Riken Summer Program 2008

Friday, August 8, 2:00-4:30pm: Silvia A. Bunge, Ph.D.

2:00-2:45 Introduction
Typical Brain Development over Childhood and Adolescence

The brain undergoes major structural and functional changes over childhood and adolescence that may, in part, explain changes in behavior and cognition. Rapid changes occur at the neuronal level in the first few years of life, followed by slower, protracted changes through adolescence. While brain changes at the cellular level can only be examined in post mortem brain tissue, advances in neuroimaging techniques have made it possible to study gross anatomical development in vivo. Structural magnetic resonance imaging (MRI) methods make it possible to quantify age-related changes in cortical thickness, in the volume of specific brain structures, and in the thickness and coherence of white matter tracts connecting distant brain regions to one another. Further, developmental changes in inter-regional connectivity have been studied with an MRI-based method known as diffusion tensor imaging (DTI). Both cortical pruning within regions and increased neuronal connectivity within and between regions are likely to underlie improvements in cognition over development. Researchers are beginning to make links between developmental changes in behavior, brain structure, and brain function. This lecture will provide an overview of structural and functional changes in the brain over childhood and adolescence.

2:45 – 3:00 Break

3:00-4:30 Advanced Topic
Neural Development of Control over Memory Processes

A subject of much debate in the developmental literature is the idea that improvements over childhood in inhibitory control contribute significantly to improvements in working memory and long-term memory. Thus far, behavioral studies have not shown conclusively that the ability to suppress irrelevant thoughts is critical for working memory or long-term memory performance. Here, I will present two new datasets from my laboratory in which we have examined neurodevelopmental changes over middle childhood in the ability to control memory – both at the time of encoding and at the time of retrieval. In one study, we find that working memory performance in children is strongly correlated with a neural index of suppression of irrelevant information in a perceptual region of the brain (Wright, Baym, Repin, Gazzaley, & Bunge, in preparation). We further show that right ventrolateral prefrontal cortex is engaged during suppression of irrelevant information. In the other study, we show that there are marked improvements over middle childhood in the ability to suppress memory retrieval. In adults, right ventrolateral prefrontal cortex activation is associated with successful memory suppression (Paz-Alonso, Ghetti, Matlien, Anderson, & Bunge, in preparation). These findings are consistent with the emergence and refinement over childhood of a neural circuit involved in inhibiting irrelevant thoughts and memories.