Psychology 560 - Cognitive Neuroscience

Fall Semester, 2019

Class meetings: Instructors: Dr. Hoi-Chung Leung; Ryan Parsons
Wednesday: 4:00 p.m. - 7:00 p.m.   Office: Psych B, Room 314; Psych B, Room 320
Psych A, Room 256   Office Hours: By appointment

Course Description

Behavioral and cognitive neuroscience is an interdisciplinary field, at the interface of systems neuroscience, computational neuroscience, and cognitive psychology. In this course, we will explore how one might investigate the underlying neural substrates of cognitive functions (e.g., memory, executive functions) by discussing both classic and current articles. We will ask questions such as "What are the neural mechanisms associated with different forms of memory?" Our goal is to evaluate the strengths and weaknesses of different approaches, and we will discuss how behavioral and cognitive neuroscience investigations have shaped our view of mental processes.

Class Format

The class will be in the format of short presentation, interactive discussion and open debate between seminar participants. To facilitate dialogue, each member is expected to briefly present points raised in their reaction papers (see below) as a starting point for discussion.

COURSE LEARNING OBJECTIVES:

How does complex purposeful behavior emerge from interactions between millions of neurons? This course is to introduce the major themes, theories, and methodologies in the field of cognitive neuroscience, and to foster critical thinking skills for you to develop your own view and understandings in the scientific literature of this research area.

After completing the course, students should be able to:

- Describe the fundamental issues in the study of mental processes such as working memory.
- Describe the basic findings and theories derived from classic and modern cognitive and behavioral neuroscience studies.
- Describe the importance of a multi-disciplinary approach to understanding the neural basis of cognition.
- Identify the key approaches and limitations in studies of cognitive and behavioral neuroscience.
- Critically evaluate the implications of findings from cognitive and behavioral neuroscience for broader issues concerning human cognition and mental health.
- Recognize, interpret, and critically evaluate data and figures from primary and secondary sources.
- Write critical reviews of scientific papers.
- Formulate a plausible cognitive and behavioral neuroscience research question and study design.
- Apply concepts and research findings from cognitive and behavioral neuroscience to issues in everyday life.

Course Requirements

1. Weekly Readings

There is no textbook requirement. Weekly readings will be assigned in advance. Please check blackboard frequently for updates (http://blackboard.stonybrook.edu/).

2. Weekly reaction papers/questions (*Upload files on blackboard no later than 5 pm the day prior to class.*)

Class members are expected to write a short reaction paper (*as if you are a reviewer*) on selected readings. The reaction papers should be <u>concise</u> (not to exceed 1 single spaced page). You are recommended to first write a brief summary (not to exceed 150 words to state the purpose, hypotheses, approach and major findings of the study) and then summarize your reactions to the followings:

i.   General comments you have about the readings (e.g., the significance of the findings);
ii. Why you agree or disagree with the theoretical position, approach, and/or interpretation of data;
iii. Suggestions you have for further analysis, design, experimentation, hypothesis testing, and/or theoretical clarifications.

iv. Try to find at least one additional article to support your view and integrate it into your argument. Ideally, this paper should offer strong evidence that enhances your writing. (Remember to properly cite your source of information.)

NOTE: <u>The reaction papers should not be summaries of the readings</u>, but can take many forms such as critiquing the points raised by the authors, integrating ideas across reading, developing hypothesis, and identifying and critiquing unstated assumptions. <u>The goal is to achieve efficient and thoughtful writing</u> – boiling down the discussion to its essence, and, based on logic and empirical evidence, presenting your argument clearly and concisely. <u>Try to make constructive suggestions and DON'T nick pick</u>.

3. Weekly presentation and discussion *(see Course Resources on **blackboard for suggestions*)*

Each week, class members are expected to give presentations and lead discussions on the assigned readings. Students will be designated to present the assigned paper and leading the discussion (e.g., offering views to support the theory propose by the readings or critiquing assumptions and overextended speculations).
Our general aim is (1) to generate constructive critiques, (2) to develop hypothesis and (3) formulate experimental design to address the concerns and/or follow-up experiments to further address the question.

Starting on week 4, students will lead the presentations with each assigned reading being presented by 1 student. The students who do not present that week will write reaction papers on 1 of the assigned readings. All students are expected to read all assigned articles and to contribute to the discussion.

4. Term paper

The term paper *(in proposal format)* is to explore a topic in additional depth, by either following up on an issue raised in class or pursuing a topic of interest not covered in the course but within the field of cognitive neuroscience. The length of the proposal should be between 8-12 pages (double spaced and font size 12 pt). Abstract and references are not counted towards the page limit. The proposal must include the following sections: Abstract, Introduction, Methods, Predicted results, Alternative hypothesis, Discussion and References. The format of all reference sections of the paper is APA.

<u>*Term paper Schedule*</u>:
Term paper outline: Submit a title, an abstract to outline your topic, and a list of at least 10 references on or before October 16th, 1 p.m. A paper version of the outline is due in class on October 16th.   Make an appointment to meet with the instructor after submitting the outline.
Final paper: Submit the final paper (1 paper version and 1 electronic version) on or before December 2nd, 5 p.m. All papers will be published on blackboard for the class.
Final presentation: Each student will give a final presentation on his/her paper.

All students should keep in mind that the principle of Academic Honesty requires that this paper be the original work of the student who submits it, and must include appropriate citations for statements and ideas that are the original work of others. If in doubt, cite your sources.

<u>UNIVERSITY AND COURSE POLICIES ARE IN PLACE TO ENSURE FAIRNESS THAT NO STUDENT RECEIVES SPECIAL CONSIDERATION IN DETERMINING THEIR GRADES.</u>

<u>GENERAL STATEMENT:</u>

In order to do well in the course, you should attend class regularly, complete the readings carefully, and seek help from the instructor as needed. It is presumed that you will treat your classmates, your teaching assistants, and your instructor with respect and sensitivity at all times. It is hoped that your efforts will pay off and that the course will be an enjoyable and rewarding learning experience for you. Remember to turn off cellular telephones and beepers when you enter the classroom.

<u>STUDENT ACCESSIBILITY SUPPORT CENTER (SASC):</u>

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. For procedures and information go to the following website: http://studentaffairs.stonybrook.edu/dss/index.html

ACADEMIC INTEGRITY STATEMENT:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic integrity and judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

CRITICAL INCIDENT MANAGEMENT:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Grading:
Participation and presentation - 40%
Reaction papers - 40%
Term paper - 20%

Class Schedule:

Session	Date	Topic	Reaction papers	Moderator
Week 1	8/28/19	**Introduction:** From molecules to systems	None	Lecture (Parsons)
Week 2	9/4/19	**Memory systems:** Hippocampus, amygdala	RC1	Lecture (Parsons)
Week 3	9/11/19	**Memory systems:** Cortical areas (e.g., prefrontal, parietal)	RC2	Lecture (Leung)
Week 4	9/18/19	**Cellular Mechanism**: neurophysiology of temporary maintenance	RC3	Leung
Week 5	9/25/19	**Cellular & Molecular Mechanism:** LTP, molecular signaling, proteins and epigenetics	RC4	Parsons
Week 6	10/2/19	**Cortical circuits and functional organization of memory:** Model-based vs. model-free behavior	RC5	Leung
Week 7	10/9/19	**Modulatory mechanisms:** dopamine, functional connectivity (top-down control)	RC6	Leung
Week 8	10/16/19	**Neural representation of memory in humans (fMRI data)**	RC7 **Paper outline due, 1pm**	Leung
Week 9	10/23/19	NO CLASS – SFN meeting		
Week 10	10/30/19	**Computational modeling**	RC8	Leung
Week 11	11/6/19	**Synaptic Tagging and Capture:**	RC9	Parsons
Week 12	11/13/19	**Retrieval-Dependent Memory Modification:**	RC10	Parsons
Week 13	11/20/19	**Extinction of Learned Fears:**	RC11	Parsons
Week 14	11/27/19	NO CLASS - Thanksgiving		**Term paper due 12/2/2019**

Week 15	12/4/19	**Student term-paper presentations**		

Additional Supplementary Materials are on blackboard.

Reading list: *See blackboard posting for weekly reading assignments.*