursdays/Fridays 1-2pm

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Course Description & Objectives

This course is designed to immerse you in the process of scientific endeavor by conducting an experiment in the field of behavioral neuroscience – from conception to publication. All students will have an opportunity to conduct behavioral testing, neurosurgery, and histological analysis of brains. Students are expected to lead and participate in weekly journal discussions, and to prepare a scientific manuscript. Generally, the course will focus on a systems-level approach to the neurobiology of memory, and in particular on the role of the hippocampal memory system. Because of the emphasis on scientific process, we will focus on topics most germane to our experiment. Therefore, this course is not intended as a comprehensive survey of systems-level neuroscience, nor learning and memory. For those who are interested, a comprehensive survey of learning and memory is offered through NE 337 (Memory Systems).

Course Format

The course will include instructor-led lecture/discussion, laboratory preparation and discussion, and student-led discussion. Each laboratory pair will be required to lead discussion and present during the semester. Students will be required to conduct experiments using live laboratory rats, including behavioral testing, surgery, and histological analysis of brain tissues.

Required Texts

Eichenbaum, H (2002). The Cognitive Neuroscience of Memory. Oxford University Press
Various supplemental articles (reviews and primary research) will be required for class discussions, and to prepare your final paper. I will make these articles available at least one week before discussion.

This course will rely heavily on Blackboard: <http://blackboard.bu.edu>

Laboratory Partners

Choose your partners well, you will work with them throughout the semester. You will test your animals, operate on your animals, conduct histological analysis and present at journal clubs with your partners. Consult sign-up times before choosing a partner, and make sure you have schedules that allow you to work together. Both partners must be present at all procedures, and testing the animals – AT ALL TIMES. However, if you are not sure you want to conduct the surgery (etc.) yourself, you may wish to find a partner that is sure they do (and vice-versa). I will not perform the procedures for you (with the exception of perfusions).

BEHAVIORAL TESTING

During the weeks of behavioral testing, and slicing & mounting, you must be able to attend that same slot M-F. Testing will often be less than 1 hour, but must be conducted 5 days per week.

GRADING

The primary responsibility in this laboratory class is to the rats. Any student that mistreats animals, or does not fulfill the obligations of training and testing will not receive a passing grade. Further, any mistreatment of animals or failure to fulfill obligations to the animals will lead to automatic failing grade in the class. Grades will be computed from 300 points as follows:

(100 pts.) Participation: I am giving you 100 points for free for showing up, preparing for class, taking care of your animals, and posting regularly on blackboard.

Mistreatment of rats, or failure to fulfill the obligations of training and testing will result in a 0 participation grade. Obligations of training and testing include being present at all enrolled testing and procedure sessions. You MUST arrange for the care of your animals except under the most extenuating circumstances (i.e., you are in a coma).

This course will rely heavily on discussion, so you are expected to contribute. Discussion and questions make for a lively and interesting class. They are heartily welcomed and encouraged. Although you will not be 'graded' directly on discussion, class participation may affect your final grade. Borderline grades especially can be raised by class participation (active participants will receive as much as 10 points added to their grade – you can earn more than 100 points!). If you are shy about speaking in class, come discuss the lectures with me during office hours. Students are also expected to prepare for the journal club presentation. This will not be graded, although presentations of superior quality may result in an extra 5 points.

To ensure preparation for discussions, students will need to post a Discussion Preparation for each Journal Club. Discussion Preps should be posted to blackboard (there will be a specific Discussion Board for each) by 8pm the night before the Journal Club in question. Please feel free to comment on others preps! The preparation will include 3 parts (I will give you an example before the first journal club) 1) Questions, comments, thoughts; 2) A brief description of the methodology (if a primary paper) or a summary of a review; 3) A description of the most important or interesting point/finding, and why you think it is important or interesting. You will get 1 free pass for not preparing for the journal club. Obviously, presenters will not be expected to turn in the Discussion Preparation.

Failure to participate in peer review, either by not turning in a paper to be reviewed, or by failing to complete a review of peer papers will result in a loss of 10 points from your participation grade for each instance.

(100 pts.) Mid-Term take-home exam: Essay exam, with questions related to topics covered in the class, including materials presented in lectures, discussions, and labs, as well as methodological issues discussed in the course. The exam is open-book, but not open-neighbor. All answers must be well-written, and answers will be returned for rewriting if they are not clear. Note: this exam will essentially be a long version of your journal paper introduction.

(100pts.) Scientific journal paper: You will be required to write a scientific paper describing the experiment conducted in this course, that is (in principle) ready for submission to the Journal of Neuroscience. This paper is due on May 6th, and we will discuss preparation of this manuscript throughout the course. Go to the website www.jneurosci.org and look at the instructions for authors. You will be expected to follow the guidelines, including word counts, formats and citation.

HINTS FOR GOOD SUCCESS: Come to class prepared. Read, and THINK ABOUT the assigned material before class, and be prepared to discuss the materials or answer questions. Show up to procedures early, with a full stomach, empty bladder and appropriate clothing.

If you miss a class, get the notes from a fellow classmate, and come to office hours to clarify anything you do not understand.

If you are having trouble in class, come to office hours or make an appointment. But don't wait until the last minute, come in early, and come in often! If you are having trouble, participation in office hours can only help your grade. I am always happy to read drafts of written material before submission. The earlier I get a draft, the more attention it will receive.

REPRODUCTION OF LECTURES: I do NOT give blanket permission to reproduce my lectures or discussions in any way. This includes (but is not limited to) verbatim recording of lectures and public posting of notes on the Internet. If you wish to record or post lectures or discussions, you must first obtain my permission. Sharing personal lecture notes and ideas with fellow students enrolled in the class is allowed (and highly encouraged).

Academic Integrity

Cheating and plagiarism will NOT be tolerated. Any work turned in that is not your own will not be counted toward your grade (in other words, you will get a zero). Please consult the Academic Conduct Code

<http://www.bu.edu/academics/resources/academic-conduct-code/>. You will be expected to document the ideas and interpretation of others in any written communication. If you are unsure how to do this, or how to appropriately paraphrase, make an appointment with me as early as possible. Because we are using live vertebrate animals, failure to meet your obligations to the animals (including, but not limited to: mistreatment, neglect, or failure to train or test the animals, or fabrication or alteration of data) will be considered a violation of the Academic Conduct Code, and will be dealt with severely.

Class Schedule

Note: this is a real experiment, therefore unforeseen circumstances may alter the timing of some activities. I will try to keep changes to a minimum, and to anticipate changes in as far in advance as possible.

Journal clubs with a full citation will be posted on Blackboard.

		Lecture/Discussion (11-12:30p TR)	Journal Club Topic (during lecture/discussion)	Monday Lab 9-12p & 1-2p MTWRF
Week 1	Thur 1/17	Orientation: Expectations; Responsibilities; Overview of Experiment; Hands-on design activity		
Week 2	Tues 1/22	The catastrophe of memory E: 1,4		
	Thur 1/24	The ethics and responsibilities of animal research	Lab partner and journal club sign up	
Week 3	Tues 1/29	Experimental Design		Jan 28 Surgery and Perfusion Demonstration
	Thur 1/31	Anatomy of the rat olfactory memory system; Citation/Scientific Reading and Writing; Literature Search	1. O'Keef & Dystrovsky (1971)	
Week 4	Tues 2/5	Cognitive Basis of Memory E: 5,6	2. Morris et al. (1982)	Feb 4 Meet your rats/handling techniques; Experimental techniques (Morris Water Maze; Open Field; Elevated Plus Maze; Novel Objects Exploration)
	Thur 2/7	Submit experimental proposals/abstracts 3. Eichenbaum, Stewart and Morris (1990). Hippocampal Cellular Basis of Memory E: 2,3	4. Wood ER, Dudchenko PA, Robitsek RJ, Eichenbaum H (2000). Hippocampal neurons encode information about different types of memory episodes occurring in the same location. <i>Neuron</i> , 27:623-633.	
Week 5	Tues 2/12	Cerebral cortex and memory E: 7	5. Clark RE, Broadbent NJ, Squire LR (2007). The hippocampus and spatial memory: Findings with a novel modification of the water maze. <i>The Journal of Neuroscience</i> , 10(11):3531-3542.	Feb 11 Practice Surgery; Animal handling during daily hour blocks
	Thur 2/14	Multiple memory systems E: 8	6. TBD	
Week 6	Tues 2/19	Systems approach E: 9	7. Knowlton, BJ, Mangels JA, Squire LR (1996). A Neostriatal Habit Learning System in Humans. <i>Science</i> . Vol. 273, pp. 1399-1402.	Feb 20 Survival Surgery I Groups 1-4
	Thur 2/21	7. Knowlton, BJ, Mangels JA, Squire LR (1996). A Neostriatal Non-declarative memory E: 10	8. Broadbent NJ, Squire LR, Clark RE (2007). Rats depend on habit memory for discrimination learning and retention. <i>Learning and Memory</i> , 14(3):145-151.	Feb 25 Survival Surgery II Groups 5-8
Week 7	Tues 2/26	Emotional memory E: 11	9. Hollup SA, Kjelstrup KG, Hoff J, Moser M-B, Moser EI (2001). Impaired recognition of the goal location during spatial navigation in rats with hippocampal lesions. <i>The Journal of Neuroscience</i> , 21(12):4505-4512.	
	Thur 2/28	Consolidation E: 12	10. Clark RE, Broadbent NJ, Squire LR (2005). Hippocampus and remote spatial memory in rats. <i>Hippocampus</i> , 15: 260-272.	Mar 4 No Monday lab this week; (1) Animal testing during daily hour blocks
Week 8	Tues 3/5	Working Memory E: 13	11. Clark RE, Broadbent NJ, Squire LR (2005). Impaired remote spatial memory after hippocampal lesions despite extensive training beginning early in life. <i>Hippocampus</i> , 15:340-346.	
	Thur 3/7	Take-Home Midterm Due		
Spring Break 3/11-3/15				
Week 9	Tues 3/19	Introductions returned; Writing Methods and Results sections of your final paper	12. Broadbent NJ, Squire LR, Clark RE (2006) Reversible hippocampal lesions disrupt water maze performance during both recent and remote memory tests. <i>Learning and Memory</i> , 13:187-191.	Mar 18 No Monday lab this week; (2) Animal testing during daily hour blocks
	Thur 3/21	Methods section due for Peer Review	13. Save E, Poucet B (2000) Involvement of the hippocampus and associative parietal cortex in the use of proximal and distal landmarks for navigation. <i>Behavioural Brain Research</i> , 109:195-206.	
Week 10	Thur 3/28	14. Fornix vs. Hippocampal Lesions TBD	15. Corkin S (2002). What's new with the amnesic patient	Mar 25 No Monday lab this week; (3) Animal testing during daily hour blocks
	Thur 3/28	Journal Club	16. TBD	Apr 1 No Monday lab this week; (4) Animal testing during daily hour blocks
Week 11	Thur 4/4	Putting it all together; Interpreting and writing results		
	Thur 4/4	Presenting Behavioral Results; Discussion of and writing results		
Week 12	Tues 4/9	Presentation of Results; Behavioral Results due for Peer Review		Apr 8 Perfusions
	Thur 4/11	Peer Reviewed Results returned; Writing a conclusion		
Week 13	Tues 4/16	Journal Club	17. TBD	Apr 18 Slicing and Mounting; Staining and Interpreting what you see in the 'scope'; Staining during daily hour blocks
	Tues 4/23	Presentations		Apr 22 Tissue & Data Analysis
Week 14	Thur 4/25	Full Results Due; Discussion/Conclusion section due for Peer Review; Presentations		
	Tues 4/30	Presentations		Apr 29 No lab this week
Week 15	Thur 5/2	Peer Reviewed Discussion/Conclusion section returned; Presentations		

Final Paper Due by May 6