

amine storage and release mechanisms, the two chapters devoted to these could hardly be improved on.

This book should be available to everyone engaged on any aspect of catecholamine research. The pages are packed with essential information which is remarkably up to date for such a compendium; apparently most contributors were able to include consideration of publications in the first half of 1970. Another attractive feature, traditional for this handbook, is the freedom with which the contributors lay bare their ideas on mechanisms and provide stimulating but concise expressions of opinions about open problems. Their involvement in current research makes these opinions very much worth having. The editors, H. Blaschko and E. Muscholl, deserve congratulations and gratitude from all those interested in the catecholamines. The publishers deserve congratulations for the excellence of production of the book which includes a detailed, accurate index.

G. V. R. BORN

Separation Techniques

Pharmaceutical Applications of Thin-layer and Paper Chromatography. Edited by Karel Macek. Pp. xvi+743. (Elsevier: Amsterdam, London and New York, 1972.) Dfl. 250; \$73.50.

CHROMATOGRAPHY is the name given to a series of closely related but technically different separation techniques whereby minute quantities of mixtures can be resolved into their various components. The simplest and cheapest techniques—and thus the most popular—are paper and thin-layer chromatography. One consequence of the popularity has been the extraordinary number of publications dealing with one aspect or another of the technique or of application of the technique in the solution of different analytical problems. It is hard to find a branch of science that has not benefited from chromatography, although it could easily be argued that the pharmaceutical sciences have benefited most. A variety of chemical substances, synthetic and natural, will be found in the pharmaceutical literature: psychotropic drugs, antihistamines, anti-pyretics, analgesics, antitussives, sedatives, hypnotics, anaesthetics, anti-epileptics, local anaesthetics, adrenergic and cholinergic substances, diuretics and cytostatics to name but a few of the synthetic substances; alkaloids, glycosides, antibiotics, laxatives, vitamins, to name but a few of the natural products as well as auxiliary substances such as antioxidants, colouring matters and preservatives. The analyst may have to examine any one of these drugs for impurities or determine the amount of one in the presence of others. Thin-

layer and paper chromatography has almost certainly been used by someone and reported in the literature. The editor, who is bibliography editor of the *Journal of Chromatography*, in association with expert workers with the different groups of substances has compiled a very comprehensive review of more than 2,500 references. Each chapter begins with generalized information about extraction procedures for pharmaceutical dosage forms or from crude drugs and includes useful comments and explanations in connexion with the methods described. The free use of tables summarizes important information such as solvent systems, spray reagents and hRf values.

Prior to this main section of the book there is a short section on techniques—qualitative and quantitative, which, without recourse to repetition of much information already detailed in other books, gives facts and advice that are equally useful to the expert and the beginner. The text flows remarkably well and it is only the heading of chapter 9—"The Tasks of Paper and Thin-layer Chromatography" that betrays its Czechoslovakian origin. It is an extremely good translation and those concerned are to be congratulated. The book is well bound, the text is clear and printed on good quality paper with few typographical errors. While it is doubtful whether many British analysts can afford to purchase it, there is no doubt that the book should be in every laboratory concerned with pharmaceutical analysis.

E. J. SHELLARD

Stress on Plants

Responses of Plants to Environmental Stresses. By J. Levitt. Pp. xii+697. (Academic: New York and London, March 1972.) \$32.50.

JACOB LEVITT is one of the leading scientists in the field of stress physiology of plants. As a sequel to his comprehensive studies on temperature and drought resistance of plants, Levitt presents a fifth far more detailed and thematically enlarged monograph, which covers most of the recent literature from all parts of the world up to 1969–70. The references run to nearly 100 pages.

It was not, however, the author's intention to write a compendium complete in every respect, but to give an account of the research according to his own particular point of view. This holds particularly for the sections concerning temperature and water stress, which takes up four fifths of the book. The remaining chapters deal with the influences of the different kinds of radiation, salts, and mechanical factors as well as stresses caused by human civilization.

In an introductory chapter Levitt

points out ways to a unified stress concept. To conform with interdisciplinary usage he has used a uniform terminology as, for example, the terms "tolerance" instead of "hardiness" or "freezing" instead of "frost". Levitt contrives to formulate the term "stress" which has its exact definition in physics, which is otherwise used in a less precise way. He makes a clear distinction between "stress" as an ecological agent and "strain" which implies the impact and the effect on the plant.

There are strains of an elastic nature, which occur repeatedly without, however, exhausting the plant, so that the effect is reversible. Or they may be of plastic nature, stimulating the plants into adaptation to the stress. Levitt deals mainly with the plastic strain. Resistance of plants can be brought about by avoidance or by tolerance of a strain.

This concept is applied to the different kinds of stresses set out in analogous schemes. In a concluding chapter Levitt discusses the problem of comparability of the strains of the different stresses. Desiccation, for example, can be caused by single or a complex of quite different stresses such as low temperature, retarded water conductivity, osmotic effects, heat, and so on. Levitt distinguishes between comparative primary, secondary and tertiary stresses. The capability of plants to avoid strains can be ascribed to different causes. But as to how plants tolerate the different strains certain correlations can be stated. Most of the stresses described above claim the tolerance of the plants in a similar way and will finally lead to the same injuries. Thus a uniform scheme (system) of injury could be considered possible. In this context Levitt offers his not entirely undisputed theory, developed in 1962, that those injuries are results of oxidative sulphur, sulphur bindings in particular at lipids and proteins—this is a new aspect—at the membranes, which lose their semipermeability. As discussed extensively in the chapter "Molecular basis of freezing injury and tolerance" this concept turns out to be consistent with the hardening of many plant species, which keep a high reducing capacity (that is, many sulphhydryl-groups). Levitt endeavours to integrate into his concept many other existing theories, or to refute them. The seasonal "phenological" view of hardening is relatively neglected in favour of the biochemical aspects.

This excellently written book will be an indispensable source of knowledge and information for physiologists, ecologists and all students of applied biology. It should also be considered as an impulse to further critical discussions about causes of the resistance of plants (and animals) to extreme environmental stresses.

L. KAPPEN