and the chemical and physical characteristics of leaf surfaces and cuticular membranes are described, with the aid of very good electron micrographs of leaf surfaces. Then leaching from plants, modification by pollution, and microclimate of leaf surfaces are discussed.

Nine papers on saprophytes that are found on leaf surfaces constitute the second section. They describe methods used to estimate the number of microorganisms and the varied populations of bacteria, yeasts, and fungi that reside on leaves and buds of some agricultural plants.

Pathogens on leaf surfaces are the subject of the third and largest section, comprising 16 papers. The dispersal and trapping of spores by leaves, the microenvironment and the chemical environment in relation to growth of fungi, and interactions of bacteria are discussed. The only paper on viruses reviews data that ectodesmata are involved in infection sites of tobacco mosaic virus. Three papers concern development, sporulation, and structural changes in mildew infections. This section includes many electron micrographs and vivid descriptions of the infection process and the changes that accompany it. Only one chapter concerns control of leaf pathogens.

Six papers in the fourth section deal with senescing leaves. One considers biochemical aspects, the others the microbiology of leaves as they senesce, fall, and decompose.

The last and perhaps the most significant section is devoted to interactions on the leaf surface. It includes papers on the effects of leaf exudates on fungicides and on appressorium formation, photoalexins and restriction of fungal growth, and antagonism between pathogenic and saprophytic microorganisms. An interesting paper on the grass sheath as a site for nitrogen fixation describes the widespread occurrence of nitrogen-fixing bacteria on leaf surfaces and how they act as a "factory" for the production of organic nitrogen.

This book emphasizes that leaves are more than just a site for photosynthesis. They provide a surface on which many microorganisms reside, and the interactions of these microorganisms with each other and with the leaf have an important bearing upon the growth of the plant. Research workers and students in plant pathology, microbiology, botany, agriculture, and general biology will find much of interest in these papers. The editors are to be commended in bringing together 64 experts from five continents and in so well organizing their papers into this excellent book with author, systematic, and subject indexes.

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Physiological Adaptations

Responses of Plants to Environmental Stresses. J. LEVITT. Academic Press, New York, 1972. xiv, 698 pp., illus. $32.50. Physiological Ecology.

To write a book on frost resistance or water stress in plants would be a sizable undertaking in its own right, but to combine both these and other environmental stresses into a single volume represents a mammoth effort which very few lone authors would be willing or qualified to undertake. It is clear not only from the preface but from the content of this book that the author has tackled this task in order to present an integrated view of the physiological and chemical mechanisms by which plants avoid, adapt to, and respond to the environmental stresses water deficit, temperature extremes, and high salt concentrations, as well as radiation. Pollution, which is featured on the dust jacket, is however only a minor consideration. The responses dealt with are by and large the extremes of stress that may cause injury or death, and this is not an attempt to cover all aspects of temperature response or the water relations of plants. The exclusion of nutrient deficiencies, except where they interact with the other stresses, is not only understandable but a wise decision for the sake of clarity. The central thread, or recurrent theme, in this presentation is the importance of sulfur bonding and sulfhydryl groups in regulating the response of proteins and membrane structure to stress. The literature coverage is excellent, with close to 2000 references, and it must be said that although there is often a bias in favor of the "SH hypothesis," which may in fact be quite justified, other explanations of stress response are fully documented and discussed to give a balanced presentation. However, the further the author digresses from his own specialty, that is, the molecular basis of stress responses, the less critical become his views on the data presented. One aspect that comes through rather clearly is the continuing search for meaningful tests that can be used in predicting the tolerance of plants to frost, water, and salt stresses, and this underlines our as yet incomplete understanding of the nature of stress and stress responses.

The material is well presented in short, clearly headed sections, which do however result in some repetition. Students, and I suspect many others, would be well advised to read carefully the definitions in the two opening chapters in order to master such terms as "direct elastic dehydration strain," "poikilotherm," and "homoiohydric." More than half the book is concerned with temperature stresses, with the next largest section that on water stress. Radiation and salt stresses, each with about 40 pages, have a much smaller but still significant coverage. Each subject is presented in an orderly fashion, under headings that deal with the nature of the stress, avoidance, tolerance, and so on, with comments on the possible mechanisms of injury and resistance. Although the experts may argue on points of interpretation, the excellent literature coverage of this volume makes it invaluable as a reference for both students and those undertaking research in the field of environmental stress.

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Books Received

Advances in Creep Design. The A. E. Johnson Memorial Volume. A. I. Smith and A. M. Nicolson, Eds. Halsted (Wiley), New York, 1972. xx, 486 pp., illus. $42.50.

Advances in Experimental Social Psychology. Vol. 6. Leonard Berkowitz, Ed. Academic Press, New York, 1972. xiv, 310 pp., illus. $12.50.

Advances in Heterocyclic Chemistry. Vol. 14. A. R. Katritzky and A. J. Boulton, Eds. Academic Press, New York, 1972. x, 408 pp., illus. $27.50.

Africa and the Islands. R. J. Harrison Church, John I. Clarke, P. J. H. Clarke, and H. J. R. Henderson. Wiley, New York, ed. 3, 1972. xviii, 542 pp., illus. Paper, $22.50.

Air Sampling Instruments. For Evaluation of Atmospheric Contaminants. American Conference of Governmental Industrial Hygienists, Cincinnati, ed. 4, 1972. Variously paged, illus. $12.50.