Neural Basis of Cognition

Neuroscience 1034

Spring 2016

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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 6	Cortical Organization 1	Chapter 1
2	Jan 11	Cortical Organization 2	
	Jan 13	Methods	Chapter 3
3	Jan 18	no class	
	Jan 20	Hemispheric Specialization	Chapter 4
4	Jan 25	Motor 1	Chapter 5
	Jan 27	Motor 2	
5	Feb 1	**First exam**	
	Feb 3	Object Vision	Chapters 6 and 7
6	Feb 8	Objects and Faces	
	Feb 10	Spatial Vision	Chapter 8
7	Feb 15	Spatial Representation	
	Feb 17	Attention 1	Chapter 11
8	Feb 22	Attention 2	
	Feb 24	**Second exam**	
9	Feb 29	Memory 1	Chapter 10
	Mar 2	Memory 2	
10		SPRING BREAK	
11	Mar 14	Memory 3	
	Mar 16	Executive Function 1	Chapter 12
12	Mar 21	Executive Function 2	
	Mar 23	Executive Function 3	
13	Mar 28	no class	
	Mar 30	**Third exam**	
14	Apr 4	Cognitive Development	Chapter 15
	Apr 6	Developmental Disorders	
15	Apr 11	Language	Chapter 9
	Apr 13	Emotion	Chapter 13
16	Apr 18	**Fourth exam**	

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 Pelligrino, 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.