

genous acceptor groups. Such factors may prove of great importance, because the rate of irreversible fixation of a radioactive isotope within individual body-tissues determines whether any form of treatment is likely to prove effective. The inability of some chelating agents to pass from one body compartment to another also seriously detracts from their efficiency; this has led to a search for improved complexing agents by chemical substitution of the side chains in existing substances.

The most probable routes of human contamination by radioactive metallic isotopes are thought to be by implantation into wounds and absorption through the respiratory tract, and experimental work bearing on the elimination of isotopes absorbed through these two routes is discussed.

Although most attention has been directed to chelating agents as the most promising means of eliminating radioactive isotopes from the body, alternative means, such as combining the metals to form insoluble products and their hormonal release from the skeleton, are also reviewed.

Finally, the author considers the still very meagre data concerning the removal of radioactive metallic isotopes from man, and concludes by showing how fragmentary is the present state of knowledge about the whole subject and how much still remains to be discovered.

This short work is a succinct and clear account of the present state of knowledge of radioactive metallic isotope elimination, and nothing of the clarity of the original account appears to have been lost in translation.

H. SPENCER

## NUTRITION OF MAN AND HIS FARM ANIMALS

*Comparative Nutrition of Man and Domestic Animals* By H. H. Mitchell. Vol. 1: Pp. xxi+701. 178s. 6d. Vol. 2: Pp. xxi+840. 200s. (New York and London: Academic Press, 1964.)

THIS substantial work by Dr. H. H. Mitchell, whose international reputation rests in several fields of research, but in none more than in the nutritional aspects of proteins and amino acids, is most timely. It correlates, in a quantitative fashion, the nutrient requirements of man and his domesticated livestock, and the factors which modify these. *Comparative Nutrition of Man and Domestic Animals* is a thoroughly critical and stimulating book, as are all Dr. Mitchell's reviews. The emphasis is on the physiology and biochemical aspects, rather than on the more practical.

As the author describes in his preface, this work arose in the preparation and revision throughout some thirty years of a postgraduate course in comparative nutrition, held by him at the University of Illinois. However, in parallel with the development of the formal course, an experimental research programme was pursued on the material and energy requirements of poultry, pigs, sheep, cattle, and, in later years also, of man himself.

The similarities and dissimilarities among the different species are pointed out, and Dr. Mitchell has provided background information, largely biochemical in nature, concerning the various nutrients, their functions and their participation in the energy transactions of the body. The courses which led to these two volumes were designed for students in nutrition, physiology, domestic science and animal science.

Net nutrient requirements, that is, the amounts requiring to be absorbed by a completely healthy animal, are expressed in terms of animal expenditures and storages, factored in their ultimate terms of maintenance, growth, activity, reproduction, etc. These net requirements are converted into dietary requirements, after due consideration of the wastages of dietary nutrients in the course of their assimilation in the body.

The actual preparation of these volumes took place on Dr. Mitchell's retirement from active service, and it is very heartening to know that the University of Illinois, in its wisdom, provided facilities, including office space.

The first volume deals with the nutrient requirements of the animal body, in terms of energy, protein, water, minerals, and with the nutrient requirements for muscular work, growth and senescence, storage, reproduction, lactation and egg production. The second volume deals with vitamin requirements in terms of dietary equivalents, the wastage of dietary nutrients during assimilation and net nutrient values.

In combining the assessed nutrient expenditures or storages involved—in growth, activity, reproduction, lactation, etc.—to obtain a total nutrient requirement of an animal of given species, age, sex and physiological status, Mitchell warns against assuming that the whole is the sum of the parts, because the imposition of one function on another may result in stimulation or inhibition of one, or both, functions. Thus, pregnancy stimulates basal metabolism, while inhibiting lactation.

Mitchell defines a balanced diet as one containing amounts and proportions of each of the essential nutrients large enough to promote maximum performance of those animal functions with respect to which the diet is balanced, but not so large as to impair, in any way, the well-being of the animal consuming it or of any of its tissues, or to depress the net energy content of the diet. He defines the carbohydrate and fat content as one sufficient in amount to permit the full use of the essential nutrients to perform their specific functions in the body. The utilization of the metabolizable energy of a completely balanced diet is maximal, and the same for all such diets for each animal function, but varies from species to species. The corollary of this is that the nutritive value of feeds is specific and characteristic for the various feeds only with respect to their content of nutrients and their digestibility. The degree to which the absorbed nutrients are utilized in the body is dependent on the way in which feeds are combined and the animal functions they support.

The more of such a balanced ration that is consumed, the better nourished the animal will be, with reference to which the ration is balanced up to the point of depletion of its requirements, but, in agriculture, the law of diminishing returns has generally to be taken into account and, at some stage, an input/output relation has to be struck in the light of present-day economic circumstances.

Superimposed on the apparent fixity of nutritional behaviour among different species, there are secondary and specific modifications that reflect adaptations to different environmental conditions. These are the modifications that distinguish one species from another. Within any one species, adaptations to changes in environment and in food supply may occur in relatively short spaces of time. These necessitate the conception of a nutrient requirement as a range of values, symmetrically including a mean measure, rather than the mean itself. Nevertheless, this conception does not hold for net requirements because these are what have to be absorbed.

Because of lack of necessary nutritional data, little consideration can be given to some domestic species, such as the cat and dog. The author makes a strong case for the profitability of the investigation of farm animals in furthering the investigation of human nutrition.

To end the second volume there is a strong philosophical note, and this is what we would expect from a life-study of the resultant of satisfying the integration of factored requirements.

Each chapter has its own extensive bibliography and there is a complete author and subject index. The author and his publishers are to be congratulated on a magnum opus which will long remain a standard reference book, as well as being full of dynamic thought and criticism.

D. P. CUTHBERTSON