

Contents

1	The Search for the Nature of the Soul	1
	<i>Gerhard Roth, Andreas Heinz, and Henrik Walter</i>	
	References.....	12
2	The Functional Neuroanatomy of the Limbic System.....	15
	<i>Ursula Dicke</i>	
2.1	The Limbic System	16
2.1.1	Septal Region.....	18
2.1.2	Amygdala	20
2.1.3	Hippocampal Formation	26
2.1.4	Basal Ganglia and Mesolimbic System	27
2.1.5	Thalamus	31
2.1.6	Hypothalamus.....	33
2.1.7	Limbic Brainstem.....	35
2.2	Limbic Cortical Areas	41
2.2.1	Orbitofrontal Cortex.....	41
2.2.2	Cingulate Cortex.....	44
2.2.3	Insular Cortex.....	46
	References.....	51
3	Neuro- and Psychopharmacology	61
	<i>Michael Koch</i>	
3.1	Structure of the Chemical Synapse and Transmitter Release.....	62
3.2	Transmitter Receptors	65
3.3	Regulation of Transmitter Release by Presynaptic Autoreceptors and Heteroreceptors	66
3.4	Acetylcholine	67
3.5	Amino Acid Transmitters.....	68
3.5.1	Glycine.....	68
3.5.2	γ -Aminobutyric Acid	69
3.5.3	Glutamate	70
3.5.4	Monoamines	72
3.5.5	Adenosine and ATP.....	78
3.5.6	Cannabinoids.....	79
3.5.7	Neuropeptides	79
3.5.8	Opioids.....	83
	References.....	84
4	Neurophysiology.....	87
	<i>Jakob von Engelhardt</i>	
4.1	Membrane Potential	88
4.2	Equilibrium Potential of an Ion.....	92
4.3	Resting Membrane Potential.....	93
4.4	Action Potential	94

4.5	Electrical Conduction	96
4.6	Electrical Conduction Along Myelinated Axons	97
4.7	Synaptic Transmission	100
4.8	Motor End Plate	102
4.9	Electrical Synapses	102
4.10	Ionotropic Receptors	103
4.11	Metabotropic Receptors	104
4.12	Excitatory and Inhibitory Postsynaptic Potentials	105
4.13	mEPSPs and mIPSPs	106
4.14	Integration of EPSPs and IPSPs	107
4.15	Synaptic Short-Term Plasticity	109
4.16	Synaptic Long-Term Plasticity	110
4.17	Cellular Mechanisms of Synaptic Long-Term Plasticity	112
	References	115
5	Developmental Neurobiology	117
	<i>Nicole Strüber and Gerhard Roth</i>	
5.1	Prenatal Development of the Brain	118
5.1.1	Formation and Differentiation of Neuronal Tissue.....	118
5.1.2	Formation of Networks of Synaptic Connections.....	121
5.1.3	Formation of Glial Cells and Myelin	121
5.2	Postnatal Development	122
5.2.1	Activity-Dependent Modification of Neuronal Circuits.....	123
5.2.2	Sensitive Periods of Brain Development	124
5.2.3	Regulation of Plasticity.....	125
5.2.4	Time Course of Synaptogenesis and Synapse Elimination	128
5.2.5	Early Experiences and Psychological Development.....	129
5.3	Maturation of Psychologically Relevant Brain Functions	132
5.3.1	Four-Level Model.....	132
5.3.2	Six Basic Psychoneural Systems	135
	References	140
6	Emotion, Motivation, Personality and Their Neurobiological Foundations	143
	<i>Gerhard Roth and Nicole Strüber</i>	
6.1	Emotions	144
6.1.1	What Are Emotions and Feelings?	144
6.1.2	How Many Emotions Are There and How Do They Arise?	145
6.1.3	Unconscious Emotions and Conscious Feelings.....	146
6.1.4	The Neurobiological Basis of Emotions.....	146
6.1.5	The Chemistry of Emotions	150
6.2	Motivation	151
6.2.1	Psychological Motivation Models	152
6.2.2	Congruence and Incongruence of Motives and Goals	153
6.2.3	The Neurobiological Basis of Motives and Goals.....	154
6.2.4	How Is Motivation Translated into Behaviour?	157
6.3	Personality	158
6.3.1	How Do We Capture a Person's Personality?	158

6.3.2	Criticism of the “Big Five”, Additions and Alternatives	159
6.3.3	Genetic Foundations, Stability and Changeability of Personality Traits.....	162
6.3.4	The Neurobiological Foundations of Personality	163
6.4	Summary: Brain and Personality	170
	References.....	171
7	Neurobiological Consequences of Early Life Stress	175
	<i>Andrea J. J. Knop, Nora K. Moog, and Christine Heim</i>	
7.1	Early-Life Stress	176
7.2	Clinical Consequences of ELS	178
7.3	Long-Term Biological Consequences of ELS	178
7.4	Molecular Consequences of ELS: Epigenetic Programming and Telomere Biology	181
7.5	Sensitive Periods for the Effects of ELS	182
7.6	Fetal Programming of Health and Disease	183
7.7	Intergenerational Transmission of the Effects of Early Life Stress	184
7.8	Gene-Environment (GxE) Interactions	185
7.9	Implications for Intervention	186
7.10	Conclusion	186
	References.....	187
8	Psychological and Neurobiological Foundations of Consciousness	191
	<i>John-Dylan Haynes</i>	
8.1	Methodology of Consciousness Research	193
8.1.1	Criteria for Conscious Perception I: Subjective Threshold.....	194
8.1.2	Criteria for Conscious Perception II: Objective Threshold	195
8.1.3	Experimental Implementation	195
8.1.4	Criteria for Subliminal Processing	196
8.2	Neuronal Correlates of Conscious and Unconscious Stimulus Processing	197
8.2.1	Conscious Neural Processing	197
8.2.2	Unconscious Neural Processing.....	199
8.2.3	The Phenomenon of Blindsight.....	199
8.3	Contents of Consciousness	199
8.3.1	Coding Levels	200
8.3.2	Coding of Consciousness Contents.....	201
8.3.3	Multivariate Decoding.....	202
8.4	Structure of Consciousness	206
8.5	Models of Consciousness	207
8.6	Awareness, Selection and Attention	211
	References.....	214
9	Nature, Diagnosis and Classification of Mental Disorders	219
	<i>Henrik Walter</i>	
9.1	What Is a Mental Disorder?	220
9.1.1	Background and Historical Context.....	220
9.1.2	Construction of a General Concept of Disease and Disorder from a Philosophy of Science Point of View	221

9.1.3	Current Definitions of Mental Disorders.....	223
9.2	How To Diagnose a Mental Disorder?	226
9.3	What Mental Disorders Are There and How Common Are They?	227
9.4	Problems with the Classification of Mental Disorders	229
9.4.1	Heterogeneity	229
9.4.2	Demarcation Problems	230
9.4.3	The Problem of Biomarkers	231
9.4.4	Non-medical Interests	232
9.4.5	The Lock-in Syndrome.....	232
9.4.6	The Mentalism Problem.....	233
9.5	Recent Approaches	234
9.5.1	Research Domain Criteria (RDoc)	234
9.5.2	Network Theories of Mental Disorders.....	235
9.5.3	The New Mechanism.....	237
	References.....	240
10	Psyche and Mental Illness: Addiction	243
	<i>Stefan Gutwinski and Andreas Heinz</i>	
10.1	The Most Important Facts in Brief	246
10.2	Diagnosis and Classification of Substance Use Disorders	246
10.3	Symptoms	247
10.4	Incidence of Addictive Disorders	249
10.4.1	Prevalence of Alcohol Consumption.....	249
10.4.2	Prevalence of Use of Non-legal Substances	250
10.5	Risk Factors and Development Models	250
10.5.1	Biographical and Individual Factors	251
10.6	Treatment of Substance Use Disorders	251
10.6.1	Treatment of Substance Use Disorders Distinguishes Between Different Phases.....	252
10.7	Progression of Addictive Disorders	253
10.7.1	Neurobiological Basis of Substance Dependence	253
10.7.2	Development of Tolerance.....	254
10.8	NMDA Receptors and Learning Mechanisms	255
10.9	The Nucleus Accumbens and the Importance of the Dopaminergic Reinforcement System	256
10.10	Sensitization	257
10.11	Automatisms	257
	References.....	259
11	Psychotic Disorders ("Schizophrenia")	263
	<i>Florian Schlagenhauf and Philipp Sterzer</i>	
11.1	Psychotic Disorders: Overview and Incidence	264
11.2	Epidemiology, Symptoms and Diagnosis	265
11.2.1	Epidemiology	265
11.2.2	Symptoms.....	266
11.2.3	Diagnostics	267
11.2.4	Exclusion Diagnostics	269
11.3	Therapy and Prognosis of "Schizophrenia"	269

11.4	Emergence of “Schizophrenia”: A Spectrum of Theories	271
11.5	Neurobiological Foundations	273
11.6	Genetics	273
11.7	Neurotransmitter	274
11.7.1	Excitation-Inhibition Balance	275
11.7.2	Aberrant Salience.....	276
11.8	The Bayesian Brain and Predictive Processing	277
11.9	Outlook: A Neurobiological Integrative Approach.....	279
	References.....	280
12	Affective Disorders Using the Example of Unipolar Depression	283
	<i>Stephan Köhler and Henrik Walter</i>	
12.1	Affective Disorders: Overview and Incidence.....	284
12.2	Epidemiology, Symptoms and Diagnosis	286
12.2.1	Symptoms.....	286
12.2.2	Diagnostics	287
12.2.3	Exclusion Diagnostics	287
12.3	Therapy and Prognosis of Unipolar Depression	289
12.4	Theories on the Development of Depression.....	289
12.5	Neurobiological Mechanisms	291
12.5.1	Genetics of Depression	291
12.5.2	Neurotransmitters and the World of Antidepressants.....	292
12.5.3	Pharmacological Classification and Significance of Antidepressants	293
12.5.4	HPA Axis Disorder: Stress, Stress, Stress	294
12.5.5	Inflammation: Lifestyle and the Influence on Depressive Symptoms	296
12.5.6	Neuroplasticity and Neurogenesis: From Electroconvulsive Treatment to Ketamine.....	297
12.5.7	Disturbance of Neuronal Networks	298
12.5.8	Epigenetics and Early Childhood: Scars of Life.....	301
12.6	Outlook: Integration or Pluralism?	303
	References.....	304
13	Anxiety Disorders	311
	<i>Jens Plag and Andreas Ströhle</i>	
13.1	Fear: From a Protective Mechanism to a Pathological Phenomenon.....	313
13.2	Symptoms, Diagnosis and Epidemiology of Anxiety Disorders.....	315
13.3	Therapy and Prognosis of Anxiety Disorders	319
13.4	Disease-Specific Psychological Theories of Anxiety Disorders.....	322
13.4.1	Generalised Anxiety Disorder (GAD)	322
13.4.2	Panic Disorder.....	323
13.4.3	Social Phobia.....	323
13.4.4	Specific Phobias.....	324
13.5	Neurobiological Mechanisms of Fear	324
13.5.1	Learning.....	325
13.5.2	Structural and Functional Brain Anatomy	326
13.5.3	Neurotransmitters, Neuropeptides and the Stress Axis	328
13.5.4	Genetics	330

13.5.5	Epigenetics	331
13.6	A Neurobiological Integrative Approach	332
	References.....	332
14	Neuropsychotherapy: Psychotherapy Methods and Their Effect	337
	<i>Nina Romanczuk-Seiferth</i>	
14.1	Neuropsychotherapy: An Integrative Perspective.....	338
14.2	Neuroscientific Methods in Psychotherapy Research.....	340
14.2.1	Methods of Neuroscientific Psychotherapy Research	341
14.2.2	Experimental Paradigms in Neuroscientific Psychotherapy Research.....	342
14.2.3	Research Designs in Neuroscientific Psychotherapy Research.....	344
14.3	The Different Schools of Psychotherapy	346
14.4	Neurobiological Findings on the Effects of the Major Psychotherapeutic Approaches	347
14.5	Cross-School Methods and the Concept of General Mechanisms of Change in Psychotherapy.....	350
14.6	Neurobiological Correlates of General Mechanisms of Change in Psychotherapy.....	351
14.7	Implications of Neurobiological Findings for the Development of Psychotherapeutic Approaches	355
14.8	Future Perspectives of Integrative Neuropsychotherapy	358
	References.....	360
15	Psychoneuroscience and Its Relevance for Practice	365
	<i>Andreas Heinz, Gerhard Roth, and Henrik Walter</i>	
	References.....	370