

**Neural Basis of Cognition**  
**Neuroscience 1034**  
**Spring 2018**

Dr. Carol L. Colby, Department of Neuroscience

Lectures: Monday and Wednesday, 4:00 - 5:20 p.m., Mellon Institute, Room 115

Office hours: M/W 5:20-6:00 p.m.

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Week	Date	Topic	Reading
1	Jan 8	Cortical Organization 1	Chapter 1
	Jan 10	Cortical Organization 2	
2	Jan 15	no class	Chapter 3
	Jan 17	Methods	
3	Jan 22	Hemispheric Specialization	Chapter 4
	Jan 24	Motor 1	Chapter 5
4	Jan 29	Motor 2	
	Jan 31	<b>First exam</b>	
5	Feb 5	Object Vision	Chapters 6 and 7
	Feb 7	Objects and Faces	
6	Feb 12	Spatial Vision	Chapter 8
	Feb 14	Spatial Representation	
7	Feb 19	Attention 1	Chapter 11
	Feb 21	Attention 2	
8	Feb 26	<b>Second exam</b>	
9	Feb 28	Memory 1	
		SPRING BREAK	
10	Mar 12	Memory 2	Chapter 10
	Mar 14	Executive Function 1	Chapter 12
11	Mar 19	Executive Function 2	
	Mar 21	Executive Function 3	
12	Mar 26	Plasticity	
	Mar 28	<b>Third exam</b>	
13	Apr 2	no class	Chapter 15
	Apr 4	Cognitive Development	
14	Apr 9	Developmental Disorders	Chapter 9
	Apr 11	Language	
15	Apr 16	Emotion	Chapter 13
	Apr 18	<b>Fourth exam</b>	

**Prerequisites for this course are Neuroscience 1000 (Introduction to Neuroscience) and Neuroscience 1011 (Functional Neuroanatomy).**

### **Course goals**

The goal of this course is to examine the neural basis of higher cognitive functions. In the first segment, 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. The second segment will focus on perceptual and attentional processes, including object recognition, category-specific visual processing, spatial perception and representation, and attentional mechanisms. The third segment will cover neural mechanisms of working memory, long-term memory, sequencing of behavior, executive control and cognitive effort. The final section of the course will focus on brain mechanisms underlying cognitive development, language processing and emotion. 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**

The required text is "Cognitive Neuroscience" by Drs. Marie Banich and Rebecca Compton, 3rd edition, 2011. This is an excellent text with a specific emphasis on higher cortical functions. Additional readings focusing on physiological mechanisms of cognitive function will be distributed in class.

### **Additional Readings**

#### Week 1

Mishkin, M., Ungerleider, L.G. and K.A. Macko, 1983. Object vision and spatial vision: two cortical pathways. *Trends in Neurosciences* 6: 414-417.

#### Week 2

Habib, M. and A. Sirigu, 1987. Pure topographical disorientation: a definition and anatomical basis. *Cortex* 23: 73-85.

#### Week 3

Georgopoulos, A., 1997. Voluntary movement: computational principles and neural mechanisms. In: *Cognitive Neuroscience*, M. Rugg (ed.), MIT Press, pp. 131-168

#### Week 4

di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V. and G. Rizzolatti, 1992. Understanding motor events: a neurophysiological study. *Experimental Brain Research* 91: 176-180.

#### Week 5

Kanwisher, N., Chun, M.M., McDermott, J. and P.J. Ledden, 1996. Functional imaging of human visual recognition. *Cognitive Brain Research* 5: 55-67.

#### Week 6

Colby, C.L., 1998. Action-oriented spatial reference frames in cortex. *Neuron* 20: 15-24.

#### Week 7

Colby, C.L., 1996. A neurophysiological distinction between attention and intention. *Attention and Performance* 16: 157-177.

#### Week 11

Fuster, J.M., 1997. Network memory. *Trends in Neuroscience* 20: 451-458.

#### Week 13

Allen, A.J., Leonard, H.L., and S.E. Swedo, 1995. Case study: a new infection-triggered, autoimmune subtype of pediatric OCD and Tourette's syndrome. *Journal of the American Academy of Child and Adolescent Psychiatry* 34 (3): 307-311.

### **Evaluation**

There will be four exams, each of which counts for 25% 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. No make-up exams will be given.