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John F. Cryan · Andreas Reif
Editors

Behavioral Neurogenetics

 Springer

Editors

John F. Cryan
Department of Anatomy and Neuroscience
University College Cork
Western Gateway Building
Western Rd., Cork
Ireland

Prof. Dr. Andreas Reif
Department of Psychiatry
and Psychotherapy
University of Würzburg
Füchslinstrasse 15
97080 Würzburg
Germany

ISSN 1866-3370

ISSN 1866-3389 (electronic)

ISBN 978-3-642-27858-7

ISBN 978-3-642-27859-4 (eBook)

DOI 10.1007/978-3-642-27859-4

Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2012936979

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Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

The field of behavioural neurogenetics has developed significantly over the past two decades. This has been largely driven by technical advances in the field of molecular genetics both in model systems and in clinical analysis. Indeed, it is hoped that the elucidation and ongoing functionalisation of the human genome may provide new insights into the aetiology, course and, ultimately, treatment of psychiatric illnesses.

This book covers a wide array of topics relevant to behavioural genetics from both a preclinical and clinical standpoint. Indeed in juxtaposing both areas of research the reader will appreciate the true translational nature of the field. Topics covered range from technical advances in genetic analysis in humans and animals to specific descriptions of advances in schizophrenia, attention disorders, depression and anxiety disorders, autism, aggression, neurodegeneration and neurodevelopmental disorders. The importance of gene–environment interactions is emphasised and the role of neuroimaging in unravelling the functional consequences of genetic variability described.

Part I of this book focuses on advances in the basic sciences of behavioural neurogenetics with a strong emphasis on animal models of psychiatric illness. It opens with a chapter by Robert Gerlai highlighting the use of model organisms and specifically zebrafish (*Danio rerio*) in modelling complex human psychiatric disease and its applicability for behavioural genetic studies. Lisa Tarantino follows by giving the state of the art on forward genetic approaches to elucidate the contribution of genetic variation to complex behavioural phenotypes. Carola and Gross illuminate the relative contribution of environment and genetics to psychopathology and how this is informing translational studies in animals and humans. Miczek and colleagues discuss the neurobiological mechanisms underlying aggression and how it can be modified in genetically modified mice. Wegener, Mathe and Neumann describe the utility of various selectively bred rodent strains to ask key questions regarding the underlying pathophysiology of depression and anxiety. Next up is a chapter on how genetic manipulations in rodent models have allowed for analysis of the impact of specific roles of glutamate receptors and transporters in cognitive and emotional behaviours shown to be

altered by stress. The final two chapters are relevant to schizophrenia. First, O’Tuathaigh and colleagues describe how phenotypic characterisation of genetic models of candidate risk genes and/or putative pathophysiological processes implicated in schizophrenia, as well as examination of epidemiologically relevant gene \times environment interactions in these models, can illuminate molecular and pathobiological mechanisms involved in schizophrenia. Powell, on the other hand, reviews the literature on genetic models of sensorimotor gating as they apply to schizophrenia and other neuropsychiatric disorders and discusses the utility of prepulse inhibition as a tool in phenotyping mutant mouse models.

Part II of this volume focuses on advances in clinical genetic analysis as applied to various neuropsychiatric disorders. Bayes and colleagues describe how second generation sequencing technologies are generating unprecedented amounts of sequence data very rapidly and at relatively limited costs. They also describe the challenges associated with such data generation in terms of data interpretation, analysis and management in addition to highlighting where such technologies are moving to in the future. Hakonarson and colleagues follow on with a description of the role of copy number variations in a number of neurodevelopmental disorders including autism, attention-deficit/hyperactivity disorder and schizophrenia. They also discuss relevant methodological considerations for such analysis. The application of neuroimaging has transformed modern neuroscience research, thus Hariri and colleagues describe how such approaches can be used to understand the interplay between genes and behaviour in shaping individual variability in brain function. Christine Freitag, Philip Asherson and Joahannes Hebebrand discuss in detail the behavioural neurogenetics of childhood disorders including autism spectrum disorders, attention deficit/hyperactivity disorder, nocturnal enuresis and obesity. A chapter follows this on the use of new technologies to identify genes relevant to Schizophrenia by Dan Rujescu. As highlighted in the preclinical section there is growing appreciation of gene–environment as an emerging area in psychiatry research. Katja Karg and Srijan Sen give a comprehensive introduction to the field from a clinical context emphasising theoretical and practical problems that are worth considering. The behavioural neurogenetics of affective and anxiety disorders is expertly reviewed by Katharina Domschke and Andreas Reif in the subsequent chapter. This is followed up by a discussion by Quinn and colleagues of the contribution of variable number tandem repeat polymorphisms to a range of psychiatric disorders. Individual variability in response to stimulant drugs has long been known and Amy Hart, Harriet De Wit and Abraham Palmer examine the evidence for the contribution of genetic polymorphisms to this response. The penultimate chapter in the book focuses on the cognitive genetics of psychiatric disorders and reviews evidence for the heritability of the main cognitive phenotypes and early progress in the field using cytogenetic, linkage and candidate gene-based research methodologies. The book closes with a chapter from Daniela Galimberti and Elio Scarpini on the behavioural genetics of neurodegenerative disorders with a special focus on susceptibility genes for Alzheimer’s Disease and Frontotemporal Lobar Degeneration.

These chapters, either individually or as a whole, provide a broad overview of the current status of a rapidly evolving and exciting field. Both the basic scientist and clinician alike will value this volume. It will also be of use to the novice to the field, to whom it will serve as an in-depth introduction to this area of research. Finally, it is worth noting that the advances made in behavioural neurogenetics to date have been very promising and we are particularly optimistic that the parallel advances in both basic and clinical neurogenetics fields will lead to a better understanding and eventual treatment strategies for complex neuropsychiatric disorders where there remains a large unmet medical need.

Cork, Ireland
Würzburg, Germany

John F. Cryan
Andreas Reif

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