

Preface

Rhythmical behaviour is a quintessential pattern of life itself and is believed to play a key role in cell division and morphogenesis, to mediate all kind of movements, and to provide an advantageous strategy for evolution and adaptation of living organisms. Rhythms have fascinated people for more than 2000 years. As early as the fourth century B.C., Androstenes, scribe to Alexander the Great, noted that the leaves of *Tamarindus indica* opened during the day and closed at night (Bretzl 1903). Some early writers notice single movements of parts of plants in a cursory manner, Albertus Magnus in the thirteenth century and Valerius Cordus in the sixteenth century, thought the daily periodical movements of the pinnate leaves of some *Leguminosae* worth recording. Ray in his “*Historia Plantarum*” at the end of the seventeenth century commences his general considerations on the nature of the plants with a succinct account of *phytodinamical* phenomena mixing up together the movements from irritability and the daily periodical movements; the latter, he says, occur not only in the leaves of *Leguminosae*, but in almost all similar pinnate leaves, and with these periodical movements of leaves, he places also the periodical opening and closing of the flower of *Calendula*, *Convolvulus*, *Cichorium*, and others.

The number of publications on rhythms in plants increased dramatically in the last decades, and the old mystery of the “biological clock” has been tackled from the molecular, genetic, and biochemical perspectives. Yet, most research deals only with measurable rhythms—the so-called hands of the clock mechanism. The clock “pacemaker” still remains a mystery. Many superimposed rhythms are able to coexist in the same cell compartment, all with different periods. How many oscillators does a living cell have? Just one? Or is each of these processes controlled by its own independent oscillator? The situation is similar to that which existed in the physics of elemental particles in the “1960–”1970s, when an avalanche-like increase of discovered particles initiated a revision of theoretical concepts and resulted in the creation of a new paradigm in physics. Innovations in molecular biology, micro- and nanotechnology, and applied mathematics (e.g. hidden patterns, chaos theory) are providing new tools for understanding how environmental

signals and internal clocks regulate rhythmic gene expression and development. Needless to say, this fast, near astounding pace of discoveries shows how extremely the subject has changed and is reflected in the different chapters of the current book which covers aspects of plant physiology neither recognizable nor quantifiable few years ago.

The second edition of this book provides a timely update on a recent progress in this field and comprehensively summarizes current knowledge of molecular and physiological mechanisms behind circadian and ultradian oscillations in plants, and their physiological implications for growth, development, and adaptive responses to dynamic environment. The book is structured around three major topics:

- Ultradian oscillators
- Circadian oscillators
- Theoretical aspects and modelling

Written by a diverse group of leading researchers, this book will surely spark the interest of readers from many branches of science: from physicists and chemists wishing to learn about multifaceted rhythms in plant biology, to biologists and ecologists dealing with state-of-the-art modelling of complex rhythmic phenomena.

Before we close and let the reader enjoy (we hope!) the content of this volume, we would like to acknowledge the Springer's team (Dr. Andrea Schlitzberger and Dr. Christina Eckey) for their idea to proceed with this publication. We would also like to express our sincere gratitude to all contributing authors who have enthusiastically embraced an idea to go for the second edition of this book. Finally, and most importantly, we are truly grateful to all "frontline people" in our institutions and elsewhere in the world for their enthusiasm and patience in revealing one of the greatest mysteries of the life—THE CLOCK.

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