

Preface

This book is an attempt to capture the spirit of a dynamic, expanding, and exciting discipline. The subject is elusive, however, because the limits of developmental biology are variable. I visualize developmental biology as the study of progressive changes that occur within cells, tissues, and organisms themselves during their life span. Development may be studied at a variety of levels: molecular, biochemical, genetic, morphological, or physiological—terms that describe biological points of view that also imply methodology. Much current biological research focuses on the cellular and subcellular levels, mainly because the primary controls over development are exerted there. This research has yielded an incredible amount of new information about development in the four years since the first edition of this book appeared, and the pace of discovery shows no signs of abating. Much of the recent progress has resulted from the application of new techniques, such as those utilizing recombinant DNA, to problems of development. Recombinant DNA studies have opened many new avenues of investigation that allow us to examine the composition of the genome and its utilization in regulating development with much more precision than was possible when the first edition of this book was written. Another area of active investigation has concerned the roles of the cytoskeleton and the cell surface in mediating cellular morphogenesis. Accordingly, I have added a chapter entitled "The Cellular Basis of Morphogenesis" (Chap. 5), which deals with the function of these entities in cell motility, cellular shape changes, and cell-cell interactions. These themes also recur in later chapters and reflect an increased emphasis on morphogenesis at the cellular level throughout the text.

Contemporary research has provided us with improved insight into the developmental process and a more sophisticated understanding of the

developmental phenomena that are described in the classical literature. I have discussed many of the key experiments upon which our current level of understanding of development is based. This approach gives the student an appreciation for the role of experimentation in science and a fuller understanding of the experimental results. Familiarity with these experiments should also facilitate the understanding of additional new research results introduced by instructors, help students to read research papers in the literature, and, hopefully, stimulate them to pose questions and design experiments about the many unanswered aspects of development.

This book contains several boxed essays with details on experimental procedures and other topics related to the textual material. The use of boxes allows these topics to be presented without interrupting the flow of the text. The titles and locations of these essays are indicated in the Contents.

The Index also serves as a glossary. All boldfaced page numbers refer to definitions of terms.

In such a multifaceted subject as developmental biology, the choice of material to be included in a text is discretionary and will certainly not satisfy everyone. I have attempted to select material that illustrates the major principles of development. The instructor will undoubtedly choose to use additional examples and introduce other topics. Ideally, the framework of the text will provide the flexibility that facilitates substitution and amplification by instructors.

Since principles of plant and animal development have much in common, an understanding of these principles is enhanced when they are treated together rather than separately. Accordingly, plant development is included in the text. However, I assume that most readers will have stronger zoological than botanical interests, and the ratio of animal to plant material reflects this assumption.

This text has resulted from the author's experience in teaching developmental biology to upper division undergraduate students who normally have a background in cell biology and genetics. I present an extensive review of the principles of molecular biology near the beginning of this course, which prepares most students to understand the molecular approach to development. This review is included in Chapters 3 and 4 of this text. Most students in my course are familiar with animal development at the descriptive level. For those readers who lack this background, I have included a brief overview of animal development in Chapter 1, which should provide a sufficient foundation for the early chapters. More detailed analyses of morphogenesis are incorporated into subsequent chapters.

I believe that visual material is an important aid to the learning process and have, therefore, included numerous illustrations in the text. I am grateful to the many investigators and publishers who have granted permission to reproduce these figures. Complete citations for the sources

of previously published figures can be found in the reference list at the end of each chapter.

I have been encouraged and assisted in this project by my colleagues and associates at the University of Calgary. My Department Head, Dr. Dennis Parkinson, has nurtured two editions of this book. Every textbook author should be so fortunate as to have such an understanding Head. I would like to express my appreciation to my secretary, Ms. Margaret Hunik, for her assistance. The graphic art for both editions has been prepared in the university's Commedia Department. Mrs. Marilyn Croot, who prepared the art for the first edition, contributed some art for the second edition. Most of the art was prepared by Mr. Bill Matheson, who has an exceptional ability to present data and scientific concepts in an understandable and aesthetically pleasing way.

My laboratory has managed to function in spite of (or because of) my preoccupation with this book. Mrs. Jillian Wilkes, Dr. Malgorzata Kloc, and Mr. Jeff Bury have been very patient with me. I am grateful for their understanding and assistance. Dr. Kloc also assisted in proofreading, which was very useful.

My wife, Sandy, has been a partner in this enterprise, often working evenings, weekends, and holidays. I have relied on her assistance, her judgement, and her encouragement to complete this task. My daughters, Teri and Diana, have also provided assistance, frequently helping out when deadlines were to be met. My father-in-law, Mr. Lowell O'Connor, also assisted in proofreading. No author has had a more supportive family.

Leon W. Browder