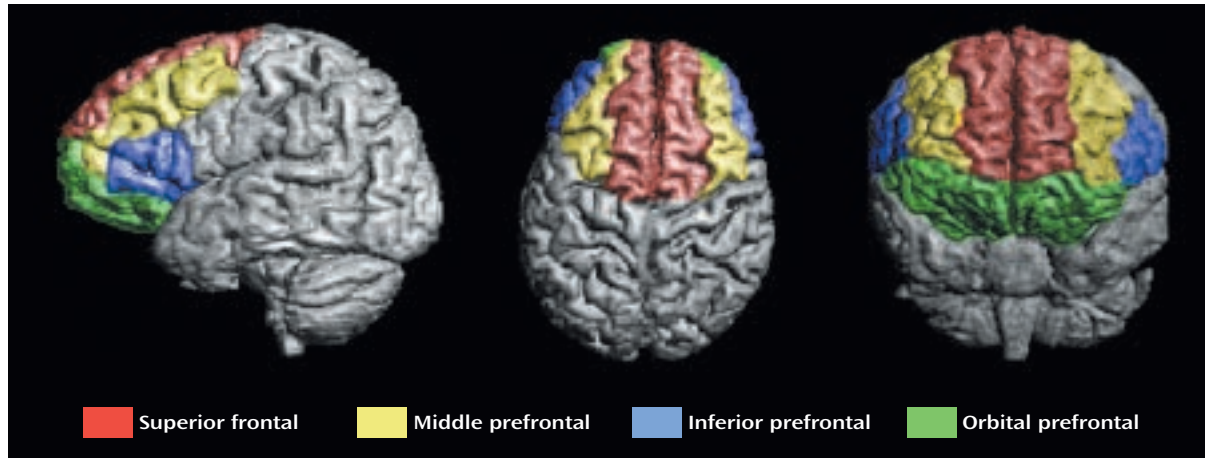


Prefrontal Cortex, Structural Analysis: Segmenting the Prefrontal Cortex



The prefrontal cortex is the anterior aspect of the human brain and is generally thought to participate in executive functions, working memory, and attention. This area can be subdivided into putative constituent regions based on surface anatomical landmarks. Particular mental functions and disease characteristics have been found to be associated with these specific subregions, an area of research wholly facilitated by modern in vivo brain imaging techniques. Brain structure can be captured with high reliability and resolution with a magnetic resonance (MR) scanner. Structural resolution ranges from 0.5 mm³ to 1.0 mm³. The technique of subdividing the prefrontal cortex into its constituent regions can be reliably accomplished by using a simple investigator-driven computerized system. As illustrated in the figure above, surface sulcal landmarks are identified on the three-dimensional reproduction of a structural MRI scan, and each region is then “painted” with a different color. The colors are also depicted on the three MRI orthogonal views (coronal, sagittal, and axial). The orthogonal views and the three-dimensional reproduction are then used in combination to identify the voxels of each region. Gray and white matter volumes are cal-

culated by using a stereological approach. An underlying assumption is that these regions correspond approximately to cytoarchitectonic subdivisions of the brain. Using this approach, we have 1) detected a reliable reduction in inferior prefrontal region gray matter, and 2) found a loss of the normal right > left volume asymmetry of the superior prefrontal cortex in schizophrenia patients. In combination with other structural abnormalities of the heteromodal association cortex detected through the use of this analytic approach, these changes suggest a particular involvement of the language neural circuit and may explain, in part, one of the core features of schizophrenia: disturbances in language function. The identification of normal and pathological characteristics of “unit” regions of the cerebral cortex will contribute to our full understanding of human cortical function and, in the future, may allow for the diagnostic and therapeutic use of these techniques that are now used only in research.

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