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Editors

Micro-, Meso- and Macro-Dynamics of the Brain

 Springer

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Contents

Hippocampal Mechanisms for the Segmentation of Space by Goals and Boundaries	1
Sam McKenzie and György Buzsáki	
Cortical Evolution: Introduction to the Reptilian Cortex	23
Gilles Laurent, Julien Fournier, Mike Hemberger, Christian Müller, Robert Naumann, Janie M. Ondracek, Lorenz Pammer, Samuel Reiter, Mark Shein-Idelson, Maria Antonietta Tosches, and Tracy Yamawaki	
Flow of Information Underlying a Tactile Decision in Mice	35
Nuo Li, Zengcai V. Guo, Tsai-Wen Chen, and Karel Svoboda	
The Visual Brain: Computing Through Multiscale Complexity	43
Yves Frégnac, Julien Fournier, Florian Gérard-Mercier, Cyril Monier, Marc Pananceau, Pedro Carelli, and Xoana Troncoso	
Grid Cells and Spatial Maps in Entorhinal Cortex and Hippocampus	59
Tor Stensola and Edvard I. Moser	
The Striatum and Decision-Making Based on Value	81
Ann M. Graybiel	
Decoding the Dynamics of Conscious Perception: The Temporal Generalization Method	85
Stanislas Dehaene and Jean-Rémi King	
Sleep and Synaptic Down-Selection	99
Giulio Tononi and Chiara Cirelli	

Psyche, Signals and Systems	107
Costas A. Anastassiou and Adam S. Shai	
Federating and Integrating What We Know About the Brain at All Scales: Computer Science Meets the Clinical Neurosciences	157
Richard Frackowiak, Anastasia Ailamaki, and Ferath Kherif	
Index	171

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Introduction

Neural systems are characterized by wide dynamic range, robustness, plasticity, and yet stability. How these competing ingredients are amalgamated into a system in which they all ‘live’ peacefully together is a key question to address and understand in neuroscience. Neuronal firing rates, synaptic weights, and population synchrony show several orders of magnitude distribution. This skewed dynamics is supported by a neuronal substrate with equally skewed statistics from the highly skewed distribution of synapse sizes to axon diameters and to macroscopic connectivity. How these different levels of anatomical and physiological organizations interact with each other to perform effectively was the topic of a recent event organized by the Fondation Ipsen: *Colloque Médecine et Recherche* on the “Micro-, Meso- and Macro-dynamics of the brain” (Paris, April 13, 2015). The participants of this symposium addressed the issues why such a multilevel organization is needed for the brain to orchestrate perceptions, thoughts, and actions, and this volume grew out of those discussions. The individual chapters cover several fascinating facets of contemporary neuroscience from elementary computation of neurons, mesoscopic network oscillations, internally generated assembly sequences in the service of cognition, large-scale neuronal interactions within and across systems, the impact of sleep on cognition, memory, motor-sensory integration, spatial navigation, large-scale computation, and consciousness. Each of these topics requires appropriate levels of analyses with sufficiently high temporal and spatial resolution of neuronal activity in both local and global networks, supplemented by models and theories to explain how different levels of brain dynamics interact with each other and how the failure of such interactions results in neurologic and mental disease. While such complex questions cannot be answered exhaustively by a dozen or so chapters, this volume offers a nice synthesis of current thinking and work-in-progress on micro-, meso-, and macrodynamics of the brain.

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