The Brain & Memory
UN3445 / Course Syllabus / Fall 2017
4 points

When / Where
Thursdays, 2:10-4pm, Schermerhorn Hall 405

Instructor
Dr. Mariam Aly [ ma3631@columbia.edu ]
Office hours: TBD, Schermerhorn Hall 355D

Prerequisites
UN1010 (Mind, Brain, & Behavior) or equivalent introductory course in neuroscience or cognitive psychology and instructor’s permission

Course description
This seminar will give a comprehensive overview of episodic memory research: what neuroimaging studies, patient studies, and animal models have taught us about how the brain creates, stores, and retrieves memories.

Detailed description of the course
In the first part of the class, we will examine the neural underpinnings of basic memory phenomena, such as encoding, storage, and retrieval. We will then delve into theories of memory and current debates in the field. Finally, we will discuss challenges to the traditional views of “memory systems” in the brain. The readings will comprise empirical papers (which report new experiments and their results) and review papers (which summarize and synthesize a large body of research). The goal of the seminar is to arrive at a deeper understanding of what we know about memory and what we are still struggling to understand.

Each week will be devoted to a different topic. Class will begin with a brief overview (by the instructor) of the topic for that week. Most of the class will comprise student presentations and discussion. Each student is responsible for one presentation on the topic of their choice. Each student must e-mail the instructor (as soon as possible after the first class) with their top three choices, and every effort will be made to give each student one of their preferences. Each student can either thoroughly present one paper or briefly present two papers. The papers can be from the required or supplementary readings (see comprehensive reading guide).

Course rationale
PSYC UN3445 is a seminar designed particularly for undergraduates majoring in Psychology or Neuroscience & Behavior and for students participating in the Psychology Post-Baccalaureate Certificate program. It fulfills the following degree requirements:

- For the Psychology major or concentration in Columbia College and in the School of General Studies, for the Psychology minor in Engineering, and for the Psychology Post-Baccalaureate Certificate program, this class will meet the Group II (Psychobiology & Neuroscience) distribution requirement.
- For the Neuroscience and Behavior joint major, it will fulfill the fifth Psychology requirement for “one advanced psychology seminar from a list approved by the Psychology Department advisor to the program.”
• For Psychology Post-Baccalaureate students and for Psychology majors who entered Columbia in Fall 2013 or later, it will fulfill the seminar requirement.
• For the Barnard Psychology major, this class will fulfill the senior seminar requirement.

Course goals and learning objectives
This course will give you training in reading primary research articles and review papers, the majority of what scientists read. Primary research articles and review papers are a much different reading experience than textbooks, and reading, dissecting, and critically thinking about them is a key skill for the developing scientist. This course will also enable you to engage in constructive scientific conversations and debates, which will broaden and deepen your understanding of cognitive neuroscience research, and teach you about which questions you should be asking as you read and hear about new results, and how to interpret them in the context of other studies. Furthermore, this course will enable you to learn how to effectively communicate, with both oral presentations and written work. You will learn how to review the literature and find relevant peer-reviewed papers, thus allowing you to keep up to date in any field of science. You will also gain a deep understanding of the links between different areas of episodic memory research, and gain an appreciation of the development of this research over several decades, challenges to this research, and the latest advancements.

Course schedule

Part 1: Discovering the neural underpinnings of memory
Week 2: Patient studies of episodic memory
Week 3: fMRI studies of episodic memory
Week 4: Do animals have episodic memory?
Week 5: Place cells: building blocks of memory?

Part 2: Formulating theories and debates
Week 6: Divisions of episodic memory
Week 7: Computations of the hippocampus
Week 8: Is the hippocampus fundamentally “spatial”?
Week 9: Organizing memories in time

Part 3: Challenges to the “memory systems” view
Week 10: The role of memory systems in perception
Week 11: The role of the hippocampus in imagination
Week 12: How the hippocampus influences, and is influenced by, attention
Week 13: Implicit memory in “declarative memory” systems

Grading
Seminars are meant to be engaging discussions. To participate in these discussions, you must carefully read the relevant papers before class and contribute to the conversation. Grading will be based on whether you have shown that you have read the papers, thought deeply about them, can write about them, and your contribution to class discussions.

Overview
25%: attendance and participation
25%: thought pieces
25%: class presentation, including mandatory meeting with the instructor
25%: final paper, including 1-paragraph overview 1 month prior to paper submission
**Attendance and Participation**

Everyone is expected to attend and participate in every class. Attendance will be taken at the beginning of each class, and each student should contribute at least once (but preferably more!) to each class discussion. If participating in class is difficult for you, please see me and we can discuss other ways that you can contribute. **Attendance and participation are worth 25% of your grade.**

**Thought Pieces**

To ensure that everyone reads the material, each student must submit a short (1 paragraph) ‘thought piece’ via Courseworks the evening before each class (no later than 6pm; thought pieces must also be handed in on the week that you present – these will be much easier for you!). The thought piece should describe something you found interesting in the readings (and why it was so interesting), or raise substantive questions about something you found confusing (and why it was so hard to understand). Specifically, you should briefly summarize a point from the readings (e.g., a specific result, a theoretical viewpoint, an analysis technique; this is worth 2 points), raise a question or an observation about it (this is worth 2 points), describe what led you to that question or observation (this is worth 2 points), and what new evidence could be useful for answering the question or supporting/contradicting the observation (this is worth 2 points). This allows me to make sure everyone is on track, and get a better handle on what might be challenging in the readings. Grading will be based on your ability to follow the instructions for the thought piece (as noted above), as well as the clarity of writing (2 points). **Thought pieces are worth 25% of your grade** (each thought piece is graded out of 10, as noted above).

**Class Presentation**

Each student is also expected to present for one class period: choose at least one paper assigned that week (from any listed, whether required or not) and make a slide presentation to lead the class through the paper(s). Depending on class size, there may have to be more than one presenter in any given week. If this happens, the instructor will contact the individuals presenting on the same day, and they should coordinate to make sure they present different papers. **Each student is required to meet with me before their presentation so that they can receive feedback and have time to incorporate edits before their class presentation. Doing so can substantially improve your grade, and not doing so will result in an automatic 5 point deduction from your presentation.**

If it is an empirical paper, describe the question (this is worth 5 points), the method (this is worth 10 points), the results (this is worth 10 points), the conclusions (this is worth 5 points), and then bring up points for discussion (this is worth 10 points). Don’t get bogged down by details in the methods, especially for neuroimaging studies: convey the critical parts of the method that we need to understand the paper.

If it is a review paper, describe the big question it attempts to answer (this is worth 5 points), the different theories it brings up (this is worth 10 points), the evidence for each (this is worth 10 points), the conclusions reached (this is worth 5 points), and then bring up points for discussion (this is worth 10 points).

Clarity of presentation (speaking and slides) is worth an additional 10 points.

Often, papers are much too comprehensive to go over in detail in a short presentation; you therefore must decide what the main points are and communicate those. If some sections in a paper are tangential to the main topic, feel free to skip them in your presentation. You can present one paper thoroughly, or two papers more briefly. You can bring in additional material as well (this is highly encouraged!). And remember: presentations are meant to be engaging, and you should try to involve your classmates as much as possible (e.g., by posing questions intermittently or asking for opinions regularly). Do your best to understand the background, main findings / arguments, and conclusions of
each paper — but it’s okay if you don’t understand everything. You can see me in office hours to discuss difficult points before your presentation. You can also bring up challenging aspects of the paper(s) in class, and we can discuss them together. But try your best to figure things out on your own first (you can always Google things you don’t know). Your class presentation is worth 25% of your grade (presentations are graded out of 50 points, as noted above).

**Final Paper**

At the end of the course, each student must submit a final paper (10-15 pages, double-spaced, excluding references) summarizing the topic that was of most interest to them in the class and raising new questions. What do we know now, and what do you think we still need to understand? You should feel free to bridge across topics discussed in different weeks. In your paper, you should be able to describe some findings that interested you (describing them in enough detail for a person to understand if they did not read the article you are talking about; this is worth 10 points), discuss the implications of those findings (this is worth 10 points), and raise problems with those findings and/or outstanding questions for future research (this is worth 10 points). You should then discuss ways of answering those outstanding questions, or specific experiments that could be conducted to test problematic aspects of prior work (this is worth 10 points). To do a good job on this, you must do research beyond the papers discussed in class: find new peer-reviewed articles that touch on the same topic (if you’re stuck, a good place to look is in the references of articles that you read, or use Google Scholar to find articles that cited your article). Because this paper is about a whole area of research, you should read several articles carefully, and make sure to cite them: the expectation is to read and cite at least 10 articles, no more than 5 of which can be articles from the course reading list. Clarity of writing is worth an additional 5 points, and reading/citing enough articles (at least 5 new ones) will be worth 5 points. Your final paper is worth 25% of your grade (papers are graded out of 50 points, as noted above). Your final paper is due on **Monday, December 11 (by 11:59pm).**

To make sure you are on track, each student is required to submit one paragraph describing what they intend to write about and including some references. This must be handed in no later than Thursday, November 9, to allow me enough time to give everyone feedback before the final paper is due. Not handing this in will result in an automatic 5 point deduction from your final paper.

**Additional course notes**

**Academic integrity**

As a member of the academic community, one of your responsibilities is to uphold principles of honesty and integrity. This means that you can only present your own work on assignments and presentations — plagiarism is strictly prohibited, as is presenting work as your own when it was done by someone else. Doing so compromises your academic integrity and potentially your academic standing. If you are falling behind, don’t understand the material, or are not confident about your writing or presentation, talk to me as soon as possible instead of taking measures that go against principles of academic integrity. [Columbia’s Honor Code in Columbia’s Guide to Academic Integrity](http://www.college.columbia.edu/academics/academicintegrity).

**Students with disabilities**

If you are a student with special needs and require accommodation, meet me before the first class to discuss your needs. You must also contact Disability Services before the first class to register for specific accommodations ([https://health.columbia.edu/disability-services](https://health.columbia.edu/disability-services)).
**Weekly Topics and Readings**
Readings come in different forms: some are required, some you get to choose from, and others are optional. I have listed many fewer papers than needed to truly understand a topic, but the supplementary readings are there to help you pursue your interests should any topic intrigue you. Assuming we all read slightly different sets of papers, we can have a very rich discussion in class! The last few pages of the syllabus are the comprehensive reading guide.

**Week 1: Introduction (and how to find papers online)**
**Required background reading that will help during the class (no ‘thought piece’ required)**
*Primer on hippocampal anatomy and function*

*Understanding fMRI multivoxel pattern analysis / decoding / classification techniques:*

*Overview of the cognitive neuroscience of episodic memory (and more):*

*Anatomy of the medial temporal lobes (see especially Figures 2 & 3)*

**Week 2: Patient studies of episodic memory**
**Required**


**Choose one of**


Optional

Week 3: fMRI studies of episodic memory

Required


Choose one of


Rissman J, Greely HT, Wagner AD. (2010). Detecting individual memories through the neural decoding of memory states and past experience.


Optional


Week 4: Do animals have episodic memory?

Required


Templer VL, Hampton RR. (2016). Episodic memory in nonhuman animals Current Biology, 23, R801-R806.

Choose one of


Optional


Week 5: Place cells: building blocks of memory?

Required


Choose one of


Optional


Week 6: Divisions of episodic memory

Required


Choose one of


Optional


**Week 7: Computations of the hippocampus**

**Required**


**Choose one of**


**Optional**


**Week 8: Is the hippocampus fundamentally “spatial”?**

**Required**


Choose one of


Optional

Week 9: Organizing memories in time
Required


Choose one of


Optional

**Week 10: The role of memory systems in perception**

**Required**


Choose one of


**Optional**


**Week 11: The role of the hippocampus in imagination**

**Required**


Choose **one** of


**Optional**


**Week 12: How the hippocampus influences, and is influenced by, attention**

**Required**


Choose **one** of


Cosman JD, Vecera SP. (2013). Learned control over distraction is disrupted in amnesia. Psychological Science, 24, 1585-1590.


Optional


Week 13: Implicit memory in “declarative memory” systems
Required


Choose one of


Optional


** These readings are subject to revision. Revisions will be noted in class and on the website **