Preface

The last six years have been an exciting time for biology, especially for plant biologists. In this time, the number of gene sequences in databases has ballooned, and it is now possible to compare the sequences of conserved genes from a large number of organisms in all the kingdoms of life. Gene sequences provide marvelous information for determining evolutionary relationships, and our understanding of the tree of life has taken some new twists and turns.

We have seen the completion of the sequencing of several genomes. The human genome was perhaps the most trumpeted, but many others have been completed, including the genome of a small research plant, *Arabidopsis thaliana*, the "white mouse" of plant biology. Rice will be the next plant—and the first agricultural crop—to have its genome sequenced. Scientists are taking a new genome-wide view of the growth and development of plants.

Plant biologists have been among the first to recognize and embrace the power of modern phylogenetic logic in determining the evolutionary progression of the earth's diverse organisms. The major changes in the text—and the ones that we feel put this book in the forefront of introductory plant biology textbooks—deal with the description of the evolutionary origins and relationships of plants. With this new edition, the biodiversity part of the book largely adopts the best-supported, most current phylogenetic view of the organisms covered in our text. We introduce the topic of cladistics and show its application to various kinds of information, including gene sequences. We then describe how cladistics and sequence information have changed and enriched our understanding of plant evolution. This is a subject that excites strong passions among biologists. We show students how to appreciate different types of evidence—including both gene sequences and morphological traits—that describe the past events and directions of evolution.

Genetic modification has become big business, in plant biology more than any other field. When we wrote the first edition, we could only point to one or two genetically modified crops available to consumers. Now over 20 percent of the world's soybean, corn, cotton, and canola plants—and 75 percent of the soybeans grown in the U.S.—have been engineered for new traits. The new traits make foods and fibers cheaper to grow or pest-resistant. New varieties will even be more healthful. At the same time, many people in the world have become concerned about genetically modified plants, the procedures by which they are developed, approved, and distributed, and the possibility of gene "leakage" from the modified plants to nearby wild relatives. This edition deals with the opportunities and concerns in an objective manner.

There also has been much recent excitement in the field of ecology. Climate change continues to hold the attention of scientists and non-scientists alike. Can photosynthesis by plants ease the problems caused by our profligate burning of fossil fuels? Can we manage ecosystems to stem the present rate of biodiversity loss? Satellite sensors have given ecologists new tools for measuring the distribution and health of plant life over large areas.

We have taken these developments into account—as well as many excellent suggestions received from reviewers—in revising the chapters of this textbook. Our goal has been to keep the text topical, improve its readability and usefulness as a guide, and keep its size and language accessible to beginning biology students.

Other changes include:

- The chapter on background chemistry has been reorganized for clarity and new summary tables have been added.
- Information on transcription, translation, the cell cycle, and signaling has been moved to the chapter on development. The information on hormones has been rewritten to focus on various phases and processes of growth and development rather than the hormones themselves.
- The Biotechnology chapter has new information on PCR, genomics, and cloning; also, there are new figures showing recent applications of the technology.
- The chapter on prokaryotes now clearly distinguishes the Archaea and Bacteria.

- Chapters on plant structure have been carefully edited and new images have been added to enrich the already strong illustrations in the first edition.
- Within each biodiversity chapter we discuss organisms in terms of their phylogeny, rather than in terms of their Linnaean relationships.
- Cladograms are used in each chapter as a way to diagrammatically summarize phylogenetic relationships.
- There are many new sidebars throughout the book's chapters, organized into four areas: Plants, People, and the Environment; Economic Botany; Biotechnology; and In Depth (technical points).
- Each chapter ends with a selection of references, carefully chosen for readability, to articles that are available through InfoTrac®, an on-line subscription reference service. More technical references can be found through the Brooks/Cole–Thomson website.
- We added appendixes on useful and practical botanical subjects, including a list of toxic plants and information on choosing and nurturing house plants.

Bearing in mind the differences in preparation and experience of the students who will use this textbook, we have elected to retain the sequence of topics of the first edition. We begin with chapters on the structure, function, reproduction, physiology, and genetics of flowering plants because they are more familiar to readers, making the new information more easily absorbed. We then present the evolutionary survey, with detailed excursions into the Prokaryotes, Protists, and Fungi, as well as into divisions of the Kingdom Plantae. The overall sequence of major subjects in the book builds from metabolism to whole plant function to reproduction within flowering plants, then from simpler to more advanced organisms, concluding with two ecological chapters that tie together the entire book. We recognize that instructors differ in their preferences for chapter sequence, and we have taken great pains to ensure that chapters are independent, so that it is possible to start with survey chapters and proceed to the reproduction, structure and physiology of flowering plants. We hope that instructors and students will find the chapters easy to apprehend in whatever sequence they read them.

This book is the capstone of a chain of plant biology textbooks that is probably longer than that of any other existing biology textbook in the world. The ancestral book, *A Textbook of General Botany,* was co-authored in 1924 by Richard M. Holman of the University of California, Berkeley, and Wilfred W. Robbins in the Botany Division of what was then called the University Farm, located in the small town of Davis. The book was widely adopted through its four editions. After Richard Holman passed away, Professor Robbins invited a young faculty member in the Farm's Botany Division to be co-author of a 1950 book, *Botany: An Introduction to Plant Science.* That faculty member was T. Elliot Weier, a cytologist and pioneer in the use of the electron microscope. After Wilfred Robbins' death, Dr. Weier invited a colleague in the department, C. Ralph Stocking, a plant physiologist, to become co-author of the second and third editions. Michael Barbour, a plant ecologist, joined Weier and Stocking on the fourth (1970) and fifth (1974) editions, and Tom Rost, a developmental anatomist, joined for the sixth edition (1982). Plant physiologist Robert Thornton helped them write two editions of a smaller book called *Botany: A Brief Introduction to Plant Biology* (Rost et al., 1979 and 1984). Terence Murphy, a molecular plant biologist, has become the eighth co-author in a story that has wound through 13 versions/editions, 74 years, hundreds of thousands of books printed, two publishers, and four generations of readers. Welcome to you, the fourth generation!

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