BOTANY ILLUSTRATED

SECOND EDITION

Introduction to Plants, Major Groups, Flowering Plant Families

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by Janice Glimn-Lacy
and Peter B. Kaufman

Springer

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Preface

This is a discovery book about plants. It is for everyone interested in plants including high school and college/university students, artists and scientific illustrators, senior citizens, wildlife biologists, ecologists, professional biologists, horticulturists and landscape designers/architects, engineers and medical practitioners, and physical therapists and their patients. Here is an opportunity to browse and choose subjects of personal interest, to see and learn about plants as they are described. By adding color to the drawings, plant structures become more apparent and show how they function in life. The color code clues tell how to color for definition and an illusion of depth. For more information, the text explains the illustrations. The size of the drawings in relation to the true size of the structures is indicated by $\times$ 1 (the same size) to $\times$ 3000 (enlargement from true size) and $\times$ n/n (reduction from true size).

The contents reflect a balanced selection of botanical subject matter with emphasis on flowering plants, the dominant plants of the earth. After a page about plant names and terms, the book is divided into three sections. The first is an *introduction to plants*, showing structure and function; then, *major groups*, providing an overview of the diverse forms; and lastly, one-seventh of the *flowering plant families*, with the accent on those of economic importance. The sequence in the sections is simple to complex (cell to seed), primitive to advanced (blue-greens to flowering plants), and unspecialized to specialized (magnolias to asters and water-plantains to orchids). Where appropriate, an "of interest" paragraph lists ways these genera are relevant in our lives (categories include use as food, ornamentals, lumber, medicines, herbs, dyes, fertilizers; notice of wild or poisonous; and importance in the ecosystem). "Of interest" sections in *Botany Illustrated*, second edition, have been expanded to include many more topics of interest.

Evolutionary relationships and the classification of plants have been undergoing many changes in the past two decades since the first edition. In this edition controversial categories have been eliminated allowing individuals to be exposed to current thinking on plant classification. Classification from this second edition may be found in the Index under "Fungi Kingdom" and "Plant Kingdom." Pages on bacteria have been eliminated and two new pages on plant fossils, with accompanying illustrations, have been added. Every text page has undergone extensive revision.

For those interested in the methods used and the sources of plant materials in the illustrations, an explanation follows. For a developmental series of drawings, there are several methods. One is collecting several specimens at one time in different stages of development; for example, several buds and flowers of a plant (see 29) and button to mature forms of mushrooms (see 50, 51). Then, some are cut open to observe parts and decide how to present them, while others are to use for final drawings. Another method is waiting for the plant to change, which involves "forcing" stems (see 14), germinating seeds (see 40), watching one leaf expand (see 69), and drawing a flower in one season and its mature fruit in another (see 104, 109, 110, 111). An alternative to waiting for fruit is to use a collection of dry or frozen specimens, so that as spring flowers appear, the later maturing fruits can be seen at the same time (see 102, 105, 106).

In the first section, *introduction to plants*, there are several sources for various types of drawings. Hypothetical diagrams show cells, organelles, chromosomes, the plant body indicating tissue systems and experiments with plants, and flower placentation and reproductive structures. For example, there is no average or standard-looking flower; so, to clearly show the parts of a flower (see 27), a diagram shows a stretched out and exaggerated version of a pink *(Dianthus)* flower (see 87). A basswood *(Tilia)* flower is the basis for diagrams of flower types and ovary positions (see 28). Another source for drawings is the use of prepared microscope slides of actual plant tissues. Some are traced from microscope slide photographs such as cross-sections, vascular bundles, and transections. Scanning and transmission electron micrographs are traced for chloroplasts, amyloplasts, trichomes, internodes, and pollen grains. Preserved museum specimens provide the source for animals in the pollination series. The remainder of the drawings are from actual plants found in nature, the grocery store, plant nurseries, farm fields, botanical gardens, florist shops, and suburban yards.

In the *major groups* section, three pages have hypothetical diagrams, indicated in the captions. Other microscopic forms are from observations of living material or prepared microscope slides. For plants not locally available, dry-pressed herbarium specimens are measured for drawings (*Stylites*, *Helminthostachys*, *Gnetum*, and *Ephedra*) or machine-copied and traced (habit drawings

of filamentous algae) or chemically revived to three dimensions (bryophytes) for drawing with the use of a dissecting microscope. Drawings are also made from liquid-preserved specimens (*Tmesipteris* habit, *Welwitschia* and *Ginkgo* reproductive structures). For the majority of this section's drawings (including *Welwitschia* habit), living organisms are used.

For the *flowering plant families* section, except for two indicated diagrams in the grass family, all the drawings are from actual plants gleaned from fields, forests, roadside ditches, bogs, neighbors' yards, botanical conservatories, florist shops, grocery stores, and our gardens. The bumblebee arrived of its own accord.

Janice Glimn-Lacy
Peter B. Kaufman

Color Code Clues

The illustrations may be colored by using the easy-to-follow *Color Code.* Each drawing has lines from structures to letters, duplicated in the *Color Code.* All structures similar to the one with a line and letter are the same color; for example, only one of five petals may be identified. Colored pencils are recommended for pleasing results. My personal preference is Berol Prismacolor pencils. The colors needed are 2 shades of red, green, and blue, and 1 each of orange, yellow, pink, purple, brown, and black. Sometimes the *Color Code* lists double colors such as yellow-green, red-brown, or purple-green. Color the same area with a light touch of both colors for the closest resemblance to the plant's natural color. A black pencil used lightly provides a gray color. White is to remain blank. Using pink over light purple results in a lavender color. So as not to color areas that are to remain white or have small areas of color, follow the order listed in the *Color Code* for an individual drawing. Letters, missing from the *Color Code*, are in the text. They usually indicate structures shown as black outlines or colorless areas.

When drawing a 3-dimensional object, scientific illustrators traditionally use an upper-left light source on the object, which casts shadows on the lower right. Converting those shadows into ink dots (stipple) and lines (hatch) within the drawing outline creates an illusion of depth. Another aid to realism in black-and-white drawings is to show foreground structures as darker and larger than background ones. Obvious examples using this technique are the pitcher-plant leaves (see 91) and the iris flower and leaves (see 129). We see colored objects as brighter and more distinct when near and as muted and less distinct when distant. Accordingly, by the use of bright shades of colors for foreground structures and muted shades for background structures, your colored pictures will appear more 3-dimensional. Darker shades of a color on the dot-and-line shadow areas will add to the effect.

To avoid having a green book, the illustration of foliage has been kept to a minimum with an abundant variety of colors indicated throughout. In the *introduction to plants* section, there is uniformity of a designated color. For example, water-conducting tissue and cells (xylem) are always color-coded blue, so that as you look at your colored pages, you see how water moves within a plant. For enlarged flower drawings in the *flowering plant families* section, true colors of flower parts are indicated in the *Color Code.* Dotted lines indicate where structures have been cut, show "see-through" areas, or separate color areas. Some lines are close together, others are single lines to color, but a color overlap of the lines will not detract from the over-all result.

Begin with the first page, which explains the names used, then choose any page that strikes your interest. If a flowering plant structure is new to you, it would be most helpful to look over the structure of the stem (14), leaf (21, 23), flower (27, 28), and fruit types (38, 39). Then, you will be ready to explore. Some discoveries are seeing how an apple flower matures into an apple (see 99), finding that grape flowers have flip-top petal caps (see 104), and learning that inside a common garden sage flower is a mechanical "arm" for sticking pollen on visiting bees (see 113).

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Contents

35 Flower Pollination by Wind
36 Flower Pollination by Birds and Bats
37 Flower—Fertilization and Embryo Development
38 Fruit—Dry Types
39 Fruit—Fleshy Types, Compound
40 Seed Structure and Germination

Major Groups

41 Major Groups; Geologic Time Scale
42 Fossils
43 Fossils (continued)
44 Blue-greens
45 Slime Molds
46 Water Molds, Downy Mildews, White Rusts; Chytrids and Allies
47 Fungi
48 Molds, Mildews, Morels (Sac Fungi)
49 Rusts, Smuts, Jelly Fungi (Club Fungi)
50 Gill Fungi
51 Gill and Pore Fungi
52 Pore, Coral and Toothed Fungi
53 Puffballs, Stinkhorns, Bird's-nest Fungi
54 Lichens
55 Dinoflagellates
56 Golden Algae, Yellow-green Algae, Diatoms
57 Red Algae
58 Green Algae
59 Brown Algae
60 Brown Algae (continued)
61 Brown Algae (continued)
62 Stoneworts
63 Liverworts, Hornworts, Mosses
64 Whisk Ferns
65 Clubmosses, Spikemosses, Quillworts
66 Horsetails
67 Ferns
68 Common Ferns
69 Fern Leaf Development
70 Water Ferns
71 Cycads
72 Ginkgo
73 Conifers
74 Gnetes

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Janice Glimn-Lacy has a **Bachelor of Science in Botany** from The University of Michigan, 1973, and plans to have a **Bachelor of Fine Arts** from Herron School of Art and Design, Indiana University-Purdue University at Indianapolis (IUPUI), 2008. She is a member of the University of Michigan Alumni Association, the Indiana Native Plant and Wildflower Society, the Indianapolis Museum of Art, the Indianapolis Museum of Art Horticultural Society, and the Watercolor Society of Indiana. While a Landscape Designer, she wrote and illustrated *What Flowers When with Hints on Home Landscaping* (the Flower and the Leaf, Indianapolis, 1995). She was a co-author and illustrator of *Practical Botany* (Reston), illustrator of *Michigan Trees* (University of Michigan Press), *Plants Their Biology and Importance* (Harper & Row), several Ph.D. theses, and many botanical journal articles. For several years she taught botanical illustration in the University of Michigan Adult Education Program, at the Indianapolis Art Center, and at the Indianapolis Museum of Art.

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