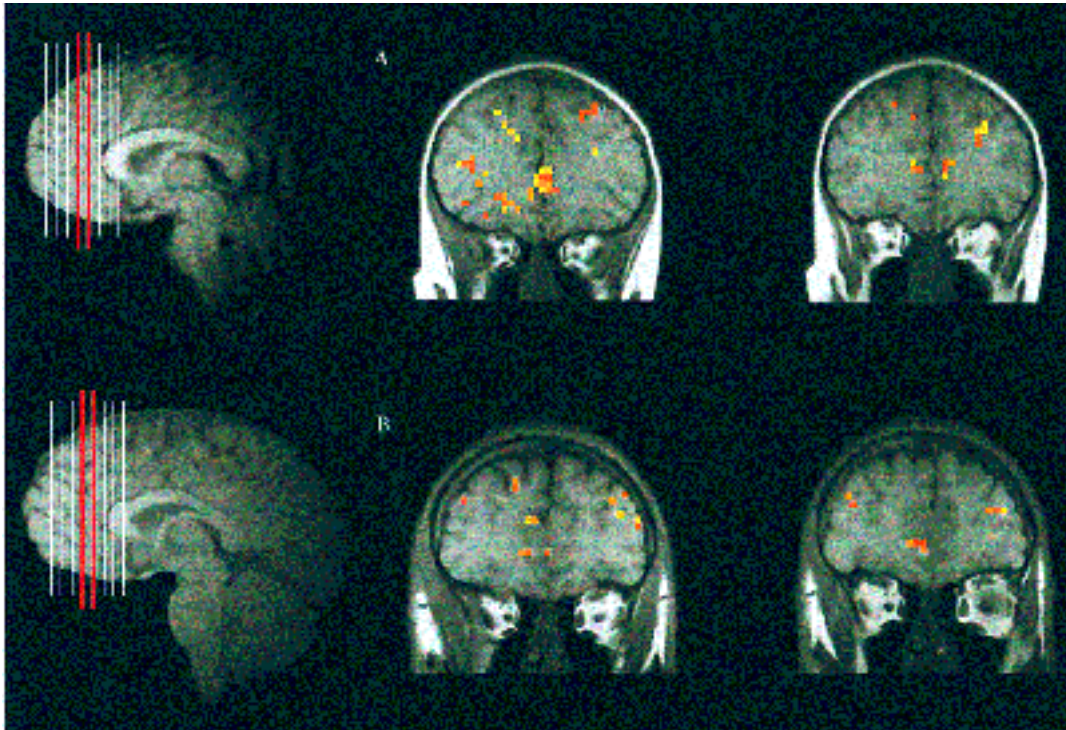


Images in Neuroscience

Carol A. Tamminga, M.D., Editor

Brain Development, XII



The midsagittal images to the left of panels A and B depict the prescribed slice locations. Overlays of activation on two T₁-weighted coronal images located approximately 40 and 45 mm anterior to the anterior commissure for a right-handed 9-year-old male (panel A) and a right-handed 24-year-old male (panel B).

Maturation in Brain Activation

Advances in neuroimaging technology now make it possible to examine the developing human brain *in vivo*. Functional magnetic resonance imaging can be used as a research tool in children to study patterns of brain activity because the technique delivers no ionizing radiation while providing unique brain performance data. Maturation of the prefrontal cortex, including its dorsolateral and orbital frontal regions, is assumed to correspond to the development of higher-level cognitive processes, like working memory and response inhibition, throughout childhood and adolescence. The study associated with the above figure probed the development of different patterns of activation in the prefrontal cortex during response inhibition by using a modified version of the “Go–No–Go” task. The goal was to examine whether brain circuitry underlying inhibitory mental processes is the same in children (ages 7–12) and adults (ages 21–24) during the performance of a task requiring behavioral inhibition. This study found that the location of the activation in the prefrontal cortex is not different between children and adults (figure). However, the study also found that the volume of the activation was greater for children than for adults, especially in the dorsolateral prefrontal cortex, when performing the inhibitory part of the task (figure). These data suggest that children may have to activate (i.e., utilize) more of the dorsolateral prefrontal area to maintain a representation of (i.e., remember) the task-relevant information. In adults, greater efficiency (i.e., less activation volume) at representing task-relevant information may correspond to the greater neural selectivity characteristic of the mature brain. Maturation, as demonstrated here by task-associated differences in brain activation, may correspond to the molecular and cellular changes (including neuronal and synaptic pruning) that are going on in the neocortex during these years of development.

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