

Psychology 413: Research in Physiological Psychology  
Lecture/Discussion (123 Millington): TR 9:30-10:50 p.m.  
Laboratory (123 & 10 Millington): T 2:00-3:20 p.m.

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### **Course Description**

Welcome to Research in Physiological Psychology! I truly hope you will enjoy this course and develop an understanding of some of the experimental paradigms and techniques used in this area of research. Studying the relationships between brain and behavior remains one of the greatest challenges to today's researchers. At the end of the semester, I think (hope) you will appreciate the complexity and challenges of the questions being asked and the experiments being conducted in behavioral neuroscience.

### **Readings**

We will be reading primary and review journal articles. Please read the articles by the date on the schedule. All articles are available on the course website (through blackboard).

### **Exams**

There will be three exams in this course. The first two exams will only cover material since the previous exam. The final will be 50% material since exam 2 and 50% cumulative. The exams will consist of multiple choice and short answer questions (in some cases, requiring identification of brain regions). The percentage of your final grade that is determined by each exam is listed below. Please make every effort to contact me prior to an exam if you need to take a make-up exam. There will not be a make-up exam for the final.

### **Research Project**

During the semester, you will participate in one group experiment. Details of the requirements of the project are outlined in more detail below. The assignments related to your research project will count for 50% of your final grade.

### **Grading**

Exam 1 & Exam 2	15% each
Final Exam	20%
Final Research Project	50%

(Proposal 5%, Experiment Participation 15%, Final presentation 5%, Final Paper 25%)

I will use the following to guide the distribution of grades: 90-100 A range, 80-89 B range, 70-79 C range, 60-69 D range, below 60 F. If warranted, I will consider adjusting the final grade scale (this can only work to your advantage).

### **Disabilities**

Please contact me immediately if you have any disabilities or special needs for this course. I will do my best to accommodate you.

### **Course Schedule**

Aug 25	Introduction/Animal Ethics
Aug 30	Functional Neuroanatomy; <b>1-3</b>
<b>Aug 30</b>	<b>Biopac Demo</b>
Sep 1	Functional Neuroanatomy/Review Lab
Sep 6	Neuroanatomical Techniques; <b>4-6</b>
<b>Sep 6</b>	<b>Sheep Brain Dissection</b>
Sep 8	Applying Neuroscience Techniques to Questions Related to Psychology
Sep 13	Basics of Psychopharmacology
<b>Sep 13</b>	<b>Sectioning and Mounting Tissue</b>
Sep 15	Basics of Psychopharmacology; <b>7,8</b>
Sep 20	Animal Models/Alzheimer's Disease; <b>9,10</b> ; <b><u>Preliminary Proposals due</u></b>
<b>Sep 20</b>	<b>Staining and Coverslipping</b>
Sep 22	Animal Models/Alzheimer's Disease; <b>9,10</b>
<b>Sep 27</b>	<b><u>Exam 1</u></b>
<b>Sep 27</b>	<b>Group Projects (from this point on, you will meet on your own schedule to conduct experiments - we will not necessarily meet at the scheduled laboratory time)</b>
Sep 29	Overview of Lesion Surgery/Interpreting lesion studies; <b>11,12</b>
Oct 4	Prefrontal cortex and executive functions
Oct 6	Hippocampus: Amnesia/LTP; <b>13-16</b>
Oct 11	Fall Break!
Oct 13	Hippocampus: Amnesia/LTP
Oct 18	Techniques in psychophysiology; <b>17,18</b>

Oct 20 Lie detection/Fear & Anxiety/Stress; **19,20**

Oct 25 Lie detection/Fear & Anxiety/Stress

Oct 27 Electrophysiology; **21**

Nov 1 Review & Discuss Group Projects

**Nov 3 Exam 2**

Nov 8 Imaging/Cognitive Neuroscience; **22,23**

Nov 10 Imaging/Cognitive Neuroscience

Nov 15 Genetics & Neuroscience; **24, 25**

Nov 17 Genetics & Neuroscience

Nov 22 Development & Plasticity

Nov 24 Thanksgiving!

Nov 29 Finish lecture/prepare for presentations

Dec 1 Group Presentations

**Friday, Dec 9 8:30-11:30 a.m. Final Exam**

### *Reading List*

- 1) Zutphen SFM, van der Valk JBF (2001) Developments on the implementation of the three R's in research and education. *Toxicology in Vitro*, 15, 591-595.
- 2) Oswald S (2000) Ground plan of the nervous system II: levels of the neuraxis. In *Functional Neuroscience*, Springer: New York. pp. 25-49.
- 3) Kolb B (1990) Organization of the neocortex in the rat. In, *Cerebral Cortex of the Rat* (Kolb B, Tees RC, eds.). The MIT Press: Cambridge, Massachusetts. pp. 21-33.
- 4) Vann SD, Brown MW, Aggleton JP (2000) Fos expression in the rostral thalamic nuclei and associated cortical regions in response to different spatial memory tests. *Neuroscience*, 101, 983-991.
- 5) Burk JA, Sarter M (2001) Dissociation between the attentional functions mediated via basal forebrain cholinergic and GABAergic neurons. *Neuroscience*, 105, 899-909.
- 6) Friedman HR, Goldman-Rakic PS (1988) Activation of the hippocampus and dentate gyrus by working-memory: a 2-deoxyglucose study of behaving rhesus monkeys. *Journal of Neuroscience*, 8, 4693-4706.
- 7) Herremans AHJ, Hijzen TH, Olivier B, Slangen JL (1995) Cholinergic drug effects on a delayed conditional discrimination task in the rat. *Behavioral Neuroscience*, 109, 426-435.
- 8) Andersen JM, Lindberg V, Myhrer T (2002) Effects of scopolamine and D-cycloserine on non-spatial reference memory in rats. *Behavioural Brain Research*, 129, 211-216.
- 9) Willner P (1991) Methods of assessing validity of animal models of human psychopathology. In Boulton A, Baker GB, Martin-Iverson MT (eds) *Animal models of psychiatry I*. Humana Press: Clifton, NJ, pp. 1-23.
- 10) Whitehouse P, et al. (1982) Alzheimer's disease and senile dementia: loss of neurons in the basal forebrain. *Science*, 215, 1237-1239.
- 11) Jarrard LE (1991) Use of ibotenic acid to selectively lesion brain structures. *Methods in Neuroscience*, 7, 58-69.
- 12) Wiley RG (1992) Neural lesioning with ribosome-inactivating proteins: suicide transport and immunolesioning. *TINS*, 15, 285-290.
- 13) Eichenbaum H (1995) The LTP-memory connection. *Nature*, 378, 131.
- 14) Gustafsson B, Wigstrom H (1988) Physiological mechanisms underlying long-term potentiation. *TINS*, 11, 156-162.
- 15) Squire LR (1986) Mechanisms of memory. *Science*, 232, 1612-1619.
- 16) Milner B, Corkin S, Teuber H-L (1968) Further analysis of the hippocampal amnesic syndrome: 14-year follow-up study of H.M. *Neuropsychologia*, 6, 215-234.
- 17) Kogan EA, Korczyn AD, Virchovsky RG, Klimovizky SS, Treves TA, Neufeld MY (2001) EEG changes during long-term treatment with donepezil in Alzheimer's disease patients. *Journal of Neural Transmission*, 108, 1167-1173.
- 18) Renaud P, Blondin J-P (1997) The stress of Stroop performance: physiological and emotional responses to color-word interference, task pacing, and pacing speed. *International Journal of Psychophysiology*, 27, 87-97.
- 19) Lang PJ, Davis M, Ohman A (2000) Fear and anxiety: animal models and human cognitive psychophysiology. *Journal of Affective Disorders*, 61, 137-159.
- 20) Dawson GR, Tricklebank MD (1995) Use of the elevated plus maze in the search for novel anxiolytic agents. *Trends in Pharmacological Sciences*, 16, 33-36.

- 21) Buszáki G (2004) Large-scale recording of neuronal ensembles. *Nature Neuroscience*, 7, 446-451.
- 22) Desmond JE, Chen SHA (2002) Ethical issues in the clinical application of fMRI: factors affecting the validity and interpretation of findings. *Brain and Cognition*, 50, 482-497.
- 23) Sarter M, Berntson GG, Cacioppo JT (1996) Brain imaging and cognitive neuroscience: toward strong inference in attributing function to structure. *American Psychologist*, 51, 13-21.
- 24) Mirnics K, Pevsner J (2004) Progress in the use of microarray technology to study the neurobiology of disease. *Nature Neuroscience*, 7, 434-439.
- 25) Price DL, Wong PC, Markowska AL, Lee MK, Thinakaran G, Cleveland DW, Sisodia SS, Borchelt DR (2000) The value of transgenic models for the study of neurodegenerative diseases. *Annals of the New York Academy of Sciences*, 920, 179-191.

## Research Project Assignments

There will be three assignments associated with the research project.

(1) Preliminary Proposal: The proposal should be ~ 2-3 pages long. Although you will be working on the projects together, each proposal should be written individually. The proposal should describe the proposed project. In the process of describing the project, the proposal should indicate the rationale, hypotheses, any potential anticipated problems and how those problems will be dealt with. A few journal articles may be helpful in developing the proposal, but I do not expect an extensive literature search. The proposal is due on **September 20**.

(2) Each group will give a final presentation, summarizing the results of the experiment, on **December 1**. The presentation should include an introduction, overview of the methods, results, and conclusions based on the group experiment. The presentations will be approximately 20-25 minutes.

(3) Final research paper: The final research paper should include an introduction, methods, results, and a discussion section. All members of the group may submit the same methods and results section, but the introduction and discussion should be written individually. **The final research paper is also due on December 1.**

## **Class Project: PSY 413**

During the semester, you will participate in one group experiment. The number of students in each group will be determined early in the semester. This sheet describes the parameters for the experiments. Below, the types of experiments are separated based on the participants/subjects you choose.

### **Human Participants**

Dependent measures: EEG, reaction time, & galvanic skin response, but these have to be done within the modules for the biopac system. If your group is interested, I will describe the modules in more detail.

Possible manipulations:

- ask students drink a coke or water before taking measurements
- ask students perform one of the following tasks: Stroop task, working memory task (briefly remember numbers, or letters). There might be other tasks we can talk about, depending on group interests.

### **Animal Subjects: Rats**

Each group will be given at most 12 rats. You can choose from among the following:

- Lesions: Radiofrequency lesions of the dorsal hippocampus or prefrontal cortex (I will do the lesions).
- Pharmacology: you can choose to inject the animals with scopolamine (muscarinic receptor antagonist), nicotine, or alcohol. Rats cannot receive more than three injections.
- Behavior: open field, spatial memory (radial arm maze), or anxiety (elevated plus maze).