
MRI in Psychiatry

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Editors

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 Springer

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Preface

Magnetic resonance imaging (MRI) is a technique that is widely used in many fields of modern medicine today for the investigation of structure and function of the human body. MRI is a routine procedure for medical diagnosis, for staging of disease, and for follow-up without exposure to ionizing radiation. It has also become an essential tool for understanding the brain as it offers an important window for viewing both brain structure and function in living humans, where previously most information came from postmortem studies. Neuroscience, and a focus on the brain, most particularly in neuropsychiatric disorders, has been an area of intense scientific inquiry. For understanding these conditions – with unknown etiologies and many open questions concerning pathophysiology and therapy – insights into brain structure and function have been greatly enhanced with the advent of advanced MRI. MRI can be safely done at many imaging facilities all over the world and has become very attractive for young researchers who are thinking about a career in the area of neuroscience that involves neuroimaging techniques. This book is intended to provide an overview and to introduce this fascinating area of scientific inquiry to the Ph.D. student in psychology or neuroscience, to the medical student, and also to residents in psychiatry or clinical psychiatrists. The chapters are written by leading experts in their respective fields. Given the fast-paced development of new and distinctive MRI techniques, this book will also be of interest to experienced researchers who want an overview about topics they are not specialized in themselves.

This book is divided into three sections. With respect to the background of the three sections, we thought it would be important to provide a comprehensive textbook that includes information about methodology and concepts, as well as brain systems and psychiatric disorders, all in one place. Accordingly, the book is divided into three sections with the first part of the book focused on relevant methods. It introduces the basic aspects of fMRI statistics and advanced statistical procedures for effective connectivity analyses, as well as technology and applications of real-time fMRI. Moreover, different MRI techniques are described such as MR spectroscopy, diffusion tensor Imaging (DTI), or simultaneous EEG-fMRI. In addition, we have the impression that there is a need to go beyond MRI technology itself and shift to more hypothesis- and model-driven approaches. Accordingly, combinations of MRI with other approaches that have been successfully used are introduced, such as the combination of MRI with brain stimulation procedures, or imaging genetics,

a scientific field that is very influential in the understanding of psychiatric disorders today. The second part of the book introduces the reader to major brain systems. Here, possibilities, including recent findings and limitations, are reviewed for MRI imaging in the context of perception, cognition, emotion, and reward. Finally, the third part of the book covers most of the major psychiatric diseases. Here, findings with different MR techniques are summarized in individual chapters. As the reader will come to understand, the number of studies is different among the different psychiatric conditions. We nonetheless decided to include disorders that have a smaller number of studies completed thus far given their clinical relevance, such as personality disorders. This book can thus be read in different ways: from the very beginning to the end for obtaining a comprehensive overview – or as a reference for certain topics both in advanced MRI techniques and in MR findings that are relevant to specific psychiatric disorders.

We note that while MRI techniques are widely used clinically for medical diagnosis, and, as noted previously, for staging of disease as well as for follow-up, MRI in psychiatry is still more in its infancy and is used more as a research tool where groups of clinical populations are compared to healthy controls rather than as a clinical tool that provides information for an individual patient. The latter, however, is changing and the potential is quite high for neuroimaging to be used diagnostically in the near future where individual patients will benefit from the tools that are now used solely for research purposes. Some of these latter ideas are also expressed in this book, particularly with respect to the early diagnosis of Alzheimer's dementia, as well as therapeutic applications with real-time fMRI neurofeedback.

Finally, no project of this scope is ever done alone. First and foremost, we want to thank all of the authors who contributed their time and effort to make this book a reality. Second, we wish to thank Meike Stoeck from Springer for her assistance on all aspects of this book. We also thank Marius Mußmann who was of great help in making this book come to fruition. And we also wish to thank our spouses, Marianne and George, who have supported our endeavors.

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