

there are comprehensive lists of references at the end of each chapter.

The book is divided into four main parts. Part 1, entitled "Range Management in Perspective", deals with the general concept of range management and gives a very concise picture of grazing practices throughout the world and problems which should be of interest to all concerned with the supply of meat and animal products. There follows a consideration of the scientific principles, mainly physiological and ecological, which have an important bearing on range problems, and one is struck by the similarity of many of the problems to some encountered in Britain. This leads to a consideration of some of the aspects of United States grazing, followed by a historical survey.

Part 2 is mainly botanical and deals with the many species of plants which go to make up the range, giving adequate details of the value or otherwise of each. These are classified according to natural orders, and mention must be made of the excellent line illustrations of the plants, many, but by no means all, not commonly seen in Britain. Part 3 deals with the improvement and management of range and stock, starting with the improvement of the herbage, both by natural and artificial reseeding, and the control of noxious woody vegetation. This leads, by way of management and considerations common to both range and range livestock, to livestock choice and management, followed by two chapters on general range management. Again one is struck by the broad similarity of many aspects of the subject to the management of rough grazings in Britain. The final section of the book deals with such subjects as timber and its place on the range, poisonous plants and their control, wild life on the range, soil erosion and, finally, the administration of public grazing lands.

The book will be a useful reference work for advanced students of agriculture, and certain sections will be of more than passing interest to geographers, economists and biologists.

PLANT CELL WALLS

The Molecular Architecture of Plant Cell Walls
By Dr. R. D. Preston. Pp. xii+211+10 plates.
(London: Chapman and Hall, Ltd., 1952.) 36s. net.

THE advancing study of the fine structure of plant cell-walls now has an evident relevance to problems of growth, and may also have taxonomic implications; it thus commends itself to general botanical interest. A concise account, from Dr. R. D. Preston, of the essentially botanical (as distinct from the technological) aspects of cell-wall micro-structure is thus a welcome addition to botanical literature.

To the non-specialist, however, his subject presents certain difficulties of approach, derived from its basis in unfamiliar research techniques and modes of thought. Dr. Preston therefore devotes about a third of his book to outlines of the salient features of the chemical and physical structure of cellulose and other cell-wall substances and of the techniques applicable to their study. Special attention is given to the methods of X-ray crystallography and polarization optics, which have proved most fruitful in cell-wall studies. Modern views of the micellar structure of cellulose are explained and discussed in the light of these and other techniques.

Against this physico-chemical background the main theme of the book is developed, largely by reference to the researches of the author and his colleagues. Facts and hypotheses of cell-wall structure and growth are considered in relation to the evidence, and described in terms of the mean orientation, angular dispersion and dimensions of cellulose micelles and microfibrils, and of the nature, proportion and distribution of non-crystalline material in the wall.

Thick cell-walls, having a dense, well-oriented cellulose framework, are described first, by reference to algae, especially *Valonia*, *Cladophora* and related forms, and to cells of higher plants, especially conifer tracheids and bamboo and other fibres. Such diverse examples, while differing in detail, nevertheless exhibit a certain unity of structure; helical organization, and lamellation of the wall, in varying degrees, are common features. Primary walls are considered separately: here again different examples have a common type of structure; the cellulose framework is more diffuse than in secondary walls and less highly oriented; and protein is present among the non-cellulosic components.

From features of wall structure the author passes to processes of wall growth, of which, as yet, we know little. The growing primary wall is regarded not as a membrane separate from the protoplast, but rather as a differentiated outer layer of the latter, consisting perhaps largely of carbohydrase systems, within which cellulose deposition takes place. It is possible that deposition of the secondary wall may also occur in this way; the complexity, in *Valonia*, of growth in area of an already multi-lamellate wall, without apparent disturbance of its astonishing regularity of structure, seems especially to demand some such relationship. The concept of a definite interface between the protoplast and the wall may thus have to be abandoned. It might be added that cellulose-synthesizing systems external to the protoplast (in the ordinary usage of that term) appear in the activities of *Acetobacterium xylinum* and in the growth of the stalk of the sorocarp of *Dictyostelium*; they may well thus be of wider occurrence.

Further problems arise in the relationship between wall structure and cell shape. A detailed consideration shows that they are not simply related mechanically as has sometimes been supposed, but must be regarded as consequences of different aspects of cytoplasmic organization of which our appreciation is as yet speculative, but towards an understanding of which future cell-wall studies will extend.

In its conception, and in the broader aspects of its presentation, this is a valuable and stimulating book. The detailed exposition is, however, marred by a certain lack of coherence and an inexactness of style which make for unnecessary difficulties. This appears in the arrangement of the physical sections and in ambiguities such as the conflicting statements on pp. 48 and 71 concerning molecules and micelles; the confusion on p. 67 between n_p and n_p' (not apparently a mere misprint) in relation to the degree of crystallinity; and the reference on p. 140 to "cellulose micelles . . . (of) low cellulose content"—to cite but three examples among many. There are also some misprints which lead to confusion.

The book is generously illustrated, though in some instances the half-tone reproduction is inadequate. There is a bibliography of some hundred and twenty titles.

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