

Preface

THE DUAL ORIGINS OF STEM CELL RESEARCH are developmental biology, the study of how different cell types arise in the embryo, and pathology, exploring changes in adult tissues in the context of diseases, particularly cancer. These two foundations are now fully integrated in the field of stem cell research, as pluripotent stem cells can be induced to form organoids with many characteristics of adult tissues. A further synthesis is evident in two clinical approaches to repairing human tissues—gene therapy and cell therapy—as we see combination treatments such as CAR T cells entering the mainstream. Stem cell research has traditionally been interdisciplinary, with input from biologists, mathematicians, physicists, engineers, bioinformaticians, chemists, and, of course, clinicians.

The theme of integration is one that becomes clear from the topics covered in our book. There are chapters dealing with the clinical applications of cell and gene therapies and the exciting potential of new biomaterials to modulate stem cell properties by recapitulating the *in vivo* stem cell niche. We also cover advances in underpinning mechanistic studies, such as lineage reprogramming and stem cell plasticity. Organoid research is also prominent, whether as a means to understand aspects of human development or model diseases such as brain disorders.

In recent years, the major advances in single-cell RNA sequencing have led researchers to both explore the extent of heterogeneity in tissues and to evaluate critically the relevance of the *in vitro* and *in vivo* experimental models that have been developed over the years. And a further theme of the book is how we can understand cell lineages *in vivo* by integrating techniques such as live cell imaging and computational modeling of cell fate dynamics, and by evaluating genetic mutations as tissues age and develop cancer.

We thank Barbara Acosta, Richard Sever, and their colleagues at Cold Spring Harbor Laboratory Press for all their hard work and patience in putting this book together and all authors for responding in a timely fashion to our requests. We hope that you enjoy reading the chapters, which reflect the breadth and pace of this exciting and promising field of research. But a word of warning: in our experience it is virtually impossible to predict the next major advances in stem cell research and what a book such as this one will contain in 5- or 10-years' time.

CRISTINA LO CELSO
KRISTY RED-HORSE
FIONA M. WATT