

# Preface

Biological rhythms play pivotal roles in both physical and mental health. Spatiotemporal oscillations have been identified at different levels, from mitochondria to transmembrane potentials, from heart excitation waves to neural activities. The circadian clock is involved in gene expression regulations and various cellular processes including metabolism, proliferation, and senescence. This book provides an overview of the cellular rhythms and networks with the emphasis on the systems biology understanding of their roles in the practice of personalized and systems medicine.

The disruption of circadian rhythms has been associated with many complex diseases including insomnia, depression, heart disease, cancer, rheumatoid arthritis, and neurodegenerative disorders. The multi-scale view of circadian systems on the basis of systems biology would empower the discovery of novel therapeutic strategies such as chronotherapy (see Chap. 1). Depending on the feedback loops with multiple pathways and protein–protein interactions involved, the circadian clocks form the essential cellular timing mechanisms that synchronize vital physiological processes (see Chap. 2). For example, the multi-factorial circadian-neuroendocrine-immune networks may be involved in various disorders including the lung, heart, and gastrointestinal diseases (see Chap. 3).

Depression and circadian disruptions may share a common etiology with lower cellular resilience and reduced resistance to stressful events. The pattern analysis of systemic circadian profiles can be useful for the prediction and prevention of various psychiatric disorders (see Chap. 4). The cardiovascular system responds to environmental stimuli with circadian patterns. Such patterns are mediated via the complex interactions between the extracellular factors such as neuro-humoral elements and intracellular factors such as the clock genes with impacts on the pharmacokinetics and pharmacodynamics of drugs (see Chap. 5). Studies at molecular, cellular, and clinical levels have demonstrated the critical role of the circadian clock in carcinogenesis and anticancer treatments. The understanding of the circadian-cell cycle interaction may contribute to the optimization of drug delivery (see Chap. 6). Robust biomarkers based on chronobiology and systems biology can be used for the establishment of rhythmic profiles toward more precise diagnosis and individualized

treatment. Personalized chronotherapy may help improve the treatment of various diseases including hypertension, cancer, depression, and rheumatoid arthritis (see Chap. 7).

By covering topics from cellular networks to complex diseases, from novel concepts to emerging fields, this book intends to provide a state-of-the-art and integrative view of cellular rhythms and networks with potential clinical applications in personalized and systems medicine. Frameworks on the basis of systems biology and chronobiology are introduced for understanding the complexity in health and diseases.

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