

Preface

It has been said that the twenty-first century is the century of the photon. Optical techniques, especially those based on lasers, have reached an advanced state of complexity and have entered many disciplines of neurobiology. The optical readout of the nervous activity is an important part of the “photon revolution” bringing about predictions that the photon will progressively replace the electron for probing neuronal function. This volume entitled *Membrane Potential Imaging in the Nervous System; Methods and Applications* describes optical techniques to monitor neuronal membrane potential signals. The imaging approach provides a method for monitoring electrical signaling in the brain with sub-micron and sub-millisecond resolution. Two main advantages over conventional electrical measurements make this experimental technique both unique and valuable: (a) the ability to record voltage transients simultaneously at hundreds or thousands of sites in the nervous system and (b) the ability to monitor signals from structures that are too small for electrode measurements (e.g., terminal dendritic branches, axons, and dendritic spines). This recording technique represents a complementary component in a rapidly developing avant-garde strategy to implement a relatively noninvasive all-optical investigation of living

neural circuits using light-activated ion channels and imaging technologies.

The knowledge upon which voltage-imaging technique is based was generated over several decades and described in a wide variety of publications. The aim of the book is to provide a single comprehensive source of information on different types of voltage-imaging techniques, including overviews, methodological details, examples of experimental measurements, and future developments.

The book is structured in five sections, each containing several chapters written by experts and major contributors to particular topics. The volume starts with a historical perspective and fundamental principles of membrane potential imaging and continues to cover the measurement of membrane potential signals from dendrites and axons of individual neurons, measurements of the activity of many neurons with single cell resolution, monitoring of population signals from the nervous system, and concludes with the overview of new approaches to voltage imaging. The book is targeted at all scientists interested in this mature but also rapidly expanding imaging approach.

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