

Cognition and Memory

Psychology 490, Fall 2003, Tuesday/Thursday 12:00pm – 1:15pm

Instructor: Bill Griesar, Ph.D. (bgriesar@pacifier.com)

Office hours: Any time by e-mail, on exam “review” days, or by arrangement

Book: *The Cognitive Neuroscience of Memory*, by Howard Eichenbaum

Objectives: The primary objectives of this course are to:

- (1) Teach you about the fundamental organization of the brain and
- (2) Provide you with an understanding of how the nervous system stores and retrieves memory, and of the research that supports these conclusions.

The lectures will mirror the organization of the textbook by presenting the neuroscience of memory in four discrete sections: (1) **Connection:** how memory is inherent in the structure of neural networks, and depends on changes in how neurons communicate; (2) **Cognition:** some psychological theories of memory, and its various forms; (3) **Compartmentalization:** how different forms of memory rely on separate networks of brain regions; and (4) **Consolidation:** the transfer of short term memories into a more long term store.

Grades: Grades will be based on a 90% = A, 80% = B, 70% = C, and 60% = D scale.

Course points (which will total 100) are accumulated in the following ways:

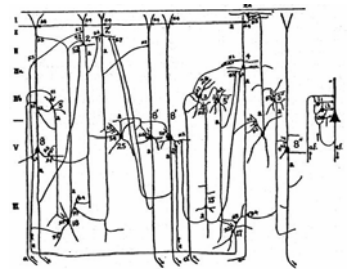
1. **“Connection” Exam (20):** From material covered in lectures, and from the book.
2. **Midterm Exam (30):** From material covered in lectures, and from the book.
3. **Final Exam (40):** From material covered in lectures, and from the book.

4. **Probe questions and quizzes (10):** Occasional questions and quizzes will focus on the material covered in the previous week's lecture, *so go over your notes* from that lecture (and do the reading for the current lecture!) *before* each class.
5. **Extra Credit (varies):** Take home questions, extra questions on exams, etc.

CLASSES:

Introduction

1. **Introduction to the class (8/26):** student introductions, overview of course syllabus, brief history of brain and memory research - and *what is memory?*
 - READ CHAPTER 1 (Introduction)
2. **The nervous system (8/28):** basic introduction to the nervous system, localization versus "globalism" of complex cognitive functions in the brain



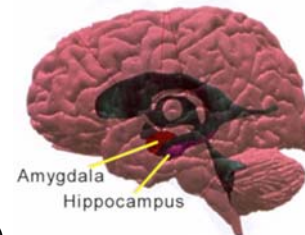
Connection

- READ CHAPTER 2 (Neurons and simple memory circuits)
3. **The neuron (9/2):** basic properties of cells, the "central dogma" of biology (transcription, translation), neuronal and glial cell structure and function
 4. **How neurons carry information (9/4):** electrical properties of neurons, the resting potential and action potential, and the role of myelin
 5. **How neurons share information (9/9):** structure/function of the *synapse*, chemical neurotransmission, receptors (ionotropic versus metabotropic)
 6. **More on the synapse (9/11):**) Review, and video ("Secret Life of the Brain")

7. **The neural network** (9/16): how networks of neurons encode complex behaviors, examples of simple networks
8. **How neural networks store information** (9/18): habituation, sensitization, long-lasting memories require *plasticity* - and changes in protein synthesis
 - READ CHAPTER 3 (Cellular mechanisms of memory)
9. **Plasticity and LTP** (9/23): Hebbian assemblies, introduction to the *hippocampus*, long term potentiation (LTP), long term depression (LTD), what causes LTP?
10. **LTP and memory** (9/25): does LTP underlie memory?, behavioral LTP, can we “build” a mouse with better memory by manipulating the mechanism of LTP?
11. **Connection Exam Review Day** (9/30): Bring questions!!
12. **CONNECTION EXAM** (10/2)

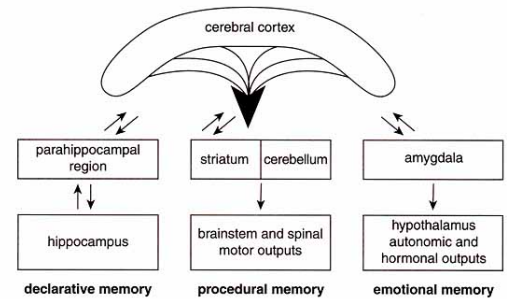
Cognition

- READ CHAPTERS 4 and 5 (Amnesia, Animal models)
13. **Lessons from amnesia** (10/7): is there a cognitive basis for memory?, patient “H.M.” and amnesia, priming, types of memory (procedural vs. declarative memory, explicit vs. implicit, episodic vs. semantic)
 14. **Animal models of memory** (10/9): animal models of amnesia, memory tasks (DNMS, Morris water maze, radial arm maze) and results, the hippocampus: spatial mapping versus “Relational Memory” theory
 - READ CHAPTER 6 (Windows into the workings of memory)
 15. **Imaging memory function in humans** (10/14): significance of functional magnetic resonance imaging (fMRI), verbal versus non – verbal memory
 16. **More on imaging memory function in humans** (10/16): medial temporal lobe and the “memory space,” single cell recording and hippocampal “place” cells



17. **Midterm Exam Review Day (10/21):** Bring questions!!

18. **MIDTERM EXAM (10/23)**



Compartmentalization

- READ CHAPTERS 7 (Cortex and memory)

19. **Brain network for declarative memory (10/28):** where is declarative memory?, the importance of the neocortex and its network architecture

- READ CHAPTERS 8 & 9 (Multiple memory systems, declarative memory)

20. **Network for declarative memory continued (10/30):** functional significance of medial temporal lobe subregions (hippocampus, parahippocampal region)

- READ CHAPTER 10 (Brain system for procedural memory)

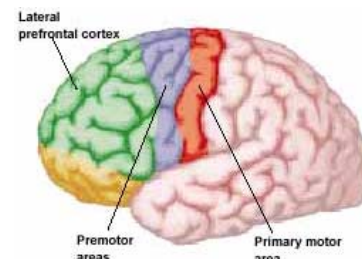
21. **Brain network for procedural memory (11/4):** Striatum, cerebellum

22. **Network for procedural memory continued (11/6):** striatum, cerebellum

- READ CHAPTER 11 (Brain system for emotional memory)

23. **Brain network for emotional memory (11/13):** limbic system, amygdala

24. **Network for emotional memory continued (11/18):** post-traumatic stress disorder (emotional memory disorder), and video (“Secret Life of the Brain”)



Consolidation

- READ CHAPTER 12 (Consolidation)

25. **Memory consolidation (11/20):** what is consolidation?, is memory consolidated?, short term versus long term consolidation, strong emotions strengthen memories

- READ CHAPTERS 13 (Working memory)
26. **Working memory** (12/2): importance of the pre-frontal cortex
 27. **Memory disorders** (12/4): Alzheimer's disease, Korsakoff's syndrome, Creutzfeldt-Jakob disease (including "mad cow" variant), and other dementias
 28. **Disorders continued** (12/9): video ("The Brain: Our Universe Within")
 29. **Final Exam Review** (12/11): **** Bring questions!!!!
 30. **FINAL EXAM** (12/16)



**Phillip's
Milk of Amnesia
for people
who can't
remember**