Biological Compartments

Compartmental Analysis in Biology and Medicine: Kinetics of Distribution of Tracer-labelled Materials. By J. A. Jacquez. Pp. xiv+237. (Elsevier: Amsterdam, London and New York, 1972.) Dfl. 77.50; $24.25.

COMPARTMENTS in a system interact with one another and perhaps with the surrounding environment. A compartment is an amount of material acting kinetically like a distinct well-mixed amount of the material. Separation between compartments does occur in various biological systems, for chemical as well as physical reasons. Compartments can be such things as plasma, interstitial and intracellular spaces. Hence the mathematical study of compartmental system models is useful, that of linear systems having counterparts in other areas of applied mathematics.

Inevitably the practical interpretation of compartmental analysis raises difficulties and arguments, and systems of order higher than linear are not easy to analyse. Nevertheless this book is an interesting survey of the present state of the art.

Necessary basic mathematics, covered in early chapters, comprises linear differential equations, vectors and matrices, and Laplace transforms: considerable facility in applying all these is needed to understand the book. This will indicate the appropriate level of readership.

It is in chapter 5 that biological interest really becomes aroused, by a study of radioactive tracer movement in steady state systems under suitable (and not unreasonable) assumptions. Henceforward, numerous references are made to the massive list of 455 papers (including some books) which appears at the end of the volume. This list is an excellent feature, but its presence only serves to make one wonder why space could not be found for answers to, or brief discussion of, the exercises at the ends of chapters.

Chapter 6 is concerned with systems partly compartmental and partly flowing, for example in some respiratory studies. Analysis in terms of experimentally observable functions can only be approximate, but does take the form of a compartmental system. Chapter 7 considers how one might set up a compartmental model from experimental data—very salutary after the almost entirely mathematical nature of the early part of the book—and chapter 8 introduces biological problems of varying complexity, and their solution by these methods.

After these two more practically biased chapters, the author moves from linear systems to introduce cases where experiments are long-term and so must allow for such things as daily (24-h) periods in bodily functions. Unfortunately too, biological systems have a habit of containing random components: thus drug therapy has randomness in times of application, and even in amounts. Finally, the author picks a few points out of control theory, and in an interesting chapter 14 discusses some examples of compartmental control systems.

G. M. CLARKE

Microcapsules not Cells

Artificial Cells. By Thomas Ming Swi Chang. Pp. xiv+207. (Charles C. Thomas: Springfield, Illinois, June 1972.) $16.

THE eye-catching title of this book immediately evokes curiosity and is likely to lead one to suppose that what may be predicted as achievable well beyond AD 2000 has already been accomplished in some quiet corner unbeknown to everybody. This is to some extent promulgated by the editor's preface connecting the studies with the synthesis of cells. Reference is made to forms of life on other planets and that the basic unit of such life could be different from the cell we know. All this seems to herald the shape of things to come in the book.

Authors are aware that the inclusion of a fashionable word in the title of a paper will send up the requests for reprints. A fashionable word is "cell" and in biology it stands for an extraordinary piece of machinery organized at the molecular level at a complexity that is almost beyond our belief and understanding. In the author's preface of the book we read: "Back in 1956 I was surprised to find that despite the fundamental importance of cells serious attempts had not been made to use available knowledge to investigate the feasibility of preparing artificial cells". We read on to find that "equipped with a borrowed clinical centrifuge, a few chemicals, a few glasswares and a few frustrating months" the author came up with samples of artificial cells. Each consisted of haemoglobin and enzymes from red cells enveloped in an ultrathin spherical polymer membranous bag of cellular dimensions. This comes as something of an anticlimax to anyone who takes the title of the book too literally.

The honest and exceedingly interesting theme of the book is the potential use of packaged enzymes and detoxicants. The membrane is constructed to allow entry of substrate and the passage out of the product while retaining the enzyme. Toxins would pass through the membrane and become adsorbed onto contained charcoal. Emphasis is laid on the membrane being inert and how enzymes safely kept within this membrane would not be able to elicit an immune cellular response. The approach holds much promise in biomedical research and clinical therapy.

There is an enthusiasm pervading the book which makes one overlook a certain amount of repetition. The spectulations in chapter 1 would have been better left to the end. The next chapter deals with the procedures for encapsulating microdroplets of cell products, and chapter 3 with the biophysical properties of the different kinds of membranes that can be produced. The experiments described in chapters 4 to 9 are certainly interesting; for example, urease in dialysis bags injected intraperitoneally can act efficiently on endogenous urea, converting it into ammonia; mice with a congenital deficiency in catalase can be furnished with this enzyme; tumours dependent on asparagine could be denied this substance by the presence of asparaginase-loaded dialysis bags. Substitutes for red blood cells bring one up against the importance of not using artificial membranes to which platelets adhere. The use of microcapsules containing charcoal instead of the two-compartment system of the kidney machine to trap waste metabolites seems practical enough, but one is left with the underlying feeling that the safety of the conventional machine is more important that ridding the blood of waste at a faster rate with "artificial cells". But, even so, the general idea of "artificial cells" being used in medical therapy is intriguing and I should imagine that practitioners in this field will welcome this book which draws attention to the state of progress so far made towards what is a difficult target.

B. M. JONES

Whence the Moon

From Plasma to Planet. Edited by A. Elvius. (Proceedings of the Twenty-first Nobel Symposium held in Salysjobaden, Sweden, September 1971.) (John Wiley: New York and London; Almqvist and Wiksell: Stockholm, October 1972.) £10.45.

AT the end of the Apollo manned lunar exploration programme scientists realize that they are on the verge of further exciting discoveries about both the history of the Moon and the origin of the solar system. Many fast-acquired, hard facts about the Moon have been creamed off by investigators using Apollo and Luna data. More subtle facts remain to be prised from the returned samples; and increasingly reliable interpretations will surely derive from continuing studies of lunar rocks and photographs and from the fascinating records now being accumulated via the Apollo experimental stations which continue to function automatically on the Moon's surface.

Lunar elemental abundances point