

Preface

All genes must be expressed to exhibit their biological activities. How genes are expressed and regulated is a central question in molecular biology and our knowledge in this area has been expanding enormously in recent years. The complexity of gene regulation is compounded by the fact that gene activities reach every corner of biology. Transcription is universally the first step toward expressing a gene. It is a highly regulated process. Understanding the molecular mechanisms of transcription regulation is of fundamental importance. For protein-coding genes, post-transcriptional steps, including pre-mRNA processing, mRNA transport and translation, can also play important roles in regulating gene expression. To contain the scope of this book, we will focus primarily on RNA polymerase II transcription and regulation. We will explore not only the biochemical basis of transcription but also the biological consequences of, and biological influences on gene transcription.

The book is composed of 35 individual review articles written by authorities in the field. The chapters are organized into five sections: The History, The Machinery, The Regulators, The Genome, and Special Topics. The History section contains one chapter, written by James Goodrich and Robert Tjian, who provide an excellent historical perspective and overview of the transcription process. The Machinery section has six chapters that cover essential topics on the transcriptional apparatus, general cofactors, chromatin structure, and core promoter structure. The Regulators section has thirteen chapters. While the first two of them investigate the mechanisms of transcriptional activation and repression, the remaining eleven chapters discuss in depth selected gene-specific transcription factors that play critical roles in a variety of biological processes, including STATs, Smads, NF κ B, nuclear receptors, NFAT, Rb, p53, HIV Tat, ATFs, c-Jun and Hox proteins. The Genome section contains six chapters that examine topics relevant to transcription regulation and genome behavior, including chromatin boundaries, heterochromatin, DNA methylation, genomic analysis, genomic integrity, and cell death. Finally, the Special Topics section contains nine chapters that investigate such important issues as pre-mRNA splicing, DNA supercoiling, microRNA, transcription factor dynamics, role of actin in transcription, gene therapy, and transcription regulation in bacteria, plants and developmental signaling.

When Higher Education Press invited me to write a textbook for their Current Scientific Frontiers book series two years ago, I did not think I had the time needed to tackle such a big project. Instead, I made a proposal—endorsed quickly by HEP—to explore the possibility of editing a book (resembling a textbook style) on the topic of gene expression and regulation, with individual review articles written by experts in the field. Without the enthusiastic support and generous commitment from the contributors, this project would have never even started. I am deeply indebted to all of them. Every chapter in this book is a scholarly work reflecting numerous hours of intense efforts of the contributors. I would like to express my special thanks to Cheng-Ming Chiang for generously contributing two excellent chapters, a few contributors for kindly agreeing to write on relatively short notice, and Gordon Hager for providing the cover photo and design suggestions. I would also like to thank HEP for their flexibility and trust in this project, and the HEP and Springer editorial and design teams, in particular Li Shen at HEP, for their excellent work. Finally, I would like to thank Bingxiang Li at HEP for the countless email communications and her hard work—at every step along the way—that made this book a reality.

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