

Preface

With the invitation to edit this volume, I wanted to take the opportunity to assemble reviews on different aspects of circadian clocks and rhythms. Although most contributions in this volume focus on mammalian circadian clocks, the historical introduction and comparative clocks section illustrate the importance of various other organisms in deciphering the mechanisms and principles of circadian biology.

Circadian rhythms have been studied for centuries, but only recently, a molecular understanding of this process has emerged. This has taken research on circadian clocks from mystic phenomenology to a mechanistic level; chains of molecular events can describe phenomena with remarkable accuracy. Nevertheless, current models of the functioning of circadian clocks are still rudimentary. This is not due to the faultiness of discovered mechanisms, but due to the lack of undiscovered processes involved in contributing to circadian rhythmicity. We know for example, that the general circadian mechanism is not regulated equally in all tissues of mammals. Hence, a lot still needs to be discovered to get a full understanding of circadian rhythms at the systems level. In this respect, technology has advanced at high speed in the last years and provided us with data illustrating the sheer complexity of regulation of physiological processes in organisms. To handle this information, computer aided integration of the results is of utmost importance in order to discover novel concepts that ultimately need to be tested experimentally. In this development of new concepts lies the chance to understand living organisms better and to develop strategies to apply these new concepts for the benefit of society. A decade ago, the influence of changing day-night cycles (e.g. jet-lag and shift work) on health was intuitively possible but not taken very seriously due to lack of convincing scientific evidence. This has changed in the last years due to discoveries illustrating the involvement of clock components in the development of cancer, obesity and mood disorders.

The main task of the circadian clock is to optimize an organism's performance and tune it with temporal changes in the environment. In that sense, the clock links the genetic setting of the organism with its environment. A better understanding of the circadian clock, therefore, will open avenues for treatment of diseases via environmental stimuli such as light. The importance of this approach is evident in the treatment of seasonal affective disorder and probably could be extended to the treatment of other neuropsychiatric disorders in the future.

However, this non-pharmacological approach is strongly underrated since no direct economic benefit is evident, except for reducing costs for health care. On the other hand, pharmacological approaches to influence biochemical mechanisms via the circadian clock might emerge. First attempts to optimize available cancer treatments taking the temporal dimension into account, have indicated to be beneficial for patients. However, the awareness of the importance for the timing of medical treatment is still very rudimentary in the medical community.

I hope that the different topics described in this book illustrate the importance of the circadian clock for health, although the evidence presented is certainly not complete. The selected topics are thought as starting points for discussions and hopefully ignite new ideas and hypotheses.

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