

## PROGRAMMING NUTRITION

### Linear Programming and Animal Nutrition

By J. B. Dent and H. Casey. Pp. vii+111. (Crosby Lockwood: London, 1967.) 35s.

THE book falls into two main parts. It deals first with the technique of linear programming, and after a chapter covering the economic interpretation of feeding standards (chapter 5) it goes on to discuss some practical applications of the technique.

Interest in the use of linear programming for least-cost ration formulation is increasing. For many people who are working in the field of animal nutrition it is difficult to find a text which explains the basic economic concepts involved alongside the mechanics of the Simplex routine. This book is aimed at the non-mathematical reader, and the authors are to be congratulated on the clarity and simplicity of their treatment of the computational aspects of linear programming. Most texts dealing with the subject very quickly seek refuge in mathematical symbols which can deter even the most earnest reader. Here is an exception which takes the reader step by step through the use of very simple examples, to an understanding of the interrelationships which are important.

The chapter about the economic interpretation of feeding standards is interesting and thought provoking. It inevitably exposes gaps in knowledge, and one would have liked to see this chapter developed further. It reinforces the case for better cooperation between economists and animal researchers in the design of experiments, so that the results obtained may perhaps provide more satisfactory data for economic analysis. Nutritionally, most of the examples used relate to monogastrics, which are rather better documented nutritionally. For ruminants, the problem of producing satisfactory nutritional constraints is much more difficult, and the authors have wisely avoided this area, and have used, for illustration in chapter 3, an example which perhaps lies more in farm management in the broader sense than in basic nutrition.

The final three chapters discuss problems relating to the feed compounder and to the farmer. Probably the feed compounders have, to date, made most use of linear programming, and perhaps it was only right that they receive some special treatment. One may wonder a little, however, at the nature of the problem which is posed for the compounder, in illustrating profit maximization. The problem posed is one of maximizing returns in relation to mixing and milling equipment and total sales commitments.

The difficulties encountered in solving business problems lie firstly in describing the problem, and subsequently in using the right technique to solve it. One of the dangers in the use of linear programming is in attempting to use it to solve problems for which it is unsuited. The large literature on extensions to linear programming testify to the need to introduce greater flexibility into the technique. It seems probable in this case, even bearing in mind that the example used was illustrative of linear programming, that the solution to even this small milling and mixing plant required consideration of other operational research techniques.

A rather disappointing feature of the book is the surprisingly poor bibliography. There is little reference to some of the standard texts on linear programming. Missing, too, is reference to most of the published data on least-cost ration formulation. This is an unfortunate omission for the reader who, having read this book, wishes to go more deeply into the whole subject.

Accepting the authors' statement that "This book was conceived as a non-mathematical approach to linear programming... to those concerned in feeding farm livestock...", the book achieves a large measure of success. It is brief (111 pages), and simply illustrated. It should provide a very useful introduction to the subject both for

those who wish no more and for those who wish to go more deeply into it. J. HARKINS

## ELASTIC WAVES

### Theory of Elastic Waves in Crystals

By Fedor I. Fedorov. Translated from the Russian by J. E. S. Bradley. Pp. xiii+375. (Plenum Press: New York, 1968.) \$25.

AN understanding of the theory of the propagation of elastic waves in crystals is basic to ultrasonic and piezo-electronic technology and to many areas of solid-state physics of practical and theoretical significance, so it is not surprising that many papers on the subject have appeared in recent years. A few survey articles have been published, but these have been written for workers already familiar with the mathematical techniques of theoretical mechanics. Fedorov's book—the original Russian edition appeared in 1965—provided the only detailed and modern account of the general theory of elastic waves in homogeneous crystalline solids. Based on a course of lectures to graduate students of crystal physics in Moscow University, its clarity of exposition was exemplary. Now the Plenum Press of New York has published an excellent translation and given the author an opportunity to incorporate some substantial changes and additions reflecting recent Soviet work on the subject.

To make the subject matter accessible to as wide an audience as possible the author has made the book virtually self-contained—in the sense that in the first two chapters it develops the general equations of the classical theory of elasticity and the elements of linear algebra and tensor calculus. It does, however, demand of the reader a knowledge of calculus up to Gauss's divergence theorem.

The next three chapters treat the general laws of propagation of elastic waves in crystals including a comparison with the corresponding phenomena in isotropic materials. This is followed by two chapters which consider, respectively, hexagonal crystals and crystals of the higher systems. The remaining two chapters deal with the reflexion and refraction of elastic waves and with thermal properties of crystals.

Extensive tables in the later chapters illustrate the application of the general theory to the existing body of experimental data.

This book provides an extensive and lucid treatment of those aspects of the mathematical theory of elasticity which are of interest to workers in crystal physics. It is strongly recommended. IAN N. SNEDDON

## SPECTRA FOR THE CHEMIST

### Ultra-Violet and Visible Spectroscopy

Chemical Applications. By C. N. R. Rao. Second edition. Pp. xiii+210. (Butterworths: London, 1967.) 50s.

THE first edition of this book, which appeared in 1961, was designed to provide the organic chemist with a descriptive introduction to the electronic absorption spectra in solution of organic compounds, with a minimal emphasis on theoretical concepts. It proved to be a useful book which replaced earlier accounts of the subject. The same treatment has been retained in the second enlarged edition and is still a valid approach to the problem of providing the organic chemist with an adequate background of information for the qualitative interpretation of the solution spectra of complex molecules. In such cases the more rigorous theoretical analyses applicable to simpler molecules are rarely feasible, and certainly not for the non-specialist.