teins and their balance, nitrogen and energy balance, inherited disease, respiratory quotients, calorimetry and the action of vitamins. Useful summary diagrams are included. A valuable feature of both books is the set of references at the end of each chapter.

The second volume starts with a summary chapter on nutrient requirements; pains are taken to explain the different possible meanings of this, and the differences between the minimum and optimum requirements. Attention is given to recommendations of different bodies such as WHO and national schedules. A table gives recommended daily intake of vitamins, iron and protein at different ages. There is valuable critical discussion of tissue depletion, vitamin C and the increased need by elderly folk for thiamin, and the interaction of fats in the absorption of vitamin A.

Chapter 5, running to 108 pages, is occupied with the problem of the assessment of nutritional status, and is in some ways the most important, for the reason that a description is given in critical detail of the various possible approaches and the difficulties under field conditions of arriving at a true assessment. Its wisdom is clearly based upon much practical experience and should be read by anyone who thinks of starting such work. Part 2 concludes with a description of nutrition programmes and service, including problems of education. There is also a fascinating account of food habits, from which most would learn something which they do not know. I noticed with interest that there is no explanation of the replacement of calories by joules; surely it is better not to worry the reader with this new term in place of the universally accepted "calorie". RUDOLPH PETERS

Mathematical Men

Men and Discoveries in Mathematics. By Bryan Morgan. Pp. xii + 235 + 9 photographs. (John Murray: London, October 1972.) £2.

MORGAN surveys the development of mathematics from antiquity to our times in a style suitable for the layman. Many such books are available now, and they should give this one a rough time, for they normally recount the same material with greater command and accuracy. For example, consider chapters 6 ("The Great All Rounder", referring to Gauss—although the last third deals with other mathematicians) and 7 ("Yesterday and Today"). Among the anachronisms, Gauss's contemporary Babbage is in chapter 7, and is falsely said to be "fifteen years later" than de Morgan; Weierstrass is in chapter 6, before Abel and Galois; and Fourier is a chapter early, in chapter 5. There are also frequent errors of fact or questionable interpretation. In particular, in one section Morgan misrepresents Cantor's continuum hypothesis and claims that Cantor proved it, asserts that Kronecker's criticisms drove Cantor into a mental hospital, confuses Russell's *The Principles of Mathematics* with *Principia Mathematica*, describes Frege's *Die Grundgesetze der Arithmetik* as dealing with "the logic of classes", asserts that Russell tried to prove consistency, and identifies Gödel only as "an Austrian logician".

It is not worth going on; better to pick up the danger signals at the beginning. For anyone who thinks that M. Cantor's *Geschichte der Mathematik* is "definitive" and E. T. Bell's *Men of Mathematics* is "scholarly" must have a measure of historical command which is "there but not there", to use Morgan's misrepresentation elsewhere of Leibniz's infinitesimals.

I. GRATTAN-GUINNESS

Uses of Groups

The Fascination of Groups. By F. J. Budden. Pp. xviii + 596. (Cambridge University: London, August 1972.) £6; $18.50.

THE basic reason for teaching any branch of mathematics to non-specialists is that it provides an appropriate language in which to talk about some interesting and frequently occurring class of phenomena. What that class is, in the case of well established branches, is something that we learn so early that we hardly think about it at all. Even the least numerate person knows that numbers are there for counting and measuring, and has some idea of the situations in which counting and measuring are useful. But with a less traditional subject, such as group theory, the kinds of situation in which the language applies, as well as the truths that can be expressed in it, have to be taught consciously. This is what is meant, in this context, by that rather misleading word motivation. The great merit of this book is that it makes a serious attempt to provide motivation in this sense; no one will learn much group theory from it, but anyone who reads it carefully will end up with some idea of what group theory is about. I doubt Mr Budden's claim that his book will be of use to university students, but I would expect it to be indispensable to teachers of mathematics in schools, and of immense value in school libraries.

What the book does first is to take the two ingredients of a group, a set and a binary operation on it, and the four conditions imposed on them, the closure and associativity of the operation, and the existence of a neutral element and of inverses, and to examine them in turn, with a wealth of examples, chosen to show what the definitions exclude as well as what they include. The same detailed treatment is then given to such basic concepts as the order of an element, isomorphism, subgroups, direct products, and homomorphisms, and to the simplest classes of groups, cyclic groups and dihedral groups. Finally, there are four chapters on applications, to music, to bellringing, in geometry, and to plane symmetries. The chapter on applications to music includes an interesting example of motivation; namely, the relation between equally tempered and natural scales. One can think of the natural scales as reality: equal temperament is a mathematical construct, which simplifies reality at the cost of some distortion, and the simplification consists in this, that the set of intervals is now closed under the appropriate composition, and so forms a group.

I found the book irritating in places. Why, for example, should two successive chapters be labelled "Cyclic Groups" and "The Dihedral Group" when it is clear that on any interpretation there are just as many dihedral groups as cyclic ones? More seriously, it is a pity to state on page 410 that Galois proved that the alternating group A_n is simple for $n \geqslant 5$, and to suggest on page 411 that we do not know whether there is an infinity of finite simple groups. Again, it is perfectly reasonable to ask the reader to show that the relation $r^4=1$ is a consequence of the relations $ar=r^3a$ and $a^2=r^2$, but, for the sort of reader at which it is aimed, it seems too hard to be asked to prove that $r^4=1$ and $ar=r^3a$ do not imply $a^2=r^2$. At the very least, he should be asked first to consider carefully what sort of argument could possibly prove such a non-implication.

But these are minor blemishes. The book's only major blemish is its price.

GRAHAM HIGMAN

Echinoderms

Physiology of Echinoderms. By John Binyon. Pp. x + 264. (Pergamon: Oxford and New York, October 1972.) £4.80.

THE current spreading of interest in echinoderms, together with the physiological emphasis of many undergraduate courses in zoology, has created a need for an up-to-date review of the subject. The various chapters cover most aspects of echinoderm physiology, and Dr Binyon has used his knowledge and experience to provide a direct account of the topic.