M. Onozuka
C.-T. Yen
Editors

Novel Trends in Brain Science

Brain Imaging,
Learning and Memory,
Stress and Fear,
and Pain

Springer

Preface

An enormous number of neurons in the brain form neural circuits by creating synaptic bonds with other neurons. Many of those circuits come together and function as a system. To clarify the function of the human brain, a study needs to be developed as a whole, not merely at the molecular, cellular, or systemic level.

With the development of neural science, knowledge of the molecules and neurons that comprise the brain has increased exponentially in the last two decades. The mysteries of human brain function are being solved in sequence with the use of the latest medical technologies such as PET, fMRI, MEG, and TEM, and in this way, research in neural science is making rapid progress.

Springer Japan has given me the opportunity to publish this book, *Novel Trends in Brain Science*, which introduces the most important and latest knowledge in neural science on brain function imaging, learning, memory, emotions, and pain. In particular, the relationship between well-developed oral cavities and highly advanced brain function is an extremely new and unique area of study and is expected to become an entirely new field.

As of 2006, two Japanese–Taiwanese joint conferences on neural science have been held, in Gifu Prefecture (Japan) last year and in Taipei this year. In this book I have collected original research introduced by neuroscientists representing both countries at those conferences, and I am confident that the work brought together here will promote further research on the human brain.

We express our hearty thanks to staff members at Springer for their efforts in publication, and give special thanks to Nobuyuki Harikae and Ryota Sasaki at LOTTE Co., Ltd. for their support in the editing of this book.

Minoru Onozuka and Chen-Tung Yen

Contents

Preface V

List of Contributors IX

Part I Main Focus
Section I Brain Imaging

1 Diffusion Magnetic Resonance Imaging in Neuroimaging
W.-Y. I. Tseng and L.-W. Kuo 5

2 Overview of MR Diffusion Tensor Imaging and Spatially Normalized FDG-PET for Diffuse Axonal Injury Patients with Cognitive Impairments
A. Okumura, J. Shinoda, and J. Yamada 25

3 Transcranial Magnetic Stimulation in Cognitive Brain Research
S-H. A. Chen 37

4 Spectral Analysis of fMRI Signal and Noise
C.-C. Chen and C.W. Tyler 63

5 Magnetoencephalography: Basic Theory and Estimation Techniques of Working Brain Activity
Y. Ono and A. Ishiyama 77

Part II Related Topics
Section I Learning and Memory

6 Interactions Between Chewing and Brain Activity in Humans
M. Onozuka, Y. Hirano, A. Tachibana, W. Kim, Y. Ono, K. Sasaguri, K. Kubo, M. Niwa, K. Kanematsu, and K. Watanabe 99

7 Involvement of Dysfunctional Mastication in Cognitive System Deficits in the Mouse
K. Watanabe, K. Kubo, H. Nakamura, A. Tachibana, W. Kim, Y. Ono, K. Sasaguri, and M. Onozuka 115

8 Cellular and Molecular Aspects of Short-Term and Long-Term Memory from Molluscan Systems
M. Sakakibara 131

9 Role of the Noradrenergic System in Synaptic Plasticity in the Hippocampus
M.-Y. Min, H.-W. Yang, and Y.-W. Lin 149

Section II Stress and Fear

10 Involvement of the Amygdala in Two Different Forms of the Inhibitory Avoidance Task
K.-C. Liang, C.-T. Yen, C.-H. Chang, and C.-C. Chen 167

11 Bruxism and Stress Relief
S. Sato, K. Sasaguri, T. Ootsuka, J. Saruta, S. Miyake, M. Okamura, C. Sato, N. Hori, K. Kimoto, K. Tsukinoki, K. Watanabe, and M. Onozuka 183

Section III Pain

12 Muscular Pain Mechanisms: Brief Review with Special Consideration of Delayed-Onset Muscle Soreness
K. Mizumura 203

13 ASIC3 and Muscle Pain
C.-C. Chen 225

14 Tail Region of the Primary Somatosensory Cortex and Its Relation to Pain Function
C.-T. Yen and R.-S. Chen 233

Key Word Index 253