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978-0-521-89942-0 - Understanding Neuropsychiatric Disorders: Insights from Neuroimaging

Edited by Martha E. Shenton and Bruce I. Turetsky

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Preface

Historically, the opportunity to examine the inner workings of the human body was limited to the study of cadavers. In the past 30 years, medical imaging technology has provided researchers with a new window into the *living* human body. Advances in medical imaging technology have, in fact, truly revolutionized nearly every area of medicine. These advances include both dramatic improvements in image resolution and the development of novel imaging techniques, from computed axial tomography (CT), to positron emission tomography (PET), to single photon emission tomography (SPECT), to magnetic resonance imaging (MRI), including fMRI (functional MRI) and diffusion tensor imaging (DTI), to magnetic resonance spectroscopy (MRS), ultrasound, and magnetoencephalography (MEG) – all of which provide an unprecedented view, in exquisite detail, of anatomical structures and/or functions in the *living* human body.

One medical discipline that has been in the forefront of this revolution is neuropsychiatry (defined here as encompassing both psychiatry and behavioral neurology), where novel neuroimaging tools have been developed and applied to neuropsychiatric disorders in order to understand further the neuroanatomical and neurophysiological bases of mental illnesses and cognitive disorders, including Alzheimer's and Parkinson's diseases.

This book reviews important new findings about the role of brain abnormalities in neuropsychiatric disorders based on this new imaging technology. In considering the progress in this area, it is clear that initially the quest was to identify and characterize focal brain abnormalities in an effort to delineate further various psychiatric and neuropsychiatric syndromes. Here, as will be evident from the chapters that follow, much work has already been done to characterize brain pathology in disorders for which the etiologies are unknown, there are often no uniform or pathognomonic clinical symptoms, and there is often extensive overlap in clinical presentation across disorders.

More recently, the focus has shifted from the examination of a single brain region, or multiple discrete brain regions, implicated in a particular syndrome or disorder, to the examination of integrated brain systems. This is a common theme that can be followed throughout the chapters of this book. Specifically, the focus has shifted from investigating only gray matter of the brain to investigating the “other half” of the brain, white matter, and the neural networks involved in the pathophysiology of different neuropsychiatric disorders. Accordingly, we have moved from an appreciation that, for example, schizophrenia *is* a brain disorder – something that had been debated prior to the late 1980s – to a quest to understand the complex mechanisms underlying the neuropathology of schizophrenia. Thus there has been a shift from the “what” and “where” of brain regions implicated in neuropsychiatric disorders to an effort to understand the neural basis of clinical symptoms, or “how” abnormal brain regions produce the clinical picture of depression, or autism, or schizophrenia. These advances in neuroimaging are moving us towards a new understanding of neuropsychiatric disorders based on their underlying neurobiology. This will likely facilitate the diagnostic reclassification of these complex heterogeneous disorders, improve our ability to predict treatment outcome, and enhance our understanding of the genetic and environmental causes of these disorders.

The change in focus from discrete brain regions and gray matter to white matter and the integrated systems that underlie cognitive, behavioral, and emotional abnormalities has followed, closely, the advances and inroads made in imaging technology. Importantly, none of the insights into the neuropathology of neuropsychiatric disorders, to date, would have been possible without these advances. That is, without the tools to probe the brain, *in vivo*, we could not even have begun to ask questions about brain structure and function and their perturbations in

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neuropsychiatric disorders. There is now, however, a need to go beyond the technology and shift to more hypothesis- and model-driven approaches. These new approaches must not only elucidate the neural networks involved in complex disorders, but must also examine the inter-relationships among genetic variables, environmental stressors, behavioral, cognitive, social, and emotional factors, and the structural and functional integrity of the neural systems that underlie the symptomatology presently used to classify these disorders.

When we were first approached by Marc Strauss at Cambridge University Press to edit a book on neuroimaging and its contribution to what we know about neuropsychiatric disorders, we thought such a book was very timely, as we believe we are now at a critical juncture in terms of our knowledge of the living brain in both health and illness. Moreover, we believe that the most interesting and important findings are yet to come.

In the chapters that follow, the current status of neuroimaging is reviewed for each of the leading neuropsychiatric disorders. The “maturity” of this research and the breadth and depth of the available data vary considerably across disorders. In some cases, such as schizophrenia or mood disorders, neuroimaging findings are quite extensive, requiring separate chapters to review structural imaging (Proton MR and DTI), functional imaging (fMRI and PET/SPECT blood flow and metabolism studies), and molecular imaging (PET/SPECT receptor studies and MR spectroscopy). In other cases, such as autism spectrum disorders, the data are still relatively sparse and findings across imaging modalities

are reviewed in a single chapter. Each disease section ends with a commentary from a luminary in the field, addressing the broad question: “What do we know and where are we going?” This was a feature that we decided to include very early in the editorial process. Given the broad scope of the book, we thought it important for a luminary to review each section, to provide a synthesis, and to comment more generally on the knowledge gleaned from these imaging techniques. The intended audience for this book is also broad and includes the clinical psychiatrist, the general practitioner, the psychiatry or neurology resident, the medical student, the PhD student in psychology or neuroscience, and/or the post-doctoral fellow interested in learning more about how neuroimaging tools lead to new discoveries about brain and behavior associations in neuropsychiatric disorders.

We wish to thank Marc Strauss, Richard Marley, and Nisha Doshi at Cambridge University Press for their assistance on all aspects of this book. We also wish to thank our spouses, George and Nancy, who kindly accepted our taking on, yet again, just one more task. Finally, we give our heartfelt thanks to all of the authors of the chapters in this book. These are leading investigators in their respective fields, who have graciously taken the time to offer their insights into neuropsychiatric disorders based on advances in neuroimaging. It goes without saying that, without them, this book would not exist.

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