Psychology/Neuroscience 4740.03F  
(Also Psych./Neuro/ 6071.03. Physiological Psychology)

Topics in the Neurobiology of Learning and Memory  
Wednesday 3:30 - 5:30, Via internet (Psychology)

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The first class of Psych/Neuro 4740 [Neurobiology of Learning and Memory] is on Wednesday 9 September 2020.

Tentative Course Outline  
[Things always change]

The tentative course outline is given below. This will probably change during the course of the class. The class is in a seminar format with students giving 3 or 4 presentations and writing a paper. Grades are based on the essay (50%); best 2 presentations (40%), and class participation (10%).

Class 1. Wed. 9 September 2020. Course outline and historical overview of research on the neurobiology of learning and memory. The Neurobiology of Learning and Memory before Hebb (1949).


8-14 November is the stupid Fall break.


Class 12.  2 Dec 2020. The epigenetic basis of learning and memory: how epigenetic changes direct gene activation and new protein synthesis.

[End of class wine and cheese party.] [Final draft of essay due]

What should you read for class 1???

I realize that I sent you a ton of stuff.

Here are seven papers and some notes on why they are important for the class:


[This paper covers the whole of the class, so acts as an outline for the class, even if it is 20 years old.]


[This a short over-view of Hebb's theory. In my mind, there is Hebb and then a bunch of idiots.]


[These are the big boys of rock and roll. They all got together to discuss the problems in the neurobiology of memory that need to be solved. Too bad they used the term engram.]


[This is a relatively new overview of the neurobiology of learning and memory.]
[I believe that these guys are on the right track--they think like we do.]

[I wrote this paper so it must be right, ha ha.]

[This is the latest paper from the world of engrams.]

Why do we (I) dislike the term "engram". A long and complex story, starting in about 1919. A topic for discussion.

4740 Course Introduction

This seminar will examine current research in the study of the neurobiology of learning and memory through presentations and discussions of journal articles. Each class will (usually) consist of one review paper and two research papers. Everyone will read the review paper and two students per class will present the research papers on each topic and direct the class in the discussion. Each student will give three or four presentations with grades for the best two counted (20 marks each). One mark per class will be awarded for class participation (Max = 10). The essay will be a critical enquiry into one of the topics covered in the class or another topic approved by the professor and end with a short research proposal. The essay should be based primarily on articles from recent journals such as Learning and Memory, Neurobiology of Learning and Memory, Behavioral Neuroscience, Trends in Neuroscience, Nature Neuroscience, Cell, Neuron, etc. Possible essay/discussion questions are listed for each class.

The grades (100 marks) will be based on the best 2 of 3 or 4 presentations (40%), class participation (10%) and on one essay (50%). Class participation is an important part of the seminar and will count for 10% of the final grade. This can make a difference of one grade, so if you never participate, you do not get the 10 points.

Grades are assessed on the following scale:

80/85/90% = A-, A, A+; 70/73/77 = B-, B, B+; 60/65% = C, C+; 55-59% = C-;
50-54% = D. Below 50% = F.
**Suggested background reading:**


**Presentations (20 marks):** The purpose of the presentations is to describe the results of a research paper. What did the research do? Why was it done and how did it influence the field? I would expect a short introduction to the research done, a description of the experimental design, methods and results and a discussion of the meaning of the results and a critique of the results. It may be necessary to use textbooks or other papers to explain some of the concepts and methods used. The presentation should be 40 minutes.

- **F** Student does not give a presentation. (0 marks)
- **D** A presentation which indicates that the student has not done adequate preparation. (10-11 marks)
- **C** A presentation that covers the bare minimum and/or does not have suitable overheads. (12 marks)
- **C+** A presentation which describes the research but has some gaps in understanding and/or poor use of overheads. (13 marks)
- **B-** A presentation that describes the paper with acceptable overheads. (14 Marks)
- **B** A good well-animated presentation which covers the research with carefully selected overheads. (15 marks)
- **B+** Supplements the basic description with extra background material, extra questions or overheads and develops own ideas. (16 marks)
- **A-** Describes the research and develops some of the problems associated with the research. Animated presentations, not read, a good introduction and summary. (17 marks)
A  Delves into the problem being presented. (18 marks)
A+  Adds own material above and beyond the research paper, ties the research to other issues and gives a performance which grabs our attention. (19-20 marks)

Essay (50 marks): (1 mark per day deducted from late papers)

F  No paper submitted. Paper written so poorly that I am annoyed beyond belief. (0-24 marks)
D  Minimal effort. Uses only a textbook as a reference. Little effort to give a complete answer. Answer contains errors. (25-27 marks)
C  Covers bare essentials. Uses only textbooks. Answer not up-to-date. Lacks adequate figures and tables. (28-30 marks)
C+  Textbook answer. Does not integrate figures, tables and text. Reads like a list of facts. (31-33 marks)
B-  Good textbook answer. Covers the question and shows that you understand the material. Uses extra references. (34-35 marks)
B  Good textbook answer- with additional integration of tables & figures. (36-37 marks)
B+  Good textbook answer- with additional integration of tables, figures, and new references. (38-39 marks)
A-  Adds extra material. Gives your own opinion. Goes beyond a textbook answer to ask new questions. Uses figures and drawings (40-43 marks)
A  Well-integrated up-to-date answer which points out problems or confusion or contradiction in the standard textbook answer. (44-47 marks)
A+  Up-to-date answer which develops question in a new and insightful way, integrating material from other disciplines to shed new light on the question. Develops your own theory. (48-50 marks)

Suggested outline of essay

Title page: title, author etc.
Abstract
1. What is the question you want to answer? Why is it important?
2. What is the history of this question? Who first proposed it?
3. What is the theory behind this question?
4. What is the key paper/theory in this research? What did they find? What methods did they use?
5. What are the criticisms of this paper/theory? What methods were used to produce these criticisms?
6. Is there a controversy? Does person A answer the question one way and person B answer it another way?
7. Is there both animal and human research on this question? Species differences (rat vs mouse vs monkey)?
8. What do you think is the answer? Why? What is the evidence?
9. Research Proposal: What experiments would you do to show (1) that your ideas are correct and (2) to further the research on this question?

10. Summary and conclusions.

11. References.

12. Tables and Figures (Can also be embedded in the text).

Some examples of essay topics: Any of the seminar topics plus:

1. What is the role of the amygdala in learning?
2. What is the role of the hippocampus in learning?
3. What is the neurobiological evidence for multiple memory theory?
4. What neural networks underlie learning?
5. What is the neural basis of learning in honey bees?
6. How do cholinergic drugs influence learning and memory?
7. What is the neural basis of cognitive decline in Alzheimer's Disease?
8. What is the role of GAP43 in learning and memory?
9. What genes influence learning and memory?
10. What is the best biochemical theory of memory formation?
11. Can the same neurobiological mechanism account for short-term and long-term memory?
12. How does estrogen influence learning and memory?
13. Does learning in the endocrine and immune systems follow the same rules as learning in the CNS?
14. Why do Hebb's theories continue to influence the neurobiology of learning and memory?
15. Discuss the neurobiology of learning and memory in fish.
17. What is the genetic theory of learning and memory?
18. Develop a neurobiological model of one type of learning (fear learning, reward learning, Pavlovian conditioning, etc).
19. What is the involvement of the cerebellum in learning and memory?
20. What drugs enhance/inhibit learning and memory?

Tips on writing a paper:

Many students spend hours working on an assignment and then get a low grade because they cannot write a good paper. Well written papers get good grades and it is not difficult to write one. All you need is persistence and a willingness to follow a few rules. Seven rules are:

1. Your report must answer the question. This is not as silly as it sounds. Many papers fail to answer the question posed. The question is "How does X influence learning and memory?" Use the suggested outline to answer this question. A good paper summarizes each point and then gives a summary.
2. Your report must be founded on data. To put it simply, you must know what you are talking about. You must be able to support every statement by showing the facts you used. You must cite all the work you reference in the text (eg., the sky is blue (Smith, 1987)) and put the full reference citation (author, year, title, journal or book, volume, pages, APA style) in the reference list at the end of the paper. (Use the American Psychological Association, Publication Manual, 4th edition, 1994)

3. Your report should be about 20 pages long (5000 words). Use 1.5 or 2 line spacing.

4. Write proper English. Spelling and grammar count. Check your spelling and typing. Pay attention to word usage, sentence structure and punctuation. Omit needless words. Delete unnecessary adjectives and adverbs. Don't write "We must examine carefully...", just say "We must examine...". Ensure that your sentences are not too long. Do not write unnecessarily complex sentences. Remember that "What causal instigators do you envision giving rise to such above-mentioned consequences?" simply means "Why do you think it will happen?". Use a dictionary. Buy a copy of W. Strunk, Jr. and E.B. White The elements of style. (71 pages) and use it.

5. Make the paper interesting to read. Tell a story; don't give me a grocery list of facts. Use varied sentence structure. Don't be boring and repetitious.

6. Your report must have figures and/or tables. A figure may be a diagram, graph, line drawing, photograph, or chart. A table is a series of columns of numbers. There are two purposes of using figures and tables in your paper: to reinforce your message and to explain a particular point that you wish to make. Apparatus is more easily described in a figure than in words, as are trends in data, brain structures, and interactions. Flow charts and comparisons/contrasts can also be put into tables.

Figures and tables are not merely something to be stapled to the back of your report. They are an integral part of the whole and must be referred to in the text. You might find it easier to make your figures and tables first and write your paper after. It is easy to write a lot about something you do not understand but it is difficult to draw figures or tables without understanding your subject. Your task is to communicate information concisely and accurately. The use of graphs, figures and tables can show the apparatus, methods, data and conclusions more rapidly than pages of explanation.

7. Rewrite it. Do not hand me a first draft. Write your paper, then ask a friend to read it with a red pen in their hand, to correct any errors and point out poor writing. Then rewrite it. Then read it yourself and see if you can understand it. Then rewrite it. Then give me the third draft. There will be two opportunities to hand in partial papers for my comments.

8. Research Proposal. End with an idea for future research and suggest an experiment to test your idea.