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Department of Psychiatry School of Medicine xi Foreword Neuroimaging has in many ways revolutionized the field of psychiatry, and its ability to help clinicians and researchers understand the mechanisms of childhood psychiatric disorders should not be underestimated. This volume reviews recent developments in neuroimaging techniques and their implications for child psychiatry. It is a unique book in that it focuses on children and integrates brain mapping with genetics and behavioral testing. What is truly astounding is the rapid evolution of this field since the seminal first edition of this book appeared in In the past decade, one of the enormous shifts in our thinking about psychiatry has been the growing appreciation that many, if not all, major psychiatric disorders have their antecedents in childhood. It is now clear that the major psychiatric disorders are serious, debilitating, life-shortening illnesses that affect millions of people worldwide. Research on the biological underpinnings of the major psychiatric disorders has therefore begun to focus less on absolute changes in individual neurotransmitters, and more on the xiii xiv Foreword role of neural circuits and synapses, and the processes controlling their function. Revolutionary techniques in neuroimaging and genetics, combined with epidemiological and longitudinal research, have now firmly established that psychiatric disorders are developmental disorders. They emerge while the brain is still developing and evolve into the more easily recognized chronic and disabling course. The field of childhood neuroimaging has played a key role in redefining this thinking. As Section 2 of this book so thoroughly describes, neuroimaging has helped identify atypical brain developmental processes associated with a variety of disorders. The work outlined in these chapters clarifies the notion that studying these disorders early in life is most likely to eventually allow us to make a major impact on their course. The neuroimaging of normally developing children provides investigators with the unparalleled opportunity to assess human structural brain development and the key domains of normal developmental processes underlying cognitive and regulatory aspects of human behavior. With regards to psychopathology, neuroimaging provides investigators with the opportunity to study and identify risk factors that may appear before the symptoms of any illness and which are therefore unconfounded by treatment. Among its many valuable advantages, neuroimaging also provides investigators with the tools to track the longitudinal course of an illness, to determine correlates of symptom reduction, and to directly assess the effects of medications or other interventions. The chapters included in Sections 3 and 4 of this book describe many of the most recent advances in neuroimaging with respect to ethical considerations, and technology, experimental design, and data analysis. They also address which neuroimaging techniques can safely be used to study children – an issue of enormous importance. The most striking thing about these sections of the book is how much the field has expanded – both in scope and volume – since Because neuroimaging affords us the possibility of directly studying the organ of interest, it has significantly altered how we conceptualize, diagnose, understand, and treat psychiatric disorders. Our expanded understanding, in turn, has led us to refine and improve neuroimaging techniques. There have been advances not only in neuroimaging technology and particularly in temporal and spatial resolution , but also the adaptation and development of novel cognitive neuroscience techniques. This integrated circle of growth has allowed investigators to conduct innovative translational research directly with children. Toward that end, neuroimaging has allowed investigators to use methods in children derived directly from cognitive neuroscience approaches used in various settings. These approaches create a basis for improving our understanding, assessment, and treatment of psychiatric disorders in children and adults; these approaches also aid the investigation of mechanisms of treatment response and provide imaging phenotypes for understanding genetic effects on brain and behavior. Ultimately, there is potential for the interventional application of the

techniques themselves. Much has been written lately about the future of predictive and, ultimately, preemptive tools in psychiatry. Part of the rationale for such thinking is the knowledge gleaned from neuroimaging and other studies showing that structural and other changes precede the development of psychiatric disorders in asymptomatic children and adolescents. Foreword This knowledge has worked synergistically with that derived from the growing field of early intervention in psychiatric disorders to change our thinking from palliative to predictive to preventive care in psychiatry. There is thus a clear need to refine these multifactorial diseases into mechanism-based subcategories so that particular target-based therapies can be matched to particular markers in subgroups of patients. Biological markers or biomarkers are quantitative measurements that provide information about biological processes, a disease state, or response to treatment. The neuroimaging biomarkers discussed in this volume thus hold the potential to provide a better understanding of the etiology and pathophysiology of the complex and heterogeneous psychiatric disorders. Moreover, biomarkers hold considerable potential to identify patients who are likely to respond to a particular treatment modality. Indeed, the Food and Drug Administration has recently changed its definitions and requirements of biomarkers to include broader categories, and to encourage submissions of putative biomarkers. Since the first edition of this book was published in , an extraordinary number of articles have been published regarding the ability of early intervention to delay the onset or positively influence the course of many psychopathological conditions. Neuroimaging “ both of children and adults ” has been an integral part of this evolving field. However, more research is certainly needed to further elucidate this topic, to identify and refine the prodromal manifestations of each psychopathological condition, to introduce and use appropriate measuring instruments, and to apply validated interventions, particularly in children. Neuroimaging is one of the most powerful tools in our armament to predict psychopathology. Finally, and as Chapter 16 of this book so excellently points out, there are multiple ethical issues concerning neuroimaging in children, and these must be examined very carefully. Given the varied nature of presentation and variability in course of many of the major psychiatric illnesses, separating and appropriately treating at-risk individuals constitutes a serious challenge. Careful selection of the subjects who might benefit from an early intervention and appropriate study designs to correctly evaluate outcome, though ongoing, are still needed. Moreover, the primary outcome measure of randomized controlled trials should be not only syndromic resolution, but also functional and psychosocial recovery, along with cognitive improvement. The results from studies conducted with high-risk subjects will eventually help identify clinical prodromes and biological markers in subjects from the general population as well. As the outstanding chapters in this volume have highlighted, the future of early intervention depends on our ability to identify individuals at risk for developing major psychiatric illnesses, and the capacity to provide targeted treatment that specifically prevents onset or recurrence of episodes. Though such work will not easily be put into practice, we now have significant clues about not only disease onset and progression, but also about the tools that are needed to help implement successful early intervention. Eight years later, these prescient words reflect how quickly extraordinary innovations can be adopted in medicine when they truly advance our understanding. The excellent chapters contained in this book highlight how far the field of neuroimaging in childhood has brought us but, more importantly, how far it can yet take us. This volume updates and expands the earlier *Functional Neuroimaging in Child Psychiatry*, edited by Monique Ernst and Judith Rumsey and published in . Since the publication of the earlier volume, there has been an exponential surge in the number of neuroimaging publications addressing the development of the pediatric brain. Paralleling this growing literature is a widening of the scope and diversity of the studies, with respect to both scientific focus and the methods applied. A heightened focus has been directed onto normative development in a variety of domains, including cognitive control, emotion regulation, goal-directed behavior, social cognition, and language. Recent advances in imaging technologies, such as blood-oxygen-level-dependent BOLD functional magnetic resonance imaging fMRI , diffusion tensor imaging DTI , perfusion imaging using arterial spin labeling ASL , and magnetic resonance spectroscopy MRS now provide a rich armamentarium of techniques whose integration with one another and with other neuroscience approaches offers unprecedented

opportunities for elucidating human neurodevelopment. Structural magnetic resonance imaging, one of the oldest of the techniques included in this volume, has likewise advanced, as new analytic techniques have enhanced our ability to derive meaningful information from anatomical images. Beyond this, these approaches are being expanded to investigate mechanisms of treatment response and to provide imaging phenotypes for understanding genetic effects on brain and behavior. And finally, there are hints of potential for interventional applications of these techniques themselves. This book is organized into five sections. Section 1 is dedicated to the understanding of normative pediatric brain-behavior development. This section describes our knowledge of human structural brain development from a neuroimaging perspective. Key domains of normal developmental processes underlying cognitive and regulatory aspects of human behavior are addressed in six chapters that focus primarily on functional brain measures, including fMRI and electrophysiology. Section 3 will provide the reader with essential knowledge of legal, regulatory, and ethical guidelines and considerations governing research involving children. Section 4 addresses neuroimaging techniques that can safely be used to study children. Also included are two special topics that integrate neuroimaging with other neuroscience approaches – the study of responses to pharmacological and other interventions and imaging genetics, an emerging approach that shows promise for deconstructing complex behavioral phenotypes. Finally, in Section 5 we highlight the value of a developmental perspective and the progress achieved in understanding human brain maturation and developmental neuropsychiatric disorders using these approaches. Finally, we outline some critical needs and challenges and consider directions for future research. The authors wish to thank David Shore, M. We also wish to thank our families for their patience and support while we dedicated so much of our energy toward this unique volume. In addition to improved resolution relative to older imaging techniques, the lack of ionizing radiation and safety made it ethically possible to study healthy, typically developing children and to do so repeatedly. The rapid development of a variety of techniques, all using conventional MRI scanners, quickly expanded research to allow researchers to study, not only structural brain development, but functional and metabolic development as well. To provide an understanding of normal brain development, the six chapters in this section describe our current knowledge of and approaches to studying structural and functional brain development. Lu and Sowell describe and richly illustrate the morphological development of the human brain Chapter 1. Bunge and Crone address the processes, neural correlates of, and developmental changes in, cognitive control Chapter 2. Gotlib and Joormann discuss emotion regulation and stress reactivity, including both neuroimaging and neuroendocrine aspects Chapter 3. In Chapter 4, Ernst and Hardin describe a heuristic model of decision making and preliminary developmental findings. In Chapter 5, Pelphrey and Perlman describe key constructs and early findings in the emerging field of developmental social cognitive neuroscience. Finally, McNealy, Dapretto, and Bookheimer provide a comprehensive look at the neural correlates of the multifaceted aspects of language development Chapter 6. Not only is the literature described key to understanding healthy, typical, or normal brain development, but it also lays a foundation for understanding deviations in development associated with neuropsychiatric disorders, particularly those beginning in childhood and adolescence. The domains and processes covered are critical to self-regulation and healthy behavioral functioning and are those most often impaired in developmental neuropsychiatric disorders. Much of the work to date has involved cross-sectional comparisons of relatively small samples of different age groups. Going forward, longitudinal designs, increasingly being adopted in structural imaging studies, hold promise for mapping developmental trajectories with improved sensitivity to maturational changes. Lu and Elizabeth R. Sowell Introduction Rapid advances in imaging technology have yielded a significant wealth of knowledge about maturational trajectories of human brain development. Magnetic resonance imaging MRI findings are based on signal intensity variations which differentiate tissue types, and regional developmental changes in tissue distribution are thought to reflect cellular changes known from postmortem studies. Imaging studies render longitudinal evaluations possible, and examination of within-subject development across time increases our ability to detect maturational changes embedded within the anatomical variability between individuals. We describe normal morphological maturation findings from three basic approaches for analyzing

T1- and T2-weighted data: Researchers are beginning to link morphological changes to cognitive development, and these efforts represent the next wave of fruitful investigations. Normal morphological maturation Volumetric image analysis First attempts to quantify structural maturation in vivo used stereotaxic region definition schemes because image resolution was relatively low i. Some of these studies assessed whole brain tissue volumes Caviness et al. Algorithms have also been used to warp standardized lobar measures to individual brains and thus define lobar regions automatically Giedd et al. These early studies found decreasing cortical gray matter volume with age while white matter volume increased with age Jernigan and Tallal, ; Jernigan et al. Within lobar regions, frontal and parietal lobes increased in gray matter during childhood years Giedd et al. These changes in lobar gray matter volume occurred concomitantly with increasing white matter volume in the corresponding lobes Giedd et al. The most notable changes during childhood and adolescence occurred in more dorsal cortices Jernigan et al. More ventral cortices of the temporal lobes changed less dramatically between childhood and Neuroimaging in Developmental Clinical Neuroscience, eds. Rumsey and Monique Ernst. Published by Cambridge University Press. Cambridge University Press Normal developmental processes adolescence Giedd et al. Most studies showed decreasing subcortical gray matter volume with age with overall brain volume controlled Jernigan et al. Voxel-based morphometry Volumetric studies can address gross lobar structural changes but are limited in addressing maturational changes with finer spatial resolution. Voxel-based morphometry VBM Ashburner and Friston, , which was initially used to evaluate functional imaging data, has been used to assess structural effects during normal development on a voxel-byvoxel basis Paus et al.

DOWNLOAD PDF NEUROIMAGING IN DEVELOPMENTAL CLINICAL NEUROSCIENCE TODAY JUDITH M. RUMSEY AND MONIQUE ERNST.

Chapter 2 : Neuroimaging in Developmental Clinical Neuroscience - PDF Free Download

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Focusing on ontogeny, this text covers basic processes involved in both healthy and atypical maturation, and also addresses the range of neuroimaging techniques most widely used for studying children. This book will enable you to understand normative structural and functional brain maturation and the mechanisms underlying basic developmental processes; become familiar with current knowledge and hypotheses concerning the neural bases of developmental neuropsychiatric disorders; and learn about neuroimaging techniques, including their unique strengths and limitations. Coverage includes normal developmental processes, atypical processing in developmental neuropsychiatric disorders, ethical issues, neuroimaging techniques and their integration with psychopharmacologic and molecular genetic research approaches, and future directions. This comprehensive volume is an essential resource for neurologists, neuropsychologists, psychiatrists, pediatricians, and radiologists concerned with normal development and developmental neuropsychiatric disorders. Introduction to Section 1; 1. Morphological development of the brain: Lu and Elizabeth R. Neural correlates of the development of cognitive control Silvia A. Bunge and Eveline A. Neurobiology of emotion regulation in children and adults Ian H. Gotlib and Jutta Joormann; 4. Charting brain mechanisms for the development of social cognition Kevin A. Pelphrey and Susan B. Language and the developing brain: Atypical processes in developmental neuropsychiatric disorders: A pathophysiology of attention deficit hyperactivity disorder: Neuroimaging of schizophrenia and its development Macheri S. Diwadkar, Konasale Prasad and Jeffrey A. Cortico-limbic development in bipolar disorder: A neuroimaging view Jessica H. Shah and Hilary P. Anxiety and depressive disorders Daniel S. Disturbances of frontostriatal circuits in Tourette syndrome and obsessive-compulsive disorder Rachel Marsh, Daniel A. Royal and Bradley S. From genes to brain to behavior: Rivera and Allan L. Alcohol exposure and the developing human brain James M. Neuroimaging as a tool for unlocking developmental pathophysiology in anorexia and bulimia nervosa Guido K. Frank and Walter H. Introduction to Section 3; Legal and ethical considerations in pediatric neuroimaging research Clinton D. Techniques and integration with other research approaches: Introduction to Section 4; Diffusion tensor imaging in developmental clinical neuroscience Dae-Shik Kim; Neuroimaging of treatment effects in developmental neuropsychiatric disorders Steven R. Pliszka and David C. Functional alleles, neuroimaging and intermediate phenotypes in the deconstruction of complex behavioral variation David Goldman, Beata Buzas and Ke Xu; Section 5. Progress and future directions: Neuroimaging in developmental clinical neuroscience today Judith M. Neuroinformatics and neuroethics resources; Index.

Chapter 3 : - NLM Catalog Result

Neuroimaging in Developmental Clinical Neuroscience Edited by Judith M. Rumsey Neurodevelopmental Disorders Branch Division of Developmental Translational Research.

Descrizione Modern neuroimaging offers tremendous opportunities for gaining insights into normative development and a wide array of developmental neuropsychiatric disorders. Focusing on ontogeny, this text covers basic processes involved in both healthy and atypical maturation, and also addresses the range of neuroimaging techniques most widely used for studying children. This book will enable you to understand normative structural and functional brain maturation and the mechanisms underlying basic developmental processes; become familiar with current knowledge and hypotheses concerning the neural bases of developmental neuropsychiatric disorders; and learn about neuroimaging techniques, including their unique strengths and limitations. Coverage includes normal developmental processes, atypical processing in developmental neuropsychiatric disorders, ethical issues, neuroimaging techniques and their integration with psychopharmacologic and molecular genetic research approaches, and future directions. This comprehensive volume is an essential resource for neurologists, neuropsychologists, psychiatrists, pediatricians, and radiologists concerned with normal development and developmental neuropsychiatric disorders. Introduction to Section 1; 1. Morphological development of the brain: Lu and Elizabeth R. Neural correlates of the development of cognitive control Silvia A. Bunge and Eveline A. Neurobiology of emotion regulation in children and adults Ian H. Gotlib and Jutta Joormann; 4. Charting brain mechanisms for the development of social cognition Kevin A. Pelphrey and Susan B. Language and the developing brain: Atypical processes in developmental neuropsychiatric disorders: A pathophysiology of attention deficit hyperactivity disorder: Neuroimaging of schizophrenia and its development Matcheri S. Diwadkar, Konasale Prasad and Jeffrey A. Cortico-limbic development in bipolar disorder: A neuroimaging view Jessica H. Shah and Hilary P. Anxiety and depressive disorders Daniel S. Disturbances of frontostriatal circuits in Tourette syndrome and obsessive-compulsive disorder Rachel Marsh, Daniel A. Royal and Bradley S. From genes to brain to behavior: Rivera and Allan L. Alcohol exposure and the developing human brain James M. Neuroimaging as a tool for unlocking developmental pathophysiology in anorexia and bulimia nervosa Guido K. Frank and Walter H. Introduction to Section 3; Legal and ethical considerations in pediatric neuroimaging research Clinton D. Techniques and integration with other research approaches: Introduction to Section 4; Diffusion tensor imaging in developmental clinical neuroscience Dae-Shik Kim; Neuroimaging of treatment effects in developmental neuropsychiatric disorders Steven R. Pliszka and David C. Functional alleles, neuroimaging and intermediate phenotypes in the deconstruction of complex behavioral variation David Goldman, Beata Buzas and Ke Xu; Section 5. Progress and future directions: Neuroimaging in developmental clinical neuroscience today Judith M. Neuroinformatics and neuroethics resources; Index.