World War and onwards; the author of the book under review has a distinguished and well-known record in that progress. He has now produced in a massive and carefully written volume a fine account of the various mathematical methods which have so far been brought to bear on the problems of neutron transport. In his task he received the active co-operation of a number of eminent specialists in the field. Readers who approach this subject with experience in some other branch of physics will be interested, possibly surprised, to read in the book the contributions to transport theory by physicists (for example, Feynman, Fuchs, Pryce) more widely known in other fields.

The book starts with a general statement of the problems involved: this may be equivalently framed either as the Boltzmann equation or as an integral equation. In the greater part of the rest of the book various solutions, analytical and numerical, are considered. The reader is left in no doubt as to which method to apply in a particular situation. The ordering of the treatment is, quite appropriately, to take simpler problems first and consider others in an order of increasing complexity. The result is that roughly the first one-third of the book is 'compulsory reading', after which various sections in the remainder are independent of each other. The intention of the author to make the mathematical treatment detailed and self-contained has been achieved with remarkable feats of economy.

The book is primarily directed to the advanced worker in neutron transport theory. To him the book offers mainly the following three advantages: the opening chapters contain a balanced and precise justification for the physical assumptions of the theory. Secondly, by presenting the subject as a systematic and compact discipline this book promises to be a standard one, as regards form and notation, and as regards the inter-relation of topics treated in the book. Lastly, much of the material is published in this book for the first time.

This book can be strongly recommended to those interested in other branches of transport theory. It is not always that the methods developed in connexion with neutrons can be legitimately applied; nevertheless, there is a great deal to be gained from familiarizing oneself with these methods.

It is a pity that the book makes scarcely any reference to the way in which these elaborate calculations have been tested or put to use. Now it may seem misguided to ask for this kind of information, much of which is probably not at the author's disposal, in what is primarily a text-book of methodology. Nevertheless, one hopes that future circumstances will enable the author to make allowance for a (proverbially deadly) weakness of his reader.

R. ENGLMAN

MINERAL REQUIREMENTS OF PLANTS AND ANIMALS

Mineral Nutrition and the Balance of Life

By Dr. Frank A. Gilbert. Pp. xv+350+30 plates. (Norman, Oklahoma: University of Oklahoma Press, 1957.) 5.95 dollars.

ANIMAL and plant physiology have an important link in the mineral nutrition of the plant. Many instances are now known, and others are constantly

coming to light, where a deficiency in a food plant has important consequences on animal health. These discoveries have led to greater emphasis on the problems of interrelationships between plant and animal nutrition, and this in turn has intensified investigations on the mineral content of soils of different localities. It is perhaps not surprising that nutritional disorders of animals due to deficiency or excess of minerals were not immediately associated with the mineral composition of the food plant because elements essential to animals are not necessarily essential to plants, and the latter have the facility of accumulating elements which take no part in metabolism but have no harmful effects on their growth. Thus, cobalt is not considered essential for higher plants but the small amount that occurs in plants is of great importance because normally this is the only way in which animals get their essential supplies of this element. Some plants are tolerant to the presence of selenium in the soil, but such plants are toxic to animals.

The story of mineral deficiencies in plants is in itself a fascinating one and Dr. Gilbert has not only given a very complete account of the mineral requirements of plants but also linked it with the question of nutrition and well-being of animals that use these plants as food. The treatment of this subject may be said to be comprehensive since the author considers each element in turn, first from a historical point of view and then how the lack (or in some cases excess) of that element affects plants and animals, including humans. These accounts are linked to the relation between deficiencies and the soils of particular localities with mention of the geographical regions where deficiencies prevail. It is inevitable that most of the latter information refers to the North American continent, where the most intensive work has been done, but available information from other continents is included.

So far about sixty elements have been identified in plants, but only about twenty of these are conceded to be essential either to plant or animal nutrition. The present book, however, deals with thirty-one, including not only the major elements nitrogen, phosphorus, potassium, calcium and magnesium and the trace elements but also others such as aluminium, silicon, selenium, fluorine, arsenic and lead which are of interest by virtue of their toxic properties.

The author has included a chapter on enzymes, hormones and vitamins which seems out of place in a book of this nature. The brief chapter on analytical methods underlines the fact that the book is not primarily addressed to the specialist although there is much in the book which is of interest to those concerned with mineral nutrition and the 1,177 references are a valuable guide to the literature, but by no means exhaustive. The book concludes with a chapter on human nutrition which repeats the main theme of the book that the health of the animal depends on a supply of nutritious forage. The author points out that we are protected by law against harmful drugs but not against inferior food, and pleads for more education and publicity to create a realization of the need for better quality food.

The book is well produced and contains numerous photographs illustrating symptoms of mineral deficiency and toxicity in plants and animals. It can be recommended as a good general account of the mineral requirements of plants and animals.

E. C. HUMPHRIES