ods of measuring plant water relations parameters, which resulted in greater precision in specifying the degree of stress and in quantifying the components of plant water potential. In the '70's specific behavioral and metabolic responses of plants to known levels of water, osmotic, and turgor potentials were elucidated and quantified. Though reviews of some of these responses have been published periodically, a general compilation of reviews of the subject has not been adequately accomplished heretofore.

This volume is intended to provide such a comprehensive treatment of the metabolic consequences of water stress on plants, and it is remarkably successful. Most of the authors are the very people who have been primarily responsible for the advances in the field, and they have synthesized and presented the information in a readable fashion in most cases.

The most important general response of plants to water deficits that has been clearly demonstrated within the past decade is osmotic adjustment, and this topic is extensively treated. The physicochemical aspects of solute accumulation as a response to water deficit are discussed by L. J. Borowitzka in the best general treatment of the roles and requirements of compatible solutes that I have seen. Borowitzka draws on her extensive experience with *Dunaliella*, which is one of the most intensively studied model systems for osmoregulatory behavior, and she gives fair treatment to proposed roles for accumulated solutes such as glycerol and proline in addition to their presumed role as compatible solutes. A pair of chapters on proline accumulation (physiological aspects by Aspinall and Paleg and biochemical aspects by C. R. Stewart) present a clear, synthetic picture of the importance of this solute in plant response to water deficits. There probably has been more research conducted on this amino acid, and more debate concerning its role, within the past decade than is the case for any other metabolite, and the abundant literature is effectively summarized in these two chapters. Especially valuable is a seven-page table listing all known examples of proline accumulation organized by taxon and type of stress. The solute next in importance in this context is betaine, which is covered by R. G. Wyn Jones and R. Storey. All known examples of betaine accumulation are summarized in a ten-page table.

The hormone that has received the most attention in the past decade is abscisic acid (ABA). Its physiological aspects are discussed by M. C. Pitman (ion uptake) and T. A. Mansfield and W. J. Davies (stomatal behavior), its biochemical aspects by B. V. Milborrow. Unfortunately, the notion that ABA increase should, and does, increase root permeability to water in stressed plants still has currency with these authors.

Two important suggestions are made in the book. Wyn Jones and Storey recommend a unified terminology, reserving the name "betaine" to indicate the class of compounds and naming individual betaines by reference to their parent amino acid (glycinebetaine, alaninebetaine, and so on). Up until now the term has been used to refer to the specific metabolite glycinebetaine as well as to the entire class of compounds. M. M. Jones, N. C. Turner, and C. B. Osmond attempt to straighten out use of "drought resistance" and related terms. They suggest a classification that uses "drought" as a meteorological term and avoids the confusion that results when "drought" and "plant water deficit" are equated. The proposed terminology makes sense, although their new term, "drought tolerance at high tissue water potential," probably should be "drought tolerance at high turgor potential."

A paper by S. K. Sinha and D. J. D. Nicholas on nitrate reductase contains far too many "unpublished results" by the senior author. That is inappropriate for a review, and it is inconsistent with all the other chapters in the book. In spite of that notable discrepancy, the chapters of the book fit together so nicely that it almost seems like a single-authored book. There are virtually no major contradictions on significant points among the contributors. I am sure this will be the most important general reference on drought resistance for the next few years.

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A Prominent Enzyme

Cytochrome Oxidase. A Synthesis. MÅRTEN WIKSTRÖM, KLASS KRAB, and MATTI SARASTE. Academic Press, New York, 1981. xii, 198 pp., illus. $30.

Cytochrome oxidase is a key enzyme of energy generation: in most respiring cells it catalyzes the transfer of electrons from the respiratory chain to oxygen gas. It is also one of the most complicated enzymes known; its four redox centers (two heme *a* groups and two copper atoms) have made it a favorite playground for physical chemists, and its many nonidentical subunits (up to a dozen, depending on the source) offer unusual opportunities for enzymologists and structural biologists. The eukaryotic enzyme is controlled by two distinct genetic systems: the three largest subunits are coded by mitochondrial DNA and made inside the mitochondria, whereas the remaining subunits are coded by nuclear DNA and made outside the mitochondria and imported into the organelles. Since the mitochondrial genes coding for cytochrome oxidase have been sequenced, the enzyme can now be studied and manipulated by the vast array of present-day genetic methods. Finally, by proper treatment with detergents, the enzyme can be persuaded to form crystalline sheets; analysis of these sheets by electron diffraction has already yielded first glimpses of the shape of individual cytochrome oxidase molecules.

Cytochrome oxidase, no doubt, richly merits a monograph, and the present volume comes close to what I regard as the ideal one. It is written by three young scientists who, working in the same Finnish laboratory, have discovered that cytochrome oxidase not only transfers electrons but also pumps protons. The style of the book is highly readable, the illustrations simple and well done, and the length just right. Most important, the different areas of research on cytochrome oxidase are presented in a competent and well-balanced fashion. The book begins with a chapter on "general orientation" and goes on to discuss structure and topography; physical properties, configuration, and topography of the redox centers; oxidoreduction properties of the redox centers; kinetics and catalytic machanism; and electron transfer and energy transduction. It is perhaps unfortunate that the manuscript was completed just as the genes for the mitochondrially made subunits were being sequenced; this important development is therefore only mentioned. As a teacher, I would also have welcomed at least a brief table summarizing the key historical developments. But these are minor points compared to the merits of the book. It will be a key reference for workers in the field for years to come, and I expect to see its brightly colored cover (green, of course) on the bookshelves of most of my colleagues. The authors have done a difficult job well.

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