

As we approached this revision of *Biology of Plants*, we recognized that extensive work would be needed to address the advances that have been made in all areas of plant biology. From new molecular details about photosynthesis to the vast differences in taxonomic relationships that have been revealed by comparison of DNA and RNA sequences, to advances in genomics and genetic engineering to an enhanced understanding of the anatomy and physiology of plants, there have been exciting developments in the field. This current edition of *Biology of Plants* has undergone the most significant revision in its history, with every topic scrutinized and, where necessary, revised and updated.

While covering these advances, we have strengthened the narrative by expanding and clarifying discussions; carefully defining new terms; and adding new diagrams, photos, and electron micrographs. Each chapter now begins with an attractive photograph and informative caption that relates to the chapter content but in a tangential way that often touches on an environmental topic.

With each revision, we continue to pay special attention to the book's interlocking themes: (1) the functioning plant body as the dynamic result of processes mediated by biochemical interactions; (2) evolutionary relationships as valuable for understanding form and function in organisms; (3) ecology as an integrated theme that pervades the book and emphasizes our dependence on plants to sustain all life on Earth; and (4) molecular research as essential for revealing details about plant genetics, cellular function, and taxonomic relationships.

## Changes Reflecting Major Recent Advances in Plant Science

Every chapter has been carefully revised and updated, most notably:

- **Chapter 7 (Photosynthesis, Light, and Life)**—presents an expanded discussion of light reactions, including an updated diagram on the transfer of electrons and protons during photosynthesis; new essay on “Global Warming: The Future Is Now”
- **Chapter 9 (The Chemistry of Heredity and Gene Expression)**—incorporates histone acetylation, DNA methylation, epigenesis, and noncoding RNAs
- **Chapter 10 (Recombinant DNA Technology, Plant Biotechnology, and Genomics)**—updates material on the

impact of new molecular methods for studying plants, resulting in the development of golden rice, as well as plants that are resistant to herbicides, pesticides, and diseases

- **Chapter 11 (The Process of Evolution)**—covers recombination speciation (speciation not involving polyploidy) and includes two new essays on “Invasive Plants” and “Adaptive Radiation in Hawaiian Lobeliads”
- **Chapter 12 (Systematics: The Science of Biological Diversity)**—presents an expanded discussion of the chloroplast as the main source of plant DNA sequence data and introduces DNA barcoding and supergroups; new essay on “Google Earth: A Tool for Discovering and Protecting Biodiversity”
- **Chapter 14 (Fungi)**—reorganized and updated with the latest classifications; includes nucleariids and the phyla Microsporidia and Glomeromycota, as well as a new phylogenetic tree of the fungi

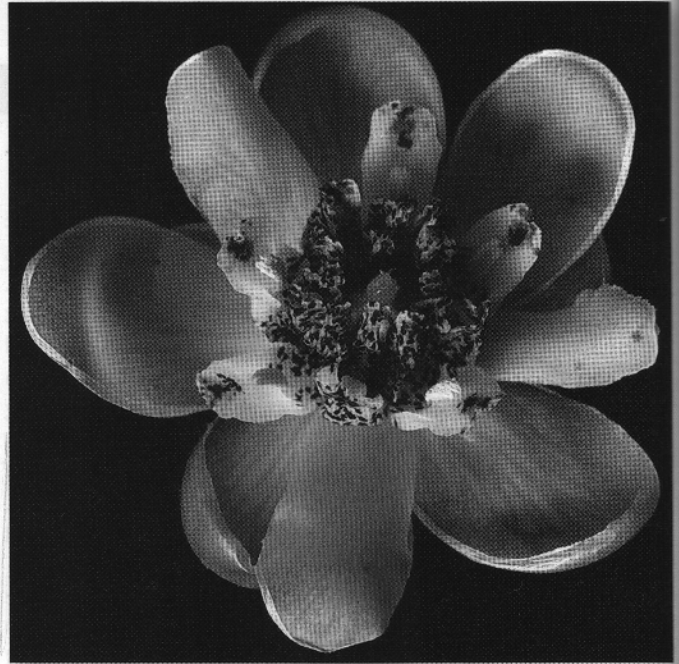


The cedar-apple rust fungus alternates between two hosts, cedar and apple trees, causing damage to apple harvests (page 278).

- **Chapter 15** (Protists: Algae and Heterotrophic Protists)—incorporates the latest classifications, including a phylogenetic tree showing the relationships of the algae; new discussion of the cultivation of algae for biofuel production and a new essay on “Coral Reefs and Global Warming”
- **Chapter 18** (Gymnosperms)—includes an expanded discussion of double fertilization in the gnetophytes, as well as a cladogram of the phylogenetic relationships among the major groups of embryophytes and a new figure depicting alternative hypotheses of relationships among the five major lineages of seed plants
- **Chapter 19** (Introduction to the Angiosperms)—follows the classification recommended by the Angiosperm Phylogeny Group and presents an expanded discussion of embryo sac types
- **Chapter 20** (Evolution of the Angiosperms)—presents an expanded discussion of angiosperm ancestors and includes new cladograms depicting the phylogenetic relationships of the angiosperms



The Chinese brake fern removes arsenic from contaminated soils (page 391).

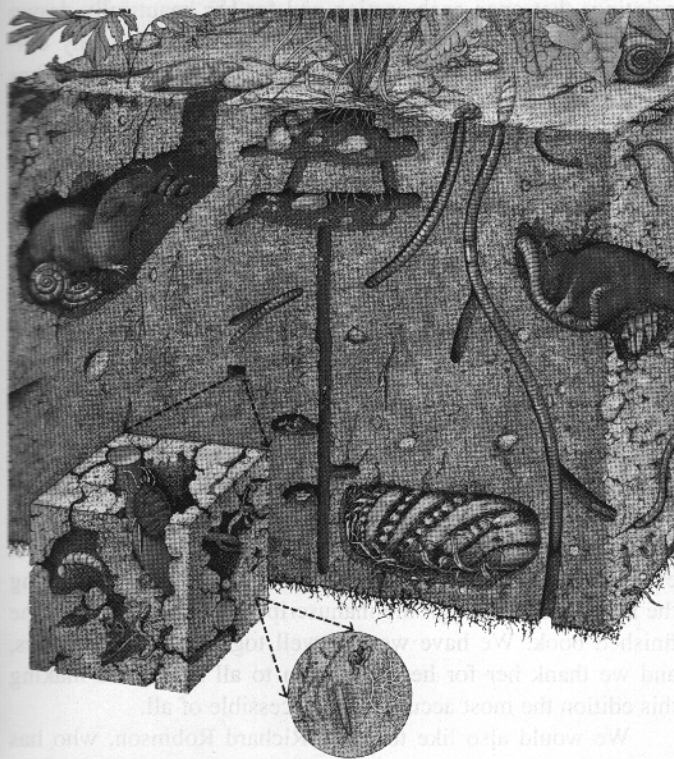


*Austrobaileya scandens* is considered to have evolved separately from the main lineage of angiosperms (page 480).

- **Chapter 21** (Plants and People)—updated and revised to include a new figure depicting independent centers of plant domestication and discusses efforts to develop perennial versions of important annual grains; new essay on “Biofuels: Part of the Solution, or Another Problem?”
- **Chapter 22** (Early Development of the Plant Body)—the discussion of seed maturation and dormancy has been revised, and considerable fine-tuning and updating have occurred throughout this and the other anatomy chapters, with an emphasis on structure/function relationships
- **Chapter 23** (Cells and Tissues of the Plant Body)—the presence of forisomes in sieve-tube elements of some legumes has been added
- **Chapter 24** (The Root: Structure and Development)—the topic of border cells and their functions has been added
- **Chapter 25** (The Shoot: Primary Structure and Development)—includes a new discussion accompanied by micrographs on leaf vein development and the ABCDE model of flower development; new essay on “Strong, Versatile, Sustainable Bamboo”
- **Chapter 26** (Secondary Growth in Stems)—a new diagram depicting the relationship of the vascular cambium to secondary xylem and secondary phloem has been added
- **Chapter 27** (Regulating Growth and Development: The Plant Hormones)—expanded discussions of the role of auxin

in vascular differentiation and on hormone receptors and signaling pathways for the plant hormones; new discussions of brassinosteroids as a major class of plant hormones and of strigolactones, which interact with auxin in regulating apical dominance

- **Chapter 28 (External Factors and Plant Growth)**—extensive revision of gravitropism, circadian rhythms, floral stimulus, and thigmonastic movements; new discussion of genes and vernalization, as well as hydrotropism, phytochrome-interaction factors (PIFs), and the shade-avoidance syndrome; new essay on “Doomsday Seed Vault: Securing Crop Diversity”
- **Chapter 29 (Plant Nutrition and Soils)**—discusses strategies involving nitrogen uptake by plants, along with the new topics of beneficial elements, determinate and indeterminate nodules, and strategies by plants for the acquisition of phosphate; essay added on “The Water Cycle”



Living organisms of the A soil horizon, or “topsoil” (page 690).

- **Chapter 30 (The Movement of Water and Solutes in Plants)**—expanded discussion on hydraulic redistribution and on the mechanisms of phloem loading, including the polymer trapping mechanism; new essay on “Green Roofs: A Cool Alternative”
- **Chapter 31 (The Dynamics of Communities and Ecosystems) and Chapter 32 (Global Ecology)**—remain

online at [www.whfreeman.com/raven8e](http://www.whfreeman.com/raven8e). Fully illustrated, these chapters have been thoroughly updated by Paul Zedler of the University of Wisconsin, Madison

## Media and Supplements

### Companion Web Site

[www.whfreeman.com/raven8e](http://www.whfreeman.com/raven8e)

For students, this free interactive Web site includes:

- **Interactive study aids** to help foster understanding of important concepts from the text, including multiple-choice quizzes, flashcards, plus interactive figures and tables
- **Animations and live-action videos** illustrate several topics from the text for a deeper understanding of the more difficult concepts
- **Two ecology chapters** in easily downloadable and printable PDF format, fully illustrated and thoroughly updated with major contributions by Paul Zedler, University of Wisconsin, Madison.

The dynamic **eBook** is customizable and fully integrates the complete contents of the text and interactive media in a format that features a variety of helpful study tools, including full-text searching, note-taking, bookmarking, highlighting and more.

For instructors, the site includes **all figures** from the text in both PowerPoint and JPEG formats, optimized for excellent classroom projection. The site also includes the **Test Bank** by Robert C. Evans, Rutgers University, Camden, which has been thoroughly revised and organized by chapter in easy-to-edit Word files. The Test Bank features approximately 90 questions per chapter, structured as multiple-choice, true-false, and short-answer questions that can be used to test student comprehension of all major topics in the textbook.

### Instructor's Resource DVD with Test Bank

Included here are all the resources from the site, with **all text images** in JPEG and PowerPoint formats, plus the Test Bank in easy-to-edit and -print Word format.

### Overhead Transparency Set

The set includes full-color illustrations from the book, optimized for classroom projection.

### Laboratory Topics in Botany

*Laboratory Topics in Botany* offers several exercises within each topic that can be selected for coverage that suits individual course needs. Questions and problems follow each topic; refinements and updating have been made throughout. Written by Ray F. Evert and Susan E. Eichhorn, University of Wisconsin, Madison; and Joy B. Perry, University of Wisconsin, Fox Valley.

## Preparation Guide for Laboratory Topics in Botany

*Preparation Guide for Laboratory Topics in Botany* offers helpful information on how to cover each topic, the length of time needed to complete the material, the sources of supplies and ordering schedules, how to set up the laboratory, and ways to guide students in their laboratory work. Written by Susan E. Eichhorn, University of Wisconsin, Madison; Joy B. Perry, University of Wisconsin, Fox Valley; and Ray F. Evert, University of Wisconsin, Madison.

## Acknowledgments

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We would also like to thank Richard Robinson, who has written the engaging ecology-oriented essays that have been added to this edition. The essays are highlighted in the text by a green leaf, and they cover such topics as green roofs, invasive plants, coral bleaching, the development of biofuels, and the use of Google Earth to map and study biodiversity.

The preparation of the eighth edition has involved the collaborative efforts of a large number of talented people at W. H. Freeman and Company. Particular thanks go to Peter Marshall, Publisher of Life Sciences, whose vision and support have made this new edition possible; to Vivien Weiss, who has

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*Ray F. Evert*

*Susan E. Eichhorn*