Neural Basis of Cognition
Neuroscience 1034
Spring 2025

Dr. S. Shushruth, Department of Neuroscience
Lectures: Tuesday and Thursday, 2:30 – 3:45 p.m., Room: TBD
Office hours: Thursday 4:00 p.m. – 5:00 p.m., Room: 115 I Mellon Institute
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Prerequisite for this course are Neuroscience 1000 (Introduction to Neuroscience).
Strongly recommend also having taken Neuroscience 1011 (Functional Neuroanatomy).

Course organization

The goal of this course is to examine the neural basis of higher cognitive functions. The course is laid out in four segments:

Segment 1: We will discuss the origins of cognitive neuroscience, including the methods and experimental approaches that have led to the development of this new field. We will also cover the basics of cortical organization, lateralization of cognitive functions, and brain mechanisms of motor control.

Segment 2: We will focus on perceptual and attentional processes, including object recognition, category-specific visual processing, spatial perception and attentional mechanisms.

Segment 3: We will cover neural mechanisms of working memory, long-term memory, executive control of cognition and language.

Segment 4: We will focus on brain mechanisms underlying cognitive development and emotion. We will also discuss pathologies of cognition and broader themes relating cognition to society.

In each segment of the course, we will draw on results from many different kinds of investigations in animals and humans, including behavioral studies, anatomical research, lesion studies, physiological recording studies and functional imaging studies. The questions to keep in mind throughout the course are what can we learn about the neural substrates of normal cognitive function and how can we design experiments to explore the relation between neural mechanisms and cognitive processes.

Readings

Textbook: Cognitive Neuroscience by Drs. Marie Banich and Rebecca Compton, 5th edition, 2024. (4th edition should also suffice)

Other readings: Additional readings of seminal scientific papers will be assigned on some weeks for in-class discussion.

Evaluation
There will be four exams, each of which counts for 20% of your grade. Material included in a test will not be re-examined in a subsequent test except that the fourth exam may require some overall perspective on the material covered. Exams will cover material equally from the lectures, the textbook and the supplementary readings. You are allowed to consult books or paper notes, but no internet-connected electronic devices will be allowed. No make-up exams will be given.

There will also be 4 sessions in which we will discuss an assigned scientific paper. Participation in each of these discussions will count for 5% of your grade.

Syllabus

WEEK	DATE	TOPIC	READING
1	Jan 9	Introduction	
2	Jan 14	Cerebral Organization	Chapter 1
	Jan 16	Methods 1 - Lesion studies	Chapter 2
3	Jan 21	Methods 2 - Modern approaches	Chapter 3
	Jan 23	Motor 1 - Learning and execution	Chapter 4
4	Jan 28	Motor 2 - Planning and volition	Chapter 4
	Jan 30	**First Exam**	**Material up to Motor**
5	Feb 4	Sensation and Perception	Chapter 5
	Feb 6	Objects and Faces	Chapter 6
6	Feb 11	Spatial Cognition 1 - Motion, Depth & Spatial Maps	Chapter 7
	Feb 13	Spatial Cognition 2 - Spatial Navigation	Chapter 7 + **Assigned paper**
7	Feb 18	Attention 1 - Taxonomy & Neural basis	Chapter 10
	Feb 20	Attention 2 - Models & Pathologies	Chapter 10 + **Assigned paper**
8	Feb 25	**Second Exam**	**From Sensation to Attention**
	Feb 27	Language	Chapter 8
9	Mar 4	**Spring Break**	
	Mar 6	**Spring Break**	

10	Mar 11	Memory 1 - Long-term memory	Chapter 9
	Mar 13	Memory 2 - Working memory	Chapter 9 + **Assigned paper**
11	Mar 18	Executive Function 1 - Planning & Decision-making	Chapter 11
	Mar 20	Executive Function 2 - Abstraction & Cognitive control	Chapter 11 + **Assigned paper**
12	Mar 25	**Third Exam**	**From Language to Executive Functions**
	Mar 27	*No class*	
13	Apr 1	*No class*	
	Apr 3	Psychopathology	Chapter 14
14	Apr 8	Brain development and Plasticity	Chapter 15
	Apr 10	Emotion & Social Cognition	Chapter 12 and 13
15	Apr 15	Disorders of Cognition	Chapter 16
	Apr 17	Cognition and Society	Chapter 17
16	Apr 22	**Fourth Exam**	**From Psychopathology to end**