



Frank B. Salisbury



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As we have worked during the past two and a half years on this fourth edition of our text, we have been impressed by the advances in plant physiology that have taken place since 1984, when we finished work on the third edition. It is humbling to realize how many people have contributed to these advances. In some areas especially (photosynthesis, for example) the depth of our understanding now reaches awesome proportions. In other areas far less is known and we frequently emphasize how much remains to be learned. At the same time, basic principles of our science remain just that: fundamental to a comprehension of its frontiers. Because of this, and in spite of our efforts to pick and choose only the most relevant topics, our book has grown significantly since the last edition. We realize that this will pose problems for teachers such as ourselves who must introduce students to the science in a one-quarter or one-semester course. Yet we want students to have some feeling for the extent of the science so we hope interested students will at least scan those topics that are not assigned in class.

Purpose of the Book

Our purpose, as in previous editions, is to provide a broad explanation of the physiology of plants (their functions) from seed germination to vegetative growth, maturation, and flowering. We present principles and results of previous and ongoing research throughout the world. Partly because of space limitations, we have concentrated on seed plants and little emphasis is usually given to other organisms (except in Chapter 21 on the Biological Clock). *Plant Physiology* is for students who are curious about what plants do and what physical and chemical factors cause them to respond as they do. Many students will use this information in careers in agronomy, horticulture, forestry, range and seed science, and plant pathology. We hope the book will motivate many others to obtain advanced degrees in plant physiology and to perform research to solve present and future problems.

Organization and Recent Revisions

We retain the same basic organization as in previous editions. The first eight chapters (Section One) are primarily concerned with physical processes that go on in plants, and this topic is introduced with a chapter that summarizes the structures of plant cells. We expect that you will know the highlights of this topic already. The next seven chapters (Section Two) concern the biochemical processes that occur in plants, including three chapters on photosynthesis. These biochemical processes depend partly on some of the physical processes covered in Section One. Section Three describes plant growth and development and with this edition we have added a chapter on molecular biology and genetic engineering as these topics relate to research and discov-

eries in plant physiology. This chapter was prepared by two guest authors, Drs. Ray Bressan and Avtar Handa, who are experts in the field. The last two chapters (Section Four) on environmental physiology and stress physiology describe important environmental factors, how they limit growth of various species and yet how some species have adapted physiologically to survive in harsh environments.

Finally, as in our third edition, we have added three appendices. Appendix A describes SI units of measurement, which are being increasingly used in all scientific fields. We hope that it will help students to become familiar with these units and that it will serve as a reliable reference source for authors who are preparing technical papers for publication. Relatively minor changes were made in Appendix B, which covers properties of various kinds of radiation including sunlight and various artificial light sources commonly used by plant researchers. Appendix C summarizes transcription and translation. You may have memorized these principles in an introductory biology course but this appendix may serve as a convenient reference.

Although the overall outline is similar to earlier editions, we have not only added much new material but we have reworked virtually every paragraph in the book, attempting to contemplate and evaluate how new information fits into the old, thereby expanding our comprehension of how plants function. And, with the help of many reviewers and an excellent copy editor, Alan Titche, we have tried to improve the presentation so that students will be better able to understand. We have also worked closely with Angela Mann, an outstanding production editor, and Cecile Duray-Bito, who has prepared some delightful new illustrations for this edition.

The reviewers were of immeasurable help. Our science has become so broad that it is impossible for two authors to keep up with it all. Virtually every chapter was examined in preliminary draft by at least three (and as many as a dozen) experts in the respective fields and the final version represents a distillation of their suggestions plus the fruits of our own efforts to assimilate the literature. We are extremely grateful for that help but of course we accept complete responsibility for the present text.

A summary following this preface describes some of the additions and changes in this edition.

Format and Features

The basic format (page size, double columns, and headings) is the same as it was for the third edition, but with some design improvements. Notably, second-level headings are set above the paragraphs, which makes them easier to find and emphasizes the book's organi-

zation. Third-level headings (which are seldom used) are in *italics* on the left margin, initiating paragraphs.

Plant physiology consists of a complex network of information that can be approached from many vantage points and discussed in various chapters. When we have discussed the same subject from a different vantage point in more than one chapter we have usually included a cross-reference to a Section or Chapter in which it is also discussed. New terms or concepts are listed in **bold-faced** type when they are defined; many such terms are defined in more than one place in the book and they are **bold-faced** each time. Page numbers in the index have a "d" by them if the term is *defined* (**bold-faced**) on that page. Page numbers with an "i" by them in the index refer to pages where the item is *illustrated*. Names of biochemical compounds, enzyme names, and certain other names or terms are usually listed in *italics* when they are first introduced to help you find them again as you read further and review.

Nearly everyone who has commented on our book has expressed enjoyment of and appreciation for the guest essays so we have kept most of those from earlier editions and added several new ones. Some of these deal almost exclusively with personal recollections of exciting times in the scientific lives of their authors; others explain some current and important topic in more detail than seemed warranted in the text. There are also smaller boxed essays on special topics, as in earlier editions.

Literature Citations and Names of People and Plants

We have added many references (authors' names and year of publication), beginning especially with Chapter 6. They are provided for students who wish to learn more about a subject and to document our source of information for subjects that we think might be controversial. We have often listed recent reviews or recent articles that expand on a given topic and introduce students to the past literature. In addition, some classic papers from the previous century and early in this century are also included in certain chapters; many of these are not easily found elsewhere. We do want students to think of plant physiologists as people, so occasionally and rather arbitrarily we have listed their first names and the places where they work or worked. References for each chapter are listed by author and year of publication in the Reference Section at the end of the book.

Plant names pose another problem. We refer to some species mostly by their common names, as did those who worked with them, whereas we identify other species by their scientific (Latin) names (but without the author who first described the species). Usually we give both at least once in the text.

Some Thoughts

In spite of the agonies of preparing a major text such as this—and it can be agonizing to check some minor point in the library for an hour to update one sentence or to read proofs for what seems like forever—on balance developing this edition has been an enjoyable learning experience. Some questions posed in our last edition have now been answered by former students and our personal understanding of how plants work has grown substantially. There is much yet to learn and answers will be coming fast as the techniques of biotechnology are applied to an increasing number of problems.

As we wrote in the preface to our third edition: "We hope that our enthusiasm and love for the science of plant physiology is apparent to you and that you will come to share these feelings with us. These are the feelings that motivate the rapid advances now being made in virtually all scientific disciplines."

List of Responsibilities

Frank B. Salisbury wrote chapters 1, 2, 3, 4, 5, 8, 12, 16, 19, 21, 22, 23, 25, 26, and the appendices. Cleon W. Ross wrote chapters 6, 7, 9, 10, 11, 13, 14, 15, 17, 18, and 20. Ray Bresson and Avtar Handa wrote chapter 24.

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Reviewers

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