

PREFACE

It appears to finally be “time”—time to compile what we know about the molecular basis of circadian rhythms. In the mid-1990s, this would have seemed a preposterous idea; the fact that it is now being done is a testament to the progress made in the field in recent times. Up until 1994 there were only two known so-called “clock genes,” one in *Drosophila* and the other in *Neurospora*. Since then, not only have many new components been identified in these two systems, but molecular circadian models have been rapidly developed for other systems such as cyanobacteria and mammals. In addition, there is increasing awareness of the overwhelming presence of circadian control in normal physiology. Clearly, temporal aspects of physiology must be considered for all biological processes. As a result, the circadian field has also grown in size, populated now not only by diehard chronobiologists, but also by many researchers who discovered that their favorite molecule or process is regulated in a circadian fashion.

My own motivation to put this book together came, at least in part, from the number of circadian biology queries I started receiving from students (graduate, undergraduate, and, in a couple of cases, even high school students). These students were basing their preliminary proposals or dissertation topics or research projects on the analysis of some molecular aspect of circadian rhythms. I must add that I was suitably impressed with the depth of the questions that these students were asking

and with the effort they had made to read the primary literature. Another reason I thought a book like this might be useful is because I recently collaborated with several groups whose work lead them into the area of circadian rhythms and who would have appreciated the introduction to molecular circadian biology that I hope this book will provide. Finally, it appears that many graduate and even undergraduate institutions are now offering classes in chronobiology, either as part of a broader course or even as a course by itself. Now that the molecular biology of the system is such an integral part of circadian studies, a book on this topic may be beneficial. While the writing of this book was under way, I was also approached by another publisher, seeking to put a similar book together. Clearly, many people now perceive the need for a textbook explaining the intricacies of circadian function. I anticipate that this book will be useful to all the scientists mentioned above, in particular to undergraduate and graduate students.

Having decided to compile this book, it took me only a couple of minutes to decide that it should reflect the truly interdisciplinary nature of this field. Molecular approaches to circadian rhythms have been used in several, very diverse species, and the field as a whole has benefited tremendously from research done in each of these. In addition, the overall approaches used in all these species are very similar. Thus, the book starts with an introduction outlining the general properties of circadian rhythms

and the description of commonly used terms (jargon) and then introduces the methodology used to study the molecular biology of clocks. It then provides an up-to-date (as much as is possible in this fast moving field) account of the research done in six organisms and systems commonly used for molecular circadian biology. The last section is devoted to the organization of circadian systems in complex organisms and the overall impact on physiology. The emphasis in this section is on mammals, although much of the discussion is also applicable to other organisms.

All the chapters have been written by people with expertise in the molecular analysis of circadian rhythms. Where possible, they have been written by researchers working on the specific organism they are writing about. In other cases, individuals working with other species have gone to tremendous effort to thoroughly research the system they were assigned and provide a comprehensive account of it. I am extremely grateful to all the contributors

and would like to take this opportunity to thank each one of them. They all cheerfully honored their commitments and endured endless messages and questions from me. Special thanks goes to Jay Dunlap, Jennifer Loros, Susan Golden, and Carla Green for providing expert opinions on the Neurospora and cyanobacteria chapters.

My secretary, Irene Stevens, scanned many of the figures and kept track of copyright permits, for all of which I thank her. I would also like to thank members of my laboratory for their patience when my time was so heavily occupied by this book. Last, but definitely not least, I am indebted to my family, my husband Jeff and my daughters Natania and Anjalie, for their endless support. They have kept me sane throughout my research career, including this most recent period when I was writing and compiling this book.

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