Essential Neuroscience for Psychiatrists

Neuroscience is increasingly understood to ground the practice of psychiatry, but clinicians can be overwhelmed by the competing facts and unfamiliar approaches utilised. This book provides key, up-to-date findings in neuroscience, and their relevance to clinical psychiatry, in an approachable format.

Clinical experts summarise the most important findings in diverse fields of neuroscience and explain their relevance for clinical practice. Topics include neuroanatomy, neurophysiology, neuropharmacology and neurophilosophy, imparting essential knowledge for the MRCPsych syllabus and examinations, as well as conveying important recent developments. Each chapter is designed to aid comprehension and learning with suggested readings, equipping the reader with the knowledge and skills to understand, assess and treat those with mental health problems in the twenty-first century.

Expertly covering essential neuroscience topics with a clear emphasis on clinical relevance, this book is ideal for clinicians in psychiatry, psychology and allied fields such as mental health nursing.

Niruj Agrawal is a consultant neuropsychiatrist at St George's Hospital, London. He is a fellow of the RCPsych, was vice chair of the Faculty of Neuropsychiatry and is a member of the MRCPsych examinations subcommittee. He sits on the Board of Directors of the International Neuropsychiatry Association and is the lead co-editor of the *Oxford Textbook of Neuropsychiatry*. His interests include neuropsychiatric conditions in neurological settings, brain injury and functional neurological disorders. He has published over 90 peer-reviewed papers and chapters, and is on the editorial boards of BJPsych Open and BJPsych Bulletin.

Norman Poole is a consultant neuropsychiatrist at South London and the Maudsley NHS Foundation Trust. He is a fellow of the RCPsych, edited the RCPsych Bulletin from 2018 to 2022, and sits on the College's Paper A Panel. He holds a National Institute for Health and Care Research grant investigating Acceptance and Commitment Therapy as a treatment for Functional Cognitive Disorder, and sits as an executive director of the British Neuropsychiatric Association. He is also the psychiatric member of the Ministry of Defence's Independent Medical Expert Group and Founding Member of the Functional Neurological Disorder Society.

'I am really pleased to see this book, from both my clinical and my academic perspective. This book not only covers the essential neuroscience syllabus content for MRCPsych basic sciences but also goes further in providing a very well laid-out neuroscience resource for psychiatrists to develop their knowledge and skills in this important and growing area. The language and format are really accessible and make even complex information really easy to understand and assimilate.'

Dr Vivek Agarwal
Consultant Psychiatrist; Chief Examiner, Royal College of Psychiatrists

'Neuroscience is a key pillar and ally of psychiatric research and practice, and an academic area that advances at a tremendous pace. The editors have done an exemplary job in curating important contemporary overviews of the subfields of neuroscience relevant to the psychiatrist, and summarising their crucial role in patient care. It's particularly pleasing to see contributions detailing neuroimmunology, neurophilosophy and sleep, key areas relevant for practice that are lacking in many texts. I recommend this excellent book to psychiatrists, trainees and students, and all mental health clinicians and researchers.'

Professor Matthew Broome
Chair in Psychiatry and Youth Mental Health, and Director of the Institute for Mental Health, University of Birmingham, UK

'Neuroscience is the bedrock of clinical psychiatry – from pharmacology to psychotherapy. As a clinical academic, I found this textbook to be a comprehensive yet accessible resource for everyday clinical practice, e.g. for sleep or eating disorders, and also for a more in-depth understanding of the fascinating underpinnings of psychiatric disorders. The illustrations are top notch and ones I will be sharing with my patients.'

Professor Subodh Dave
Dean, Royal College of Psychiatrists

'All medical specialties require broad understanding across the biosciences. For the psychiatrist that means being thoroughly grounded in neuroscience, but with a perspective that can link the integrated action of cells and synapses to the thoughts, feelings and behaviour of human beings.

A challenge mental health professionals share with biomedical colleagues is keeping abreast of advances in technologies and new discoveries in the molecular and computer age. Information is so abundant as to be overwhelming. The editors have managed to assemble a team of experts in their fields who are not only top academics but gifted communicators who have managed to distil current knowledge in a digestible form. They have pulled off an almost magical trick of conveying depth and complexity without extraneous details, and using clear and attractive illustrations without dumbing down the message. Reading this collection is like going on a journey of discovery which ends at a place where the clinical encounter can confidently begin on a stable platform of evidence and learning and more than a touch of wisdom.'

Anthony David
Professor of Mental Health, University College London, and Honorary Consultant Neuropsychiatrist, National Hospital for Neurology and Neurosurgery, London

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Edited by
Niruj Agrawal
St George's Hospital London
Norman A. Poole
South London and the Maudsley NHS Foundation Trust

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Contents

Contributors

Adam Al-Diwani
Department of Psychiatry, University of Oxford, Oxford, UK

Derek B. Bolton
Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

Andrea E. Cavanna
Michael Trimble Neuropsychiatry Research Group, and University of Birmingham, Birmingham, UK; School of Life and Health Sciences, Aston University, Birmingham, UK; Sobell Department of Motor Neuroscience and Movement Disorders, UCL and Institute of Neurology, London, UK

Alasdair Coles
Department of Clinical Neurosciences, University of Cambridge, Cambridge, UK

David Curtis
Division of Biosciences, University College London, London, UK

Valentina Gnoni
Sleep and Brain Plasticity Centre, CNS, IoPPN, King's College London, London, UK; Sleep Disorders Centre, Guy's and St Thomas' Hospital, GSTT NHS, London, UK

Paul Johns
St George's University Hospitals NHS Foundation Trust; St George's, University of London, London, UK

Belinda Lennox
Department of Psychiatry, University of Oxford, Oxford, UK

Raka Maitra
Tavistock and Portman NHS Foundation Trust, London, UK; Department of Psychosis, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

Katie Marwick
Division of Psychiatry, University of Edinburgh, Edinburgh, UK

Nandini Mullatti
Department of Clinical Neurophysiology, King's College Hospital NHS Trust, London, UK

Andrea Nani
GCS-fMRI, Koelliker Hospital and Department of Psychology, University of Turin, Turin, Italy; FOCUS Lab, Department of Psychology, University of Turin, Turin, Italy

Gemma Northam
Psychology Department, Royal Holloway, University of London, London, UK

David Cunningham Owens
Division of Psychiatry, University of Edinburgh, Edinburgh, UK

Toby Pillinger
Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

Norman A. Poole
Lishman Unit, Department of Neuropsychiatry, South London & Maudsley NHS Foundation Trust, London, UK

List of Contributors

Ivana Rosenzweig
Sleep and Brain Plasticity Centre, CNS, IoPPN, King's College London, London, UK; Sleep Disorders Centre, Guy's and St Thomas' Hospital, GSTT NHS, London, UK

Samantha Scholtz
Division of Diabetes, Endocrinology and Metabolism, Imperial College London, London, UK

Hugh Selsick
Insomnia and Behavioural Sleep Medicine Clinic, University College London Hospital, London, UK

Sukhi Sherghill
Kent and Medway Medical School, Canterbury, UK; Kent and Medway NHS and Social Care Partnership Trust, UK; Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

Martin van den Broek
The Neuropsychology Clinic, Guildford, UK

Pedro F. Viana
School of Neuroscience, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

Danielle Wasserman
Sleep and Brain Plasticity Centre, CNS, IoPPN, King's College London, London, UK; Sleep Disorders Centre, Guy's and St Thomas' Hospital, GSTT NHS, London, UK

Foreword

Neuroscience has been a rapidly developing field over the last few decades. As a result, our understanding of the aetiology of psychiatric disorders has been transformed. We have moved away from a simple reductionist model of causation to an understanding of how the interaction of neurobiological systems can lead to mental ill health and the disorders we see in psychiatric practice. We are also developing a much better understanding of how the psychological and social factors that we know are important in the aetiology of psychiatric disorders may be mediated in the brain.

This has profound implications for the practice of psychiatry. As well as identifying the causes of specific conditions, we have a much better understanding of how existing interventions work. We are also able to identify biological targets for future interventions, not only for when the conditions are manifest, but with the aim of preventing such conditions develop.

At the Royal College of Psychiatrists, we therefore strongly believe that all doctors practising psychiatry need to have a sound understanding of the scientific and theoretical basis of psychiatry. In order to demonstrate this, prospective members need to pass Paper A of the MRCPsych examination. We have developed the syllabus in recent years to reflect the advances in neuroscience in recent years that are already having a profound influence on the practice of psychiatry. We focus not only on knowledge of the normal structure and functioning of the nervous system as it relates to psychiatry (i.e. the generation of normal mental states and behaviours, and of the dysfunction that leads to mental disorder) but also on the ability to relate the symptoms and signs of mental disorder, and the examination of the nervous system, to underlying neural structures and their activity. Rapidly developing fields such as neuroendocrinology, neuroimmunology and genetics are explicitly included. Neuroscience also has much overlap with clinical psychopharmacology, where an understanding of brain science is an essential basis for understanding pharmacokinetics, pharmacodynamics and therapeutics.

Essential Neuroscience for Psychiatrists is a much needed and invaluable aid to preparing for this examination. The chapters are well pitched at an appropriate level for postgraduate doctors, and clearly map onto the relevant areas of the MRCPsych syllabus. The style is accessible, with much use of figures and tables to aid learning and revision. It is comprehensively referenced for those that want to extend their knowledge further. One particular strength throughout the book is its focus on clinical relevance, which is helpful in enabling readers to integrate the scientific understanding with their clinical knowledge. Examples include the neuroanatomy of psychiatric conditions such as obsessive compulsive disorder and autism, neurophysiology of transcranial magnetic stimulation, and the biology of neurodevelopmental conditions such as attention deficit hyperactivity disorder. There is also much that is relevant to the development of personalised medicine approaches, for example in relation to the neurogenetics of intellectual disability and psychiatric conditions, the neuroimmunology of autoimmune encephalitis and a more nuanced approach to psychopharmacology.

Preparing for postgraduate medical examinations is challenging, especially as it usually has to be fitted around work and other commitments. Choosing the optimal range of learning strategies is critical to success. Some choose to focus their learning on question banks, and while such a strategy has its place, it is

much less good when it comes to developing a coherent understanding of the whole topic, how different aspects of neuroscience integrate with others and for knowing the recent advances in the field. Study of *Essential Neuroscience for Psychiatrists* will certainly be extremely helpful in addressing this gap, especially with the College's focus on including a high proportion of new questions in each set of the examination.

Dr Ian Hall
Chief Examiner, Royal College of Psychiatrists
April 2024

Preface

Not many will dispute now that a rigorous grounding in neuroscientific principles behind the functions of the brain including thoughts, emotions and behaviours is paramount for the psychiatrists of the future. Understanding the basic neurosciences relevant to psychiatry is an essential part of the widely accepted biopsychosocial model. Despite that, there is widespread recognition that the knowledge of and exposure to neuroscience remain suboptimal. The Royal College of Psychiatrists, through initiatives such as the Gatsby Project, has taken a global leadership role in emphasising the importance of neurosciences in psychiatric training and future clinical practice. We hope this book will help in fulfilling this objective and help psychiatric trainees and clinicians of the future to develop greater understanding and interest in this topic.

The editors of this volume both work primarily as clinical neuropsychiatrists. This is often assumed to be a peripheral psychiatric speciality that cares for a narrow subset of patients. In fact, neuropsychiatry is a broad psychiatric speciality which still sees the whole spectrum of psychiatric presentations. The types of cases and proximity to neuroscience centres do, however, bring us into close contact with methodological and academic developments being made in the clinical neurosciences and how they apply to psychiatry. Many of the trainees who choose a placement with our neuropsychiatry service do so with the aim of gaining greater experience and understanding of the 'neuro' disciplines that support and deepen psychiatric practice. However, many more trainees want this exposure, but neuropsychiatry placements are a rarity, and some training schemes do not offer such opportunities at all. Neuroscience remains peripheral within some psychiatric specialities leaving trainees feeling ill-equipped to become psychiatrists of the future.

This volume has been motivated by discussions with trainees about what they most desire during their neuropsychiatry placement and with many other psychiatrists in training who show interest in understanding the biological aspects of common psychiatric conditions. This begins with greater exposure to neuroanatomy, particularly functional neuroanatomy, and how lesion location relates to organic psychiatric presentations. Often the trainees expect more precise correlation than is actually the case in practice. We are fortunate to work closely with neurophysiologists and neuroradiologists and have the opportunity to attend neuroradiology meetings to discuss complex presentations and their possible aetiological link with the manifest brain lesion associated diagnostic uncertainty. It is therefore appropriate that this book begins with a detailed chapter on neuroanatomy to acquaint the reader with the 'geography' of their organ of study. Similarly, it is essential for trainees to develop a rigorous understanding of neurophysiology and neurochemistry given their importance to the mainstay of treatments that most psychiatrists will spend their working lives providing.

We have reviewed chapters on neurodevelopment, neuropsychology and other core 'neuro' disciplines in published textbooks aimed at trainees and found them wanting. They are often overly dense, expecting the reader to already be a specialist, and fail to build from basic principles to deeper understanding. Beyond this, we are especially pleased to present accessible overviews of emerging fields that are becoming clinically essential to practising psychiatrists. This includes relevant developments within neurogenetics and neuroendocrinology, with state-of-the-art chapters on the way the fields of neuroinflammation and neuroimmunology are challenging and reconfiguring our understanding of traditional psychiatric presentations and classification.

Each chapter in this book has been written by experts close to both the academic and clinical material. Rather than produce a traditional textbook, which can be dry and unrewarding to read, each chapter

balances the essential underlying neuroscientific concepts with sections on their current clinical relevance. Readers are also signposted to key papers and texts to further their understanding. Trainees will benefit from reading chapters as they encounter different patient groups to support and consolidate their learning and understanding. Ideally, the clinical material in each chapter, alongside cases encountered in the clinic, should bring the neuroscientific concepts to life with practical relevance to the psychiatrist.

The Royal College of Psychiatrists aims to foster a greater understanding of neuroscience among psychiatrists and has been revising the curriculum and content of their examinations in line with this goal. We hope that this volume supports and aligns with this initiative, which we endorse. Nevertheless, we are mindful that enhanced knowledge of the neuroscientific advances reshaping psychiatry does not invalidate allied fields such as the social sciences and psychology. Indeed, the chapter on neurophilosophy in this volume illustrates how neuroscience is compatible with social and psychological concepts without reducing one to the other. In our view, an excellent psychiatrist is able to utilise all these knowledge domains when formulating individual cases, which is what makes psychiatry such a demanding and distinctive profession. Our ambition is that this book helps psychiatrists to meet this challenge in the 21st century.

Niruj Agrawal
Norman A. Poole