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The Promises and Perils of Neuroscience Research on Addiction

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ADRIAN CARTER AND WAYNE HALL

CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town,
Singapore, São Paulo, Delhi, Tokyo, Mexico City

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9781107003248

First published 2012

Printed in the United Kingdom at the University Press, Cambridge

A catalogue record for this publication is available from the British Library

Library of Congress Cataloging-in-Publication Data

Carter, Adrian.
Addiction neuroethics: the promises and perils of neuroscience research on addiction / Adrian Carter and Wayne Hall.
p. cm. – (International research monographs in the addictions)
ISBN 978-1-107-00324-8 (Hardback)
1. Drug addiction. 2. Neurosciences–Moral and ethical aspects.
I. Hall, Wayne. II. Title. III. Series.

HV5801.C34 2012
174.2′8–dc23

2011026105

ISBN 978-1-107-00324-8 Hardback

To Donna and Pat

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Preface

This book aims to provide a systematic analysis of the social and ethical implications of neuroscience research on addiction that will be of interest to a wide range of audiences. This includes those interested in, or working within, the fields of addiction and mental health, such as clinicians and health care professionals treating addiction and mental disorders, addiction researchers from neuroscience, psychology and the social sciences, lawyers, policy makers and public health educators. It should also be of interest to bioethicists, neuroethicists and others working in applied philosophy, who want to understand how neuroscience may affect society and public policy. *Addiction Neuroethics* is designed to be accessible to advanced undergraduate and post-graduate students in philosophy and ethics, medicine and psychiatry, psychology, social work, nursing and law, and educated general readers who want to learn more about the impact that drug use might have on the brain and on our ability to control our behaviour.

In 1997, the then director of the National Institute on Drug Abuse, Alan Leshner, famously proclaimed that '*addiction is a brain disease, and it matters*'. Neuroscience research, Leshner promised, would revolutionise our ability to treat addiction and lead to greater acceptance by society of addiction as a psychiatric disorder, increasing access to medical treatment and decreasing societal discrimination and stigma affecting those suffering from addiction. Neuroscience research would put to an end claims that addiction was simply an excuse for engaging in immoral or weak-willed behaviour, and produce more humane and therapeutic approaches to addiction.

Unfortunately, these optimistic predictions have yet to be realised. Most addicted individuals do not receive adequate medical or therapeutic assistance, even in developed countries. There is some evidence that negative attitudes toward 'addicts' have hardened with increasing acceptance of neurobiological models of psychiatric disorders. Some commentators have also begun to point out some potentially adverse consequences of the view that addiction is a brain disease. For example, an unqualified acceptance of the brain disease model of addiction carries substantial social policy risks:

- It focuses on addiction to the exclusion of other adverse effects of drug use (e.g. drug-related accidents, violence or drug-induced mental illness).
- It may unwittingly promote a policy preference for biological treatment of addicted individuals over effective social policies to minimise drug use and addiction (e.g. taxation, barriers to access).
- It may be seen as warranting experimentation with neurosurgical interventions in brain function to 'cure' addiction, as has happened in the case of neurosurgery and deep brain stimulation.
- It may also increase the use of coercive forms of treatment for addicted persons whose capacity to make free and informed choices is said to be seriously impaired by their 'brain disease'.

These outcomes are already providing challenges to health care workers, scientists and policy makers working in the field of addiction. They have the potential to cause unanticipated harm to those who suffer from an addiction and lead to misguided social policies that may paradoxically increase drug-related harm. Such misuses of neuroscience research may also lead to community scepticism or mistrust of neuroscience and neuroscientists, impeding the timely translation of research into beneficial treatments and policy.

According to many neuroscientists, addiction is a condition where repeated use of addictive drugs produces changes in the brain that undermine an addicted individual's ability to control their drug use. According to prominent psychiatrists Charles Dackis and O'Brien, the brains of addicted individuals have been '*hijacked*' by the drug. 'Addicts', they argue, are neurochemically driven to repeatedly consume drugs, despite the harm that their use causes to themselves and those around them. Such views question philosophical concepts such as free will, agency and responsibility. The ethical, social and public policy implications of addiction neuroscience will also provide instructive case studies for examining the broader neuroethical implications of neuroscience for society.

A detailed consideration of the ethical, social and policy challenges raised by neuroscience research is essential if we are to realise some of Leshner's promises about addiction neuroscience, with minimal delay and without causing harm. Our aim is to provide an accessible analysis of these challenges raised by developments in neuroscience, and, when possible, to offer guidelines and recommendations to those treating addicted individuals, conducting addiction research, seeking policy solutions, or simply affected by their own or a family member's addictive drug use.

We have four major objectives that are reflected in the four parts of this book. First, we critically review neuroscience research on addiction, from genes and molecular and cellular biology through to neuropsychology and cognitive neuroscience. We examine the impact that addictive drug use has on decision-making and control over behaviour. We also include evidence from the social and historical sciences to provide a social context to our analysis of the neuroscience. This is both a synthetic and an analytical project: it aims to bring together information and research from a range of disciplines in order to better understand the potential social impacts of neuroscience research on addiction.

Second, based on this review, we provide clear practical recommendations for treating addiction and dealing with addicted individuals, such as:

- Entering addicted individuals into treatment
- Providing treatments, including harm reduction programs, in a fair and equitable manner
- The use of coercion in treating addiction
- Conducting neuroscience research with addicted individuals

Third, we examine the latest developments in neurobiological treatments of addiction to identify the ethical, social and policy issues that their potential future use may raise. These include:

- Novel psychopharmacological treatments
- Sustained-release medications (e.g. drug implants and depot injections)
- Drug vaccines to prevent relapse
- Neurosurgical treatments (e.g. deep brain stimulation)
- Genetic screening and neuroimaging to identify those vulnerable to developing addiction

Based on this analysis, we provide ethical guidelines for conducting research on these interventions and for their clinical use, should they prove safe and effective.

Finally, we consider some unwelcome consequences of the misuse of neuroscience research for social and public health policy. These include: a focus on medical responses to addiction targeted at vulnerable individuals at the expense of more broadly effective population approaches; and the potential misuse of neuroscience research by the alcohol, tobacco and gambling industries to influence public policy in directions favourable to their interests. This book is only a beginning; we raise many questions that will require much more research and analysis. We therefore conclude the book with some suggestions for future research in the field of *Addiction Neuroethics*.

Acknowledgements

This book is an expanded and updated version of Adrian Carter's Doctoral Dissertation submitted to the Queensland Brain Institute, The University of Queensland in 2009. It builds on Wayne Hall's long-standing interests in the ethical, social and policy issues raised by research on addiction, initially as the Director of the National Drug and Alcohol Research Centre, University of New South Wales, and more recently as NHMRC Australia Fellow and Director of the Addiction Neuroethics Unit, The University of Queensland Centre for Clinical Research.

There are many researchers and colleagues who we are indebted to for their kind support and insight during the research and preparation of this book. We would like to sincerely thank Judy Illes and Eric Racine for their ongoing support and encouragement for this project. They have been invaluable in highlighting the importance of Addiction Neuroethics as well as providing important reflections on our arguments. We would also like to offer our appreciation to the following for comments and insights on earlier drafts of the material in this book: Perry Bartlett, Director of the Queensland Brain Institute for funding Adrian Carter's post-graduate research and his support throughout his thesis; Benjamin Capps, David Nutt and Richard Ashcroft who we collaborated with on a project for EMCDDA and who made important contributions on many parts of this research; Robert Hester, Craig Fry and Murat Yucel at The University of Melbourne; Dan Lubman at Turning Point, Melbourne; Mark Daglish of The University of Queensland; and Peter Miller at Deakin University. We would like to thank the two anonymous reviewers for their thoughtful comments on the proposal for this book, as well as the staff at Cambridge University Press (particularly Joanna Chamberlin). We would also like to thank colleagues at the Addiction Neuroethics Unit, UQ Centre for Clinical Research for their ongoing support and editorial advice: Jayne Lucke, Coral Gartner, Brad Partridge, Sarah Yeates, Rebecca Mathews and Stephanie Bell. We would also like to thank both our friends and families. Last but not least, we would offer our most sincere appreciation to Donna and Pat, without whose unflinching support, this book would not be possible. Any errors or omissions that remain, however, are solely the responsibility of the authors.

Portions of Chapters 3 and 4 previously appeared in Carter, A., Capps, B., Nutt, D., ter Muelen, R., Ashcroft, R. and Hall, W. (2009) *Addiction neurobiology: ethical and social implications,* European Monitoring Centre for Drugs and Drug Addiction, Lisbon.

Portions of Chapters 5 and 8 previously appeared in Carter, A. and Hall, W. (2007) *The ethical use of psychosocially assisted pharmacological treatment of opioid dependence,* World Health Organization, Geneva.

Portions of Chapters 6 and 9 previously appeared in Carter, A. and Hall, W. (2008) The issue of consent to research that administers drugs of addiction to addicted persons, *Accountability in Research,* **15**, 209–225 and Carter, A. and Hall, W. (2008) Informed consent to opioid agonist maintenance treatment: recommended ethical guidelines, *International Journal of Drug Policy,* **19**, 79–89.

Chapter 8 originally appeared in *Mental health and human rights* (Eds, Dudley, D., Silvoe, D. and Gale, F.) Oxford University Press, London, (2012).

Portions of Chapter 10 previously appeared in Hall, W., Capps, B. and Carter, A. (2008) The use of depot naltrexone under legal coercion: the case for caution, *Addiction,* **103**, 1922–1924.

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Abbreviations

aCG	Anterior cingulate gyrus
ADH	Alcohol dehydrogenase
ADHD	Attention deficit hyperactivity disorder
AIDS	Acquired immune deficiency syndrome
ALDH	Aldehyde dehydrogenase
AU$	Australian dollars
BBV	Blood-borne virus
BOD	Burden of disease
CB1	Cannabinoid receptor 1
CB2	Cannabinoid receptor 2
COMT	Catechol-*O*-methyl transferase
CRF	Corticotropin-releasing factor
D1, D2, D3, D4	Dopamine receptors 1, 2, 3 and 4
DA	Dopamine
DALYs	Disability adjusted life years
DAT	Dopamine transporter
DBS	Deep brain stimulation
DDS	Dopamine dependence syndrome
DNA	Deoxyribonucleic acid
DSM-III-R	Diagnostic and Statistical Manual for Mental Disorders, 3rd Edition, Revised
DSM-IV-TR	Diagnostic and Statistical Manual for Mental Disorders, 4th Edition, Text Revised
DSM-V	Diagnostic and Statistical Manual for Mental Disorders, 5th Edition
EAP	Employment assistance programs
ECT	Electroconvulsive therapy
EEG	Electroencephalograph
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction

FDA	US Food and Drug Administration
fMRI	Functional magnetic resonance imaging
GABA	Gamma-aminobutyric acid
GHB	Gamma-hydroxybutyric acid
HIV	Human immunodeficiency virus
HCV	Hepatitis C virus
HPA Axis	Hypothalamic–pituitary–adrenal axis
HRT	Hormone replacement therapy
ICD	Impulse control disorder
ICD-10	International Classification of Disease, 10th Edition
IDU	Injecting drug user
LSD	Lysergic acid diethylamide
LTD	Long-term depression
LTP	Long-term potentiation
MDMA	3,4-Methylenedioxy-*N*-methylamphetamine
MEG	Magnetoencephalograph
MOR	Mu-opioid receptor
MMT	Methadone maintenance treatment
NAC	N-acetylcystein
NAcc	Nucleus accumbens
NIAAA	National Institute on Alcoholism and Alcohol Abuse
NIDA	National Institute on Drug Abuse
NMDA	N-methyl-D-aspartic acid
NRT	Nicotine replacement therapy
OCD	Obsessive compulsive disorder
OFC	Orbitofrontal cortex
PCP	Phencyclidine
PD	Parkinson's disease
PET	Positron emission tomography
PFC	Prefrontal cortex
PTSD	Post-traumatic stress disorder
RNA	Ribonucleic acid
SPECT	Single photon emission computed tomography
SSRI	Serotonin selective reuptake inhibitors
TMS	Transcranial magnetic stimulation
UDHR	Universal Declaration of Human Rights
UK	United Kingdom
UN	United Nations
UNAIDS	United Nations Joint Program on HIV/AIDS

UNODC	United Nations Office on Drugs and Crime
UROD	Ultra-rapid opioid detoxification
US	United States
VTA	Ventral tegmental area
WHO	World Health Organisation