

Introduction to

BIOLOGY

SYLVIA S. MADER

Introduction to **BIOLOGY**

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Introduction to
BIOLOGY



"A personal library is a lifelong source of enrichment and distinction. Consider this book an investment in your future and add it to your personal library."

PREFACE

Introduction to Biology presents biology's fundamental concepts in an easy-to-understand manner. It was written in response to a growing need for a college-level text that is short but still covers all areas of modern biology. The simple and direct approach of the book allows students to come to a comprehensive understanding of biology. It discusses the principles of biology in a way that will enable students to appreciate the living world and their relationship to that world.

Introduction to Biology is based on my text *Biology*; therefore, it explains general principles primarily in reference to forms of life other than human beings. Some instructors may especially like the frequent application of biological principles to plants and invertebrates. The animal physiology section emphasizes comparative animal physiology in an evolutionary context before considering human physiology.

Introduction to Biology is a new book in its own right as witnessed by the inclusion of several new elements. Each chapter ends with a section called Biological Relationships that helps students pull together the concepts of that chapter and see how they relate to those discussed in other chapters. Also, the student is taught the learning strategy called concept mapping. A concept map is a way for the student to show how the main ideas of the chapter are related. Although some concept maps are better than others, there are no right or wrong concept maps. Their value lies in the actual process of creating the map because it encourages students to think about what they have learned.

Introduction to Biology has its own illustration program. New to this book are learning schematics, illustrations that simultaneously utilize rendered art, line art, and an electron micrograph to help students visualize structures and/or processes.

Organization of the Text

The text has six parts, as follows:

Part 1: The Cell

The first chapter introduces biological concepts by discussing the characteristics of life. It reviews the scientific method so

students can see that the biological view of life is a product of this method. The rest of the chapters in this part show that life is highly organized matter. Life begins when chemical molecules are organized to produce cells, the fundamental units of life. Life's organization comes about and is maintained only by an input of energy. Matter cycles through the biosphere, but energy flows by way of photosynthesis and cellular respiration.

Part 2: Genetic Basis of Life

The blueprint of life's organization is passed on when offspring receive genes from their parents. This part covers cellular reproduction before Mendelian genetics and biochemical genetics. The latest information on such topics as human genetic disorders, recombinant DNA techniques, and the human genome project are discussed.

Part 3: Evolution and Diversity

The process of evolution explains both the unity and diversity of life. Darwin's theory is seen as preliminary to today's modern theory of natural selection. Life forms are extremely diverse, but regardless, they can be classified into five kingdoms. Representatives of each kingdom are discussed.

Part 4: Plant Structure and Function

Two chapters are devoted to flowering plant anatomy and physiology. The first chapter outlines the anatomy of roots, stems, and leaves, and the second discusses the physiology and reproduction of plants.

Part 5: Animal Structure and Function

In this part, the first chapter discusses animal organization in general before considering homeostasis. The other chapters show how the various systems help maintain homeostasis. In each instance, the anatomy and physiology of other animals is compared in an evolutionary context before the anatomy and physiology of humans is reviewed.

Part 6: Behavior and Ecology

An animal behavior chapter precedes the two that cover traditional and modern ecology. The application of ecological

principles to current environmental problems is not only an excellent example of the relevancy of biology, it is also a necessary endeavor if the biosphere is to be preserved for future generations.

Aids to the Student

Introduction to Biology includes a number of aids that will help students study biology successfully and enjoyably.

History of Biology Endsheets

The front and back covers of hardbound editions list major contributions to the field of biology in a concise, chronological manner. Students may refer to these whenever it is appropriate.

Chapter Concepts

Each chapter begins with a list of concepts that introduces the student to the chapter by organizing its content into a few meaningful sentences. The concepts provide a framework for the content of each chapter.

Readings

The readings in the text were written by the author. They expand on the core of information presented in the chapter in an interesting way.

Illustrations and Tables

Numerous illustrations and tables appear in each chapter and are placed near their related textual discussion. The tables clarify complex ideas and summarize sections of the narrative. The photographs and drawings are chosen and designed to help the student visualize structures and processes. Learning schematics combine rendered art, line art, and an electron micrograph to help students visualize structures and/or processes.

Boldfaced Words

New terms appear in boldface print as they are introduced within the text and are immediately defined in context. All boldface terms are in the text glossary along with appropriate page references.

Internal Summary Statements

Summary statements are placed at strategic locations throughout the chapter. These immediately reinforce the concept that has just been discussed. The summary statements aid student retention of the chapter's main points.

Chapter Summaries

Chapter summaries offer a concise review of the material in each chapter. Students may read them before beginning the chapter to preview the topics of importance, and they may also use them

to refresh their memories after they have a firm grasp of the concepts presented in each chapter.

Biological Relationships

A section called Biological Relationships appears at the close of each chapter. This section reviews the concepts presented in the chapter and shows how they relate to those discussed in other chapters. These sections give students an overview of the current topic and its place in biology as a whole.

Chapter Questions

Review questions and review exercises are placed at the close of each chapter. The sequence of the multiple-choice review questions follows that of the chapter. The review exercises require students to supply the answers and label diagrams. Answers to the review questions and review exercises appear in Appendix D.

Concept Maps

A concept map is a diagram that shows how the main ideas of the chapter are related. There are no right or wrong concept maps, although some may be done better than others. In the early chapters, either a complete concept map is provided or the student is asked to fill in a small part of a partial one. In succeeding chapters, students are asked to fill in more and more of the map until finally they are required to make one of their own.

Further Readings

For students who would like more information about a particular topic or are seeking references for a research paper, each part ends with a listing of articles and books to help them get started. Usually the entries are *Scientific American* articles and specialty books that expand on the topics covered in the chapter.

Appendix and Glossary

The appendix contains optional information for student referral. An important part of the appendix is the Classification of Organisms used in the text. It also includes the Table of the Elements and a review of the metric system.

The text glossary defines the terms most necessary for making the study of biology successful. By using this tool, students can review the definitions of the most frequently used terms.

Index

The text also includes an index at the back of the book. By consulting the index, it is possible to determine on what page or pages various topics are discussed.

ADDITIONAL AIDS

Instructor's Manual/ Test Item File

The Instructor's Manual/Test Item File authored by Jay Templin is designed to assist instructors as they plan and prepare for classes using *Introduction to Biology*. Possible course organizations for semester and quarter systems are suggested, along with alternate suggestions for sequencing the chapters. A general discussion and a lecture outline are provided for each chapter; together, these give a brief overview. Approximately 50 objective test questions and several essay questions are provided for each chapter. A list of suggested audiovisuals for the various topics and a list of suppliers are included at the end of the Instructor's Manual.

Student Study Guide

The Student Study Guide that accompanies the text was authored by Jay Templin. Each text chapter has a corresponding study guide chapter that includes a listing of behavioral objectives, study exercises, and a chapter test. Answers to study guide questions are provided to give students immediate feedback.

Customized Laboratory Manual

The Laboratory Manual for *Biology*, authored by Kenneth Kilborn and myself, has 33 exercises, which are now available as individual "lab separates," so instructors can custom-tailor a manual for their particular course. The separates will be collated and bound by WCB on request.

Laboratory Resource Guide

Helpful and thorough information regarding each lab preparation can be found in the *Biology* Laboratory Resource Guide. Authored by Kenneth Kilborn and myself, the guide is designed to help instructors make the laboratory experience more meaningful for the student. For handy reference, a list of suppliers is printed on the inside front cover. The Resource Guide is divided into two parts: Laboratory Preparation and Instructions, and

Laboratory Exercises and Expected Results. The guide gives suggested answers to all questions in the laboratory manual.

Transparencies

A set of 100 transparency acetates also accompanies the text. These feature key illustrations from the text in full color. An additional set of 130 transparency acetates is also available to qualified adopters.

Art Masters

A set of 150 art masters consisting of one-color line art with labels can be used for additional transparencies or can be copied and used for student handouts.

The seven packages include the following titles: Cell Biology, Genetics, Diversity, Plant Biology, Animal Biology, Ecology and Behavior, and Evolution.

Adopters of *Introduction to Biology* can order one or all seven packages free.

WCB Testing Software

Wm. C. Brown Publishers provides a computerized test generator for use with this text. It allows you to quickly create tests based on questions provided by Wm. C. Brown and requires no programming experience to use. The questions are provided on diskette in a test item file. Wm. C. Brown also provides support services, via mail or phone, to assist in the use of the test generator software, as well as in the creation and printing of tests.

A computerized grade management system is also available for instructors. This allows you to track student performance on exams and assignments. Reports based on this information can be generated for your review.

Software to generate quizzes can also be provided. These quizzes can be used to allow students to prepare for the exams on their own.

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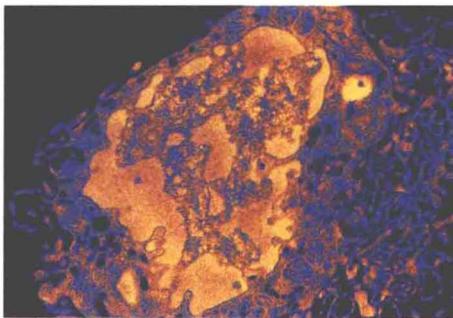
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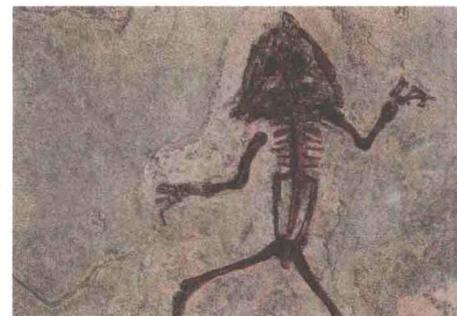
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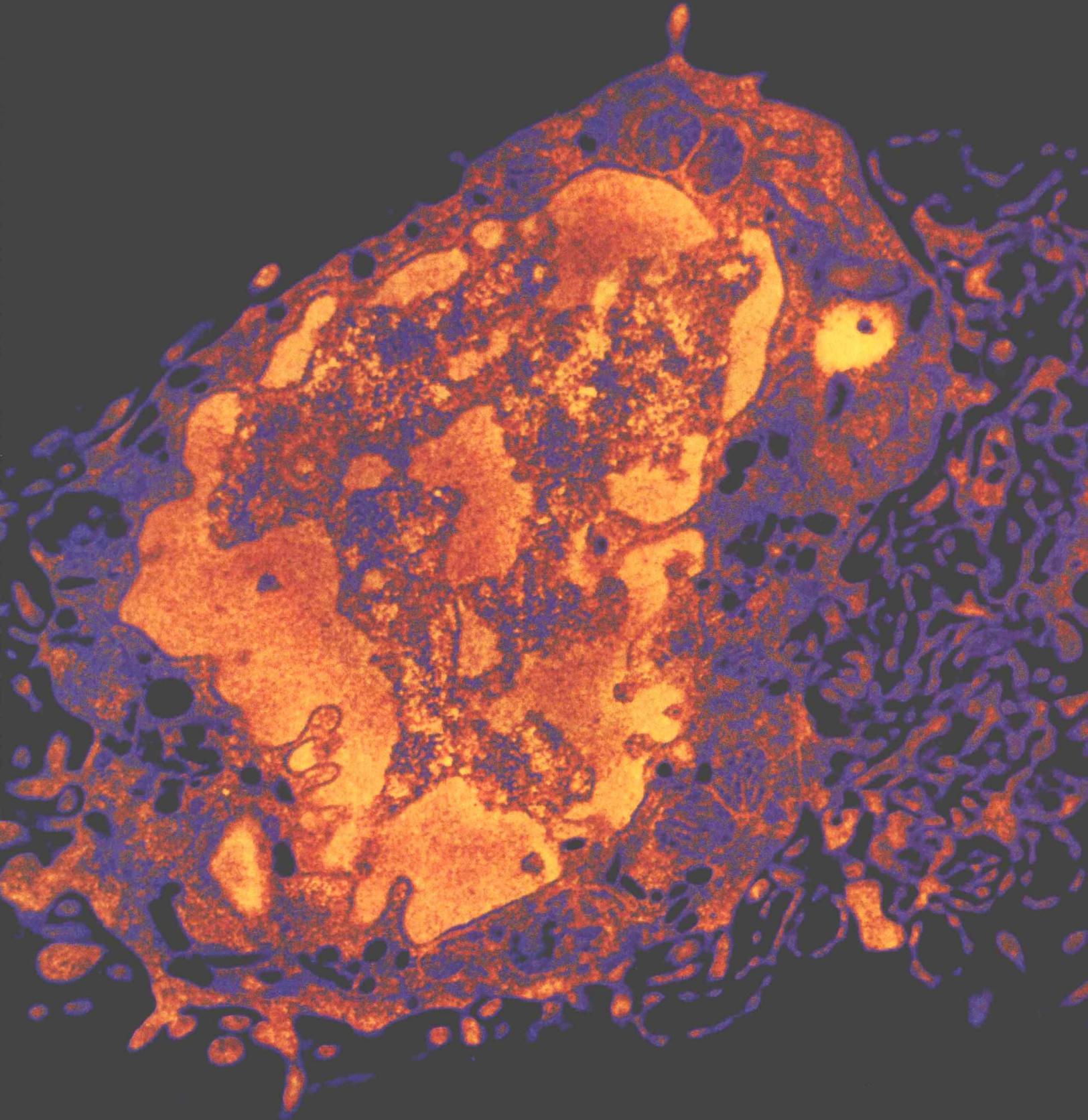
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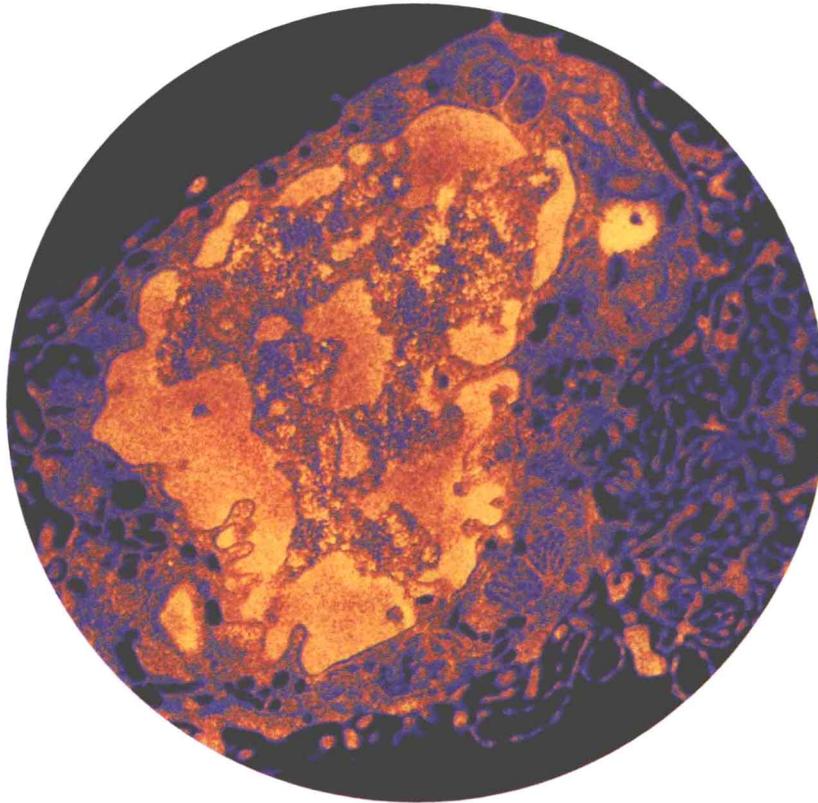
P A R T 1

The Cell



The Cell*Chapters*

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A single cell, alone but majestic. All living things are composed of cells, tiny factories that transform materials and energy into many types of molecules for themselves and for the body. The term “multicellular” is indeed appropriate to describe organisms such as ourselves because it is cells that form the structure of organisms and carry on their functions. Magnification, $\times 6,000$.