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Front cover artwork: Classical stages of mitosis depicted in the two-cell embryos of the nemertean worm *Cerebratulus*, with microtubules in gold and DNA in blue. Images are projections of approximately 20 successive 0.5-μm confocal sections. Clockwise from *top left*: interphase, prophase (chromatin condensing), prometaphase (nucleus broken down), metaphase (spindle formed, chromosomes aligned), anaphase (chromosomes segregating along spindle), and telophase (nuclei reforming, cytokinesis in progress). Images and composition kindly provided by George von Dassow, Oregon Institute of Marine Biology.

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Preface

In this small volume we believe we have captured both the depth of knowledge and current excitement about the field of mitosis. The field has a long history, reaching back to the late 19th century when Walther Flemming first observed and described the "threads" (in Greek, *mitos*) of condensed chromosomes in dividing cells, and how their movements are carefully choreographed to ensure that the two daughter cells receive an equal and identical set of "threads." This history is described by one of the editors, Mitsuhiro Yanagida, with a particular emphasis on the model systems that have played such an important role in mitosis research. Surveying the chapters in the book, it is remarkable how the combined studies from all the different model systems have contributed to deepen our understanding of the mechanisms and control of mitosis. We now have a molecular understanding of how Flemming's threads are produced—the process of chromosome condensation—and this is discussed by Tatsuya Hirano. The means by which the condensed chromosomes can subsequently be moved into their correct positions in the cells depend on building a complex attachment site for microtubules, called the kinetochore, on a specialized part of the chromosome, called the centromere. Our knowledge of both centromeres and kinetochores has advanced at a very rapid pace in the last 5 years, and these fast-moving fields are surveyed by Frederick Westhorpe and Aaron Straight and by Iain Cheeseman, respectively. The dynamic microtubules and their assembly into the mitotic apparatus to position and separate the chromosomes are reviewed by Simone Reber with another of the editors, Anthony Hyman. In yeast, and most animal cells, the microtubules are nucleated by specialized structures called spindle pole bodies or centrosomes, which also have roles in integrating signals required for mitosis. These structures are discussed by Jingyan Fu, Iain Hagan, and David Glover. The signals that are integrated, and their effect on the machinery that regulates mitosis, are reviewed by Samuel Wieser and the third of the editors, Jonathon Pines.

The final act in the choreography of mitosis is the separation of the two daughter cells, called cytokinesis, and the substantial progress made in understanding how this is regulated is reviewed by Pier Paolo D'Avino, Maria Grazia Giansanti, and Mark Petronczki. Should cells mis-segregate their chromosomes, this unbalances the genome (aneuploidy), and the complex but usually highly deleterious consequences of this are described by Gianluca Varetti, David Pellman, and David Gordon. Last, meiosis, the specialized cell division in which chromosomes undergo two rounds of division, is summarized by Hiroyuki Ohkura.

The editors are profoundly grateful to all the authors for their precious time and scholarship in contributing to this book. They are also deeply thankful to the editorial staff at Cold Spring Harbor Laboratory Press, particularly to Barbara Acosta, for their expertise, helpfulness, encouragement, and, above all, patience in its production.

Anthony A. Hyman
Jonathon Pines
Mitsuhiro Yanagida

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