Preface

As we pointed out in the preface to the fourth edition of *Principles of Development*, developmental biology is at the core of all of the biology of multicellular organisms. It deals with the process by which the genes in the fertilized egg control cell behavior in the embryo and so determine the character of the animal or plant. Developmental biology is also fundamental to evolution, as organisms that are better adapted to the environment result from changes in development. The four years since the last edition of this book have seen continuing progress in understanding the cellular and molecular basis of embryonic development, and genomics is having an increasing impact. In this fifth edition, we have included many recent advances. Of particular note is the progress in our understanding of cell differentiation (Chapter 8) and in deciphering the developmental changes that underlie evolution (Chapter 14). Throughout this new edition, we have also tried to reflect the increasing emphasis on the medical applications of developmental biology, for example in clinical genetics and in regenerative medicine (Chapter 8).

Principles of Development is designed for undergraduates and aims to provide students with an understanding of the principles that guide development. We have tried to make these principles as clear as possible and to provide numerous summaries, in both words and pictures. We focus on the systems that best illustrate the principles of development, and do not aim to provide a comprehensive text. We have also tried to avoid going into too much detail, as this can be overwhelming and obscure general principles. The details can be found in the many reviews in the literature, which are periodically updated. It is our belief that while the details are likely to change, the principles will remain, and as we understand the general principles better, we should be able to make the book shorter!

We have assumed that students have some familiarity with basic cell and molecular biology and genetics, but all key concepts, such as the control of gene activity, are explained in the text. There is also an extensive glossary, which means that the book is self-contained. The illustrations are a special feature and have been carefully designed and chosen to illuminate both experiments and mechanisms. Many new diagrams and photographs are included throughout the book, together with information about their sources. In providing further reading, our prime concern has been to guide the student to particularly helpful papers and reviews rather than to give credit to all the scientists who have made major contributions: to those whom we have neglected, we apologize. As in previous editions, we have concentrated our attention on vertebrates and *Drosophila*, but include other organisms, such as the nematode and the sea urchin, when they best illustrate a concept. As in the previous edition, we have started the book by considering the process of pattern formation in laying down the body plan in *Drosophila* (Chapter 2). This is because of the central role that *Drosophila* has played, and still plays, in understanding developmental mechanisms.

Chapter 3 describes the embryology and genetics of our vertebrate model organisms, together with some of the main methods used to study them. An outline of human embryonic development is included in this edition, because comparing this, where possible, with embryonic development in other vertebrates will be important for medical applications. The mechanisms involved in pattern formation in the early development of our vertebrate model organisms are then considered in the two subsequent chapters (Chapters 4 and 5). These have been reorganized so that the process of

laying down the early body plan is first described in its entirety in *Xenopus* (Chapter 4), the vertebrate in which the general principles were discovered. This is followed by comparisons with the process in zebrafish (Chapter 4) and in chick and mouse (Chapter 5). Chapter 5 also considers how the body plan is completed, which mainly rests on studies in chick and mouse embryos. Chapter 6 now focuses on pattern formation in two invertebrate model organisms, the nematode and the sea urchin. Chapter 7 deals with plant development, which is often neglected in general textbooks of developmental biology, and which is important in its own right. Chapters 8 and 9 focus on the fundamental processes of differentiation and morphogenesis and have been extensively revised, with particular reference to stem cells in Chapter 8. Chapter 10 deals with germ cells and fertilization. Organogenesis (Chapter 11) and the development of the nervous system (Chapter 12) are huge topics, so we have had to be very selective in our coverage, but have included new boxes highlighting examples of medical relevance. In this edition, growth and regeneration are considered together in the same chapter (Chapter 13), which has been reorganized, and the last chapter (Chapter 14) deals with development in relation to evolution.

For this new edition, Alfonso Martinez Arias has joined Cheryll Tickle and Lewis Wolpert as a main co-author, and Andrew Lumsden has also become an author. Each chapter has also been reviewed by a number of experts (see page xxii), to whom we give thanks. The authors made the initial revisions, which were then deciphered, edited, and incorporated by our editor, Eleanor Lawrence. Her involvement has been crucial in the preparation of this edition and her expertise and influence pervades the book. Eleanor's input has also been invaluable in ensuring that the information in the book is readily accessible to students. The new illustrations were brilliantly drawn or adapted by Matthew McClements, who created the illustrations for the first edition.

We are indebted to Alice Roberts and Jonathan Crowe at Oxford University Press for their help and patience throughout the preparation of this new edition.

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