

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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