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MENTAL RETARDATION AND DEVELOPMENTAL DISABILITIES
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PEDIATRIC NEUROIMAGING AND DEVELOPMENTAL DISORDERS OF COGNITION AND AFFECT: INTRODUCTION TO THE SPECIAL ISSUE

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This issue of *Mental Retardation and Developmental Disabilities Research Reviews* is devoted to neuroimaging. Powerful new methods and technologies are now available for probing the structure and function of the developing brain in both normal and disordered populations. The articles in this issue provide an overview of some of the most promising areas and emerging trends in this rapidly evolving field.

The first article by Susan Bookheimer provides an introduction to some general and important methodological issues in pediatric neuroimaging, particularly as they pertain to functional magnetic resonance imaging (fMRI). Since fMRI involves no exposure to ionizing radiation, it quickly has become the method of choice for functional imaging in children. The opportunities and challenges associated with fMRI studies in children are reviewed by Bookheimer and should provide a useful guide to those investigators who are considering using fMRI in their pediatric studies.

In the second article, Davidson and Slagter provide an overview of imaging studies that probe emotion and affective disorders in children. They first delineate some important methodological and conceptual issues in the study of neuropsychiatric disorders in children and then consider the importance of maturation changes in brain structure for understanding functional imaging findings in children. This is a generic issue that is pertinent to all domains of functional imaging in children.

The third article by Rumsey and Ernst presents a comprehensive review of functional brain imaging studies in autistic disorders. They illustrate how functional brain imaging studies have begun to suggest alterations in the brain organization for language and other cognitive functions in autism. Studies using positron emission tomography (PET) have begun to suggest abnormalities in dopamingeric and serotonergic function in this illness. Studies using magnetic resonance spectroscopy (MRS) have shown abnormalities in a marker of neuronal viability, N-acetyl-aspartate (NAA) in the cerebellum. They consider a number of important methodological issues in this area including the importance of longitudinal assessments, the heterogeneity of the disorder, and the importance of collaboration with cognitive neuroscience.

In the fourth article, Sowell and her colleagues examine morphometric abnormalities in childhood-onset schizophrenia. Some of the structural abnormalities observed in this population are similar to those that have been reported in the adult-onset variant of schizophrenia. They illustrate how voxel-based morphometric analyses can reveal subtle abnormalities in the shape and spatial location of the corpus callosum, caudate, and thalamus that are not seen with more traditional volumetric assessments. Interestingly, they report that progressive degenerative changes in this population appear only until young adulthood when there is an apparent asymptote with no further degeneration.

The fifth article by Reiss and his colleagues provides an overview of an emerging and very powerful research strategy for developmental disorders—behavioral neurogenetics. They illustrate how this strategy can be applied to understand human gene–brain–behavior linkages. Five genetic conditions are examined that all are associated with identifiable neurodevelopmental and neuropsychiatric conditions. Abnormalities in brain morphology and the possible links to molecular genetics and behavior are described.

Eckert and Leonard, in the sixth article, provide a comprehensive review of structural brain abnormalities observed in dyslexia, with an emphasis on the planum temporale. They demonstrate that the findings from this literature are inconsistent and underscore the importance of diagnostic uncertainty and heterogeneity. They show, however, that variations in the asymmetry of the planum temporale do predict strength of hand preference and general verbal skills. They emphasize the importance of having larger sample sizes in the studies of morphomet-

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ric abnormalities in dyslexia to account for the heterogeneity within this condition.

Pugh and his colleagues, in the seventh article, use functional neuroimaging data to interrogate the integrity of functional circuits within the posterior left hemisphere both in normal readers and in those with reading disabilities. On the basis of a number of different studies, they suggest that disabled readers activate inferior frontal and right hemisphere regions to compensate for deficient left hemisphere posterior abnormalities.

In the eighth article, Hale and colleagues review both structural and functional brain imaging data in attention deficit/hyperactivity disorder (ADHD). The data suggest alterations in frontostriatal circuitry involved in attention and arousal. Structural imaging data also suggest diminished prefrontal and caudate volumes in ADHD. They suggest that the abnormalities in this circuitry are associated with deficits in dopaminergic and possibly also noradrenergic neurotransmission.

In the final article, Gaillard reviews both the structural and functional imaging data in children with partial epilepsy. Morphometric data reveal the widespread effects of seizures on brain structure. The progressive volume loss in the hippocampus in some patients with temporal lobe epilepsy provides some suggestion that continued seizures may be associated with progressive neuronal injury. Gaillard reviews fMRI data that indicates how this method can be used to interrogate language function in children with partial epilepsy. Some promising findings suggest that fMRI may be able to be used eventually as a substitute for intracarotid amytal in assessing functional activity prior to neurosurgery, although sufficient study of this issue has not yet been performed.

In conclusion, this set of articles highlights the promises and pitfalls of neuroimaging in children. It is clear that collectively these techniques represent powerful tools for probing the structure and function of the developing brain. There are many conceptual and methodological problems associated with the use of these techniques in each of the featured areas. However, the advances that have been made in a relatively short period of time have been significant. The fact that fMRI as a noninvasive method for probing regional neuronal activation can be used safely in children represents a significant milestone in pediatric neuroimaging. We expect that this technique, particularly when used in conjunction with morphometric measures, will provide new insights into the development of the brain and its relationship to complex cognitive and emotional processes. By combining these functional methods with sophisticated behavioral paradigms, we can expect an even more palpable increase in progress in the next decade.