Contents

Foreword xi
Edythe D. London

List of Contributors xv

1 Introduction 3
Bryon Adinoff and Elliot A. Stein
References 5

2 An Integrated Framework for Human Neuroimaging Studies of Addiction from a Preclinical Perspective 9
Karen D. Ersche and Trevor W. Robbins
2.1 Introduction 9
2.2 A Conceptual Framework for Understanding Drug Addiction Based on Preclinical Observations 9
2.3 Neuropharmacological Considerations 15
2.4 Neuropathology of Chronic Drug Abuse 15
2.5 Impulsivity: An Endophenotype for Drug Addiction 17
2.6 Compulsivity: Craving versus Drug-Seeking 20
2.7 Summary 25
References 26

3 Structural and Functional Neuroimaging Methods: Applications to Substance Abuse and Addiction 39
Yihong Yang, Svetlana Chefer, Xiujuan Geng, Hong Gu, Xi Chen, and Elliot A. Stein
3.1 Introduction 39
3.2 MRI Based Imaging Tools and their Application to Drug Abuse Research 40
3.3 Molecular Imaging with PET and SPECT 59
3.4 Summary and Peek into the Future 69
References 69

4 Functional Neuroimaging of the Acute Effects of Drugs of Abuse 85
Laurence John Reed and David J. Nutt
4.1 Introduction 85
4.2 Fundamental Neuronal Systems Related to Abuse Liability in Humans 86
4.3 Psychostimulants 87
4.4 Alcohol 92
4.5 Cannabis and the Cannabinoids 95
5 Reward Processing

Anne Beck, Anthony A. Grace, and Andreas Heinz

5.1 Introduction 107
5.2 Neurotransmitter Systems Implicated in Reward Processing 107
5.3 Neurotransmitter Systems Involved in Drug-Related Reward Processing 110
5.4 Alterations in the Mesostriatal System in Addiction 116
5.5 Summary and Outlook 122
5.6 Acknowledgments 123
References 123

6 A Neuroimaging Approach to the Study of Craving

Francesca M. Filbey, Eric D. Claus, and Kent. E. Hutchison

6.1 A Neuroimaging Approach to the Study of Craving 133
6.2 Neural Response During Cue-Elicited Craving 134
6.3 Associations between Neural and Subjective Response During Cue-Elicited Craving 141
6.4 Modulators of Neural Response During Cue-Elicited Craving 142
6.5 Effects of Intervention on the Neural Response During Cue-Elicited Craving 147
6.6 Summary and Integration of Findings 149
6.7 Conclusions 151
References 151

7 Impulsivity and Addiction

Hugh Garavan

7.1 Introduction 159
7.2 Impulsivity as Reward versus Control 159
7.3 The Neurobiology of Impulsivity 161
7.4 Impulsivity and Risk for Developing a Drug Use Disorder 163
7.5 Impulsivity in Current Users 165
7.6 Impulsivity, Abstinence, and Relapse 168
7.7 Conclusion 170
References 171

8 Cognitive Disruptions in Drug Addiction: a Focus on the Prefrontal Cortex

Rita Z. Goldstein, Scott J. Moeller, and Nora D. Volkow

8.1 Introduction 179
8.2 Attention 181
8.3 Working Memory 190
8.4 Decision-Making 193
8.5 Pre-Morbid Vulnerabilities 198
12.4 Brain Morphometric Changes 301
12.5 Bridging Gaps 302
12.6 Imaging Pharmacogenetics 304
12.7 Conclusion 306
Glossary 308
References 309

13 The Diagnostic and Therapeutic Potential of Neuroimaging in Addiction Medicine 321
Martina Reske and Martin P. Paulus

13.1 Can fMRI Become the ECG in Addiction Medicine, or What Are the Treatment Implications of Neuroimaging Research in Drug Addiction? 321
13.2 Functional Neuroimaging in Addiction: Relevant Cognitive Constructs to Address during Treatment 322
13.3 Drug Challenge Studies Enhance Knowledge on Pharmacokinetics and Drug-Experience-Relationships 325
13.4 Imaging Symptom Severity 325
13.5 Neuroimaging-Based Monitoring of Treatment Regimes and the Prediction of Treatment Outcomes 326
13.6 Assessing the Relapse Potential Using fMRI 329
13.7 Neurofeedback as a Therapeutic Approach? 334
13.8 Methodological Challenges to Utilize Functional Neuroimaging as a Clinical Test 335
13.9 The Near Future of Brain Imaging in Addiction Medicine 336
References 338

Index 345