Study Questions for March 23  (Prof. Adele Diamond)

Prepare the answers to these IN ADVANCE, based on the readings for Mar. 23. Prof. Diamond will be leading a discussion, not lecturing. Answering these questions is essential background for that. (Mar. 23 should be fun; do not be alarmed.)

The readings are available online at:  www.devcogneuro.com/AdeleDiamond.html#Pubs


The Cognitive Abilities Dependent on Prefrontal Cortex

What are the 3 core executive functions?
  Give examples of each.
  Why are each of these executive functions important?

Changes in the Cognitive Abilities Dependent on Prefrontal Cortex during Infancy

What is the A-not-B task?
  What cognitive abilities does it require? WHY do you think it requires those abilities?

What is the object retrieval task?
  What cognitive abilities does it require? WHY do you think it requires those abilities?

Prefrontal cortex is not fully mature until your mid-20’s. How is possible then that infants in the first year of life could be using cognitive skills dependent on prefrontal cortex?

Phenylketonuria (PKU)

What causes PKU? What happens if it is untreated? Why?

If PKU is not treated by a sufficiently rigorous diet, deficits limited to the cognitive skills dependent on prefrontal cortex can result. Why?

What special properties of the dopamine projection to prefrontal cortex are relevant here?

Glucose is also an amino acid (like Phe and Tyr). What implications might you draw from the PKU story for a diabetic whose glucose levels stay a bit too high?
Attention Deficit Hyperactivity Disorder (ADHD)

What neural region is thought to be the primary site of the problem in ADHD where hyperactivity is present?
Give an example of a gene that might directly affect that brain region. Why?
What evidence supports that?
What neural circuit might be primarily affected in ADHD where hyperactivity is NOT present?
Give an example of a gene that might directly affect that circuit. Why?
What evidence supports that?
What are behavioral differences between the inattentive type of ADHD and the types of ADHD that include hyperactivity?
What are differences in medications that are most effective for the inattentive type of ADHD and the types of ADHD that include hyperactivity? Why are high dosages of methylphenidate effective for one but not the other?

Catechol-O-Methyltransferase (COMT)

Why is COMT more important in prefrontal cortex than in other regions of the brain such as the striatum?
What effect does having methionine at codon-158 of the COMT gene have on level of dopamine in prefrontal cortex? Why?
Which variant of the COMT gene is generally associated with better cognitive function? Why?
What’s the down side of that variant of COMT?
Why might the story (about which variant of the COMT gene is generally better for cognitive function) be different for women than for men?
What are some of the implications of that?
Why might stress have different effects on cognitive performance for women than for men?

Programs and Activities to Aid the Development of Prefrontal Cognitive Functions

What would you do as a parent or teacher to aid executive function development?
What’s the hard scientific evidence on the importance of educating “the whole child”? What implications does the importance of educating “the whole child” have for how you can maximize your performance in, and how much you get of, graduate school?