Alexander G. Volkov (Editor)

Plant Electrophysiology

Theory and Methods

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With 142 Figures, 26 in Color, and 4 Tables

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Preface

Plants continually gather information about their environment. Environmental changes elicit various biological responses. The cells, tissues, and organs of plants possess the ability to become excited under the influence of environmental factors. Plants synchronize their normal biological functions with their responses to the environment. The synchronization of internal functions, based on external events, is linked with the phenomenon of excitability in plant cells. The conduction of bioelectrochemical excitation is a fundamental property of living organisms.

The conduction of bioelectrochemical excitation is a rapid method of long distance signal transmission between plant tissues and organs. Plants promptly respond to changes in luminous intensity, osmotic pressure, temperature, cutting, mechanical stimulation, water availability, wounding, and chemical compounds such as herbicides, plant growth stimulants, salts, and water potential. Once initiated, electrical impulses can propagate to adjacent excitable cells. The bioelectrochemical system in plants not only regulates stress responses, but photosynthetic processes as well. The generation of electrical gradients is a fundamental aspect of signal transduction.

This book consists of a historical introduction to plant electrophysiology, and two parts. The first one deals with the methods in plant electrophysiology. Seven chapters present methods of measuring the membrane potentials, ion fluxes, transmembrane ion gradients, ion-selective microelectrode measurements, patch-clamp technique, magnetic measurements, new solid state microsensors and electrochemical sensors. The second part deals with experimental results and theoretical interpretation. All chapters are comprehensively referenced throughout.

Green plants are a unique canvas for studying signal transduction. Plant electrophysiology is the foundation for discovering and improving biosensors for monitoring the environment; detecting effects of pollutants, pesticides, and defoliants; monitoring climate changes; plant-insect interactions; agriculture; and directing and fast controlling of conditions influencing the harvest.

I am grateful to my colleagues for their valuable contribution to this book. We thank the authors for the time they spent on this project and for teaching us about their work. I would like to thank our Acquisition Editor, Dr. Christina Eckey, and our Production Editor, Ursula Gramm, for their friendly and courteous assistance.

Alexander George Volkov

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