macroscopic concept twenty years ago by Debye and Fowler, emerges with a new look. The Lorentz field employed by Debye has tacitly been dropped in favour of the Onsager field, and the Onsager equation is accepted as a reasonable approximation for non-associated polar liquids. Analysis of dipole reorientation as a kinetic process has led to the evaluation of thermodynamic parameters which have illuminated the molecular interpretation of dielectric relaxation. It is agreed that a molecule usually rotates as a unit, the rotation of a prolate molecule about its long axis being demonstrably the easiest, although there are isolated examples of very large molecules wherein reorientation occurs by intramolecular torsion. The hindering effect of adjacent dipoles is emphasized by the observation that the energy barrier opposing reorientation is greater for a pure polar liquid than for a solution in a non-polar medium of the same viscosity. Associated liquids remain a difficult problem in spite of the early success of the Kirkwood equation relating the dielectric constant of water to its dipole moment. In this treatment the reorienting unit is a single molecule, an assumption powerfully supported by the fact that the dielectric loss in the principal dispersion region—rather surprisingly for a quasi-crystalline liquid—is compatible with a single relaxation time. Earlier theories which explained the high dielectric constant of associated liquids by the rotation of molecular aggregates (the simplest expression of co-operative effects) are therefore suspect, at least in their simplest form. In solids, transitions signalize the onset of molecular rotation which often is relatively free in crystals of high symmetry. The mechanism of dipole reorientation in ice is still unsettled, but there is now definite physical evidence in favour of a process involving non-classical proton transfer in certain solid alcohols.

Prof. Smyth writes for the chemist rather than the physicist or electrical engineer. In deriving the basic equations—not always rigorously—he is at pains to describe the physical background, a point which will commend itself to non-mathematical readers. A careful balance is maintained in areas of controversy, and his book is recommended to the honours student, general reader and specialist alike.

J. C. D. BRAND

MICROSCOPY OF VEGETABLE FOODSTUFFS

Mikroskopische Untersuchung pflanzlicher Nahrungs- und Genussmittel

Von Dr. Gustav Gassner. Herausgegeben von Dr. Friedrich Bothe. Dritte, verbesserte Auflage. Pp. xvi+400. (Stuttgart: Gustav Fischer Verlag, 1955.) 33 D. marks.

ALTHOUGH the late Prof. Gustav Gassner's book on the microscopy of foodstuffs of vegetable origin, which was first published in 1931, has now reached its third edition, the reviewer has only recently had an opportunity of studying it for the first time. The author having died while the preparation of the third edition was still in progress, the work has been completed by Dr. F. Bothe. It must at once be emphasized that this book deserves to be much more widely known and used in Great Britain than it appears to be at present, and it is a

work of reference that merits a place on the shelves of all public analysts, economic botanists and microscopists who are concerned with maintaining the standard of purity of foodstuffs, and detecting adulterants in them.

As its title implies, the subject-matter of the book is essentially the microscopical structure of the products described in it, and it includes but little information concerning their sources and uses, although these are briefly mentioned.

The book is divided into thirteen chapters, twelve of which deal with such topics as cereals, starches, vegetables, condiments, beverages, spices, and seeds and fruits that are valued because of their content of oil. To give a few specific examples, the reader will here find particulars of the microscopical structure of a wide range of peas and beans, of arrowroot and sago, of dill and vanilla, of such diverse fruits as apples and dates, of cocoa and coffee, not to mention such homely vegetables as spinach and parsnips. There is a special chapter devoted to the microscopy of honey, and another on fungi includes details of morels and truffles and even of the *Penicillium* that is used for flavouring Roquefort cheese. The remaining chapter includes simple, effective, practical directions for examining foodstuffs under the microscope. The book ends with a good subject-index; but there is no bibliography.

The 866 line drawings by which the book is illustrated constitute one of its most useful features, and what a pleasure it is to find that all of them are original, well drawn, and show very clearly those characters that have proved to be the most valuable for diagnostic purposes. The illustrations are at a few selected magnifications, which have been used as standards throughout the book, so that the reader can at once form a mental picture of the relative sizes of the tissues and cells, as well as of the bodies enclosed in them, such as starch grains or crystals.

Although much of the information in the book is already available from other sources, it is an advantage to have clear and simple descriptions of the salient diagnostic characters of such a wide range of materials brought together within the compass of a book of no more than four hundred pages. The microscopical descriptions are so easy to understand that they could have been written only by a botanist with an intimate first-hand knowledge of his subject. Indeed, the whole book is manifestly based on the practical experience of the author and his colleagues.

Since the subject-matter is arranged according to the uses of the various items, rather than on a botanical basis, it follows that products derived from closely related botanical species are not always described in the same part of the book. Thus, for example, seeds derived from species of *Brassica* are described partly under oil seeds and partly under spices. This, however, is no serious disadvantage provided the reader realizes the position.

The reviewer is interested to note that many of the substitutes and adulterants described in this book are precisely the same as those which he has encountered in the course of his own work. It is indeed fortunate for microscopists whose business it is to ensure that a high standard of purity is maintained in economic plant products, that those bent on adulteration and substitution are so conservative in the selection of the materials they employ for these purposes.

C. R. METCALFE