Book Reviews

SHAPES OF SYSTEMS

General System Theory

Foundations, Development, Applications. By Ludwig von Bertalanffy. Pp. xv+289. (Braziller: New York, March 1969.) $8.95 cloth; $3.95 paper.

THE first thing to observe about this book is that very little of it—to be precise, only one chapter out of eleven—is new. The rest have been published before: indeed, the key chapter entitled "The Meaning of General System Theory" has been published in substantially the same form no less than eight times since it first appeared in 1955. Other chapters first reached publication at various dates since 1940. This is therefore a recapitulation of the author's numerous contributions to the literature of systems theory, contributions which, he repeatedly asserts, have been insufficiently recognized. He reproaches even such eminent American biologists as Dubos, Dobzhansky and Commoner for failing to acknowledge the priority of his own advocacy, in the early 1920s, of "an organismic conception in biology which emphasizes consideration of the organism as a whole or system, and sees the main objective of biological sciences in the discovery of the principles of organization at its various levels". At the same time, he readily acknowledges his own debt to Claude Bernard, and cites Whitehead's philosophy of "organic mechanism" and Cannon's work on homeostasis as examples of the simultaneous discovery of closely related phenomena.

It was, however, in the twenty years after the Second World War that von Bertalanffy's ideas began to command fuller acceptance. At this time also, no doubt prompted in each case by the exigencies (and rewards) of the military, three other conceptual systems came into prominence. These were Wiener's cybernetics, Shannon and Weaver's information theory and von Neumann and Morgenstern's game theory. Bertalanffy is at pains to point out both the primacy and the wider applicability of general system theory in relation to each of these fruitful contributions.

Although many of the essays reproduced here are extremely theoretical, not to say metaphysical, there are a number of chapters (notably one on "The Organism considered as a Physical System" and another on "Some Aspects of System Theory in Biology") which are refreshingly detailed in their biochemical illustrations. Nor are behavioural scientists neglected: human behaviour is considered as due to the operations of a hierarchical order of open systems, and a chapter is devoted to the practical implications of general system theory for psychology and psychiatry.

A recurrent theme throughout the book is the question whether the paradigm of the physical sciences evolving ever more basic mathematical relationships tested by precise measurement and quantification, in crucial experiments, is incompatible with the biologists' concern with extremely complex, multiple interactions in which the "arrow of time" often plays a crucial part. As von Bertalanffy puts it:

> "It may be that the structure of our logic is essentially determined by the structure of our central nervous system. The latter is essentially a digital computer. . . . It may well be that quite different forms of science, of mathematics in the sense of hypothetico-deductive systems, are possible for beings who do not carry our biological and linguistic constraints."

Elsewhere, he speculates interestingly upon the possible shape of these conceptual systems yet to come.

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PROGRAMS FOR PROBLEMS

Computer Programs for Chemistry

Edited by Delos F. DeTar. Vol. 1. Pp. xix+208. Vol. 2. Pp. xix+260. (Benjamin: New York and Amsterdam, 1968 and 1969.) Each vol. $14.75.

THESE first two volumes of an "open-ended" series contain details of a variety of programs which have been developed to help perform calculations associated with various chemical problems. Volume one contains details of four programs concerning NMR, two for treating first order kinetics data, and one for presentation of results in quasi-graphical form on a line printer. Two programs for handling reaction mechanism problems are given in full in volume two, together with an outline of a third.

In volume one, the NMR programs, LAOCN3 and NMRIT, serve essentially identical purposes in the calculation of transition energies and intensities based on assumed chemical shifts and coupling constants, with adjustment of these assumed values to ensure fitting with experimental data if available. The methods adopted are, however, different: LAOCN3 is a least-squares approximating program, while NMRIT uses an iterative technique involving improvement of the approximated eigenvectors of the Hamiltonians of the system. NMREN1 and NMREN2 calculate energy levels from transition frequency data, and although they can be used independently, they are primarily used as subprograms by NMRIT.

Of the first-order kinetic programs, LSG is a simple treatment while LSKIN1 gives a more general treatment of first-order reaction data. Both are least-squares procedures, but the input requirements of LSKIN1 are much more flexible, allowing for indirect input of various types of experimentally observed parameter (for example, optical densities) and a line-printer semi-graphical output can be obtained with this program. This output is presented by the use of PLOTLN, which is presented separately because it may be useful with other programs.

The mechanism programs in volume two are RMCHSS, a short program for treating quite complex mechanisms which may involve steady state intermediates, and REMECH which can handle mechanisms of essentially any complexity (150 substances in 250 equations). RMCHSS is limited to sets of equations with no more than two reactants or two products, details of which are introduced in a symbolic numerical representation: the restrictions on complexity and the input format are both relaxed in REMECH, where an essentially descriptive data input system is used, terms such as "ACID-BASE SYSTEMS", "ANHYDRIDE" and so on being "understood". Some indications of further processing of the results from REMECH to compare them with experimental data are given in the outline of the program TSTMCH, which is not listed.

An objective in the production of this series is that any program incorporated should be, as far as possible, free from errors or difficulties in possible use: some quite obscure possible causes of trouble have been foreseen. To meet such an objective implies the expenditure of considerable effort (an estimate of between $50,000 and $100,000 per volume is quoted as the development cost). A carefully thought out presentation of the material would