Book Reviews

Art, Lore, and Visual Aids

Mathematics in the Making. Lancelot Hogben. Doubleday, Garden City, N.Y., 1961. 320 pp. Illus. $9.95.

The name Hogben was known chiefly in connection with zoology until, in 1936, its bearer demonstrated conclusively that books about mathematics can break into the lists of "best sellers." The phenomenal success of *Mathematics for the Million* prompted the subsequent appearance of *Science for the Citizen* and *The Wonderful World of Mathematics*; and now we have, in much the same tradition, *Mathematics in the Making*. The motive again is to "elicit intelligent understanding" on the part of the nonspecialist, and once more the exposition is built on a historical matrix. The present work is characterized by a lavish use of illustrative material, with over 400 illustrations, of which more than 100 are in color. The application of contrasts in red and black, used in connection with figurate numbers and problems in probability, remind one of the author's *Chance and Choice by Cardpack and Chessboard* (2 volumes, 1950–1955), but in his latest book Hogben goes further in calling upon visual aids to support the narrative.

The foreword refers to the present work as a "co-operative undertaking," and there are spots in which one has the feeling that the art editor triumphed at the expense of the expositor. Some of the colored reproductions have but little ostensible relevance to the account—for example, the section of the Ford engine (page 243) or the handsome full-page drawing (page 231) of Watt's engine of 1788—and there are places where striking diagrams appear better calculated to please the eye than to aid the mind. Graphical devices used in connection with analytical geometry and calculus come close to the point of diminishing returns; the colorful Chinese patterns intended to teach the properties of determinants may be visual hurdles to understanding, rather than aids. Nevertheless, the art work is so well done that purchase on this account is justified; and if the literate purchaser is tempted to go beyond the pictures and to follow some of the printed word, much of the purpose of the book will have been achieved.

Mathematics in the Making is not a history of mathematics, despite the fact that it contains much history. Where historical development fails to take the same direction as the exposition, the latter assumes the upper hand. Historians will be less upset by such cavalier adaptation of their discipline than by the occasional failure of the author to indicate where evidence stops and conjecture takes over. Mathematicians, too, will find cause for some displeasure in that their subject has been presented from the point of view of the consumer rather than of the devotee. Eschewing modern tendencies to equate mathematics with abstract deductive thinking, Hogben proceeds from the position (page 9) that "Mathematics is the technique of *discovering* and *conveying* in the most *economical* way possible *useful* rules of *reliable* reasoning about *calculation, measurement* and *shape*." Overmuch concerned with the measurational aspect of the subject, he tends to admire Egyptian accomplishments at the expense of the Babylonian, mistakenly believing that the Nilotic equivalent for π (about $3\frac{1}{6}$) was better than the Mesopotamian. (Neugebauer recently has found that $3\frac{1}{8}$ was used on occasion instead of the more common value of 3.) Thinking again of mathematics as calculation, Hogben would rate the invention of logarithms above the discovery of the solution of the cubic equation. (Here he erroneously attributes the first solutions of the cubic and quartic to Tartaglia and Vieta, rather than to Del Ferro and Ferrari, respectively.) Similar judgments are expressed in connection with Greek mathematics. The author is distressed (page 121) that "The Alexandrians never surpassed—or even caught up with—the Chaldean temple culture in the art of computation"; and he is not much impressed by the work in Diophantine equations because (page 123) "they have no pay-off in the domain of measurement." About the celebrated Greek definition of proportion he writes pejoratively (page 100), "The notion of a ratio need not be to us, as to the Greeks, a nightmare." Perhaps this explains why he could make the meaningless statement (page 91) "We can neither multiply exactly, nor divide exactly, a number such as $\sqrt{5}$ by a number such as $\sqrt{3}$." Is it any wonder that he finds it difficult to understand (page 91) "why later generations of commentators have bestowed so much veneration on the formal definition of equiproportionality attributed to Eudoxus and expanded at great length by Euclid in Books V and X of the *Elements*?" Hogben admires instead those portions of the *Elements* which he feels are relevant to modern needs involving mensuration.

The layman who wishes to find out quickly and easily why mathematics is so useful will be charmed by the author's facile style and by the publisher's artistry. Here he will find no precise definitions, no tedious proofs, no dull exercises. One who wishes to go further and to learn what mathematics is really about should be reminded once more that, visual aids notwithstanding, to the achievement of this austere goal there is no royal road.

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One Theory

Introduction to the Study of Animal Populations. H. G. Andrewartha. University of Chicago Press, Chicago, Ill., 1961. xvii + 281 pp. Illus. $5.

During the past few decades there was a vast increase in the theoretical and practical investigations of animal populations, and it is not too surprising that interpretation of the very complex interactions which occur in nature led to considerable controversy. It is helpful to the student, therefore, to have a compact presentation of one of the main theories of natural control.

The book, based on a largely quanti-

tative and experimental course developed for students in zoology, is written in two parts, one theoretical and the other experimental. Part 1 gives a summary of Andrewartha and Birch's theory of environment. Following an introductory chapter, the properties and measurements of both the density and the dispersal of populations are discussed. The idea that the environment of an animal can be divided into four major components—weather, other animals and pathogens, food, and a place in which to live—is developed, and then each component is discussed in some detail on the basis of experimental evidence. The final chapter of part 1 is devoted to an exposition of a theory that is summarized as "the density of natural populations may be explained in terms of: (i) a shortage of time, (ii) a relative shortage of some essential resource, (iii) an absolute shortage of some essential resource, or interactions between these three mechanisms." There is also a short, critical review of the concepts of density-dependent factors and competition. Part 2 is a manual of practical exercises that arise from and are related to the theory developed in part 1. Twenty experiments, which deal with methods for measuring the distribution, density, and dispersal rate of animals and with the effects of the components of the environment on the survival, development, and behavior of animals, are described and analyzed in some detail.

As a general introduction to ecology, this textbook has some limitations. Emphasis is placed on the laws governing the physiology and behavior of individuals in relation to their environments and on the laws governing the numbers of animals in relation to the areas they inhabit; communities are discussed very briefly. The text is devoted to the development of a theory of population ecology which most workers in this field have not yet accepted. The quantitative aspects of the book require a very good grasp of statistical methods, such as analysis of variance and probit analysis. In table 3.07 the Poisson series appears to have been omitted. On the other hand, this well-written text, in addition to developing a concept, provides a wealth of experimental evidence and thus gives a good indication of current research in animal populations.

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Stimuli and Response

Bestiaire d'Amour. Jean Rostand. Translated by Cornelia Schaeffer. Doubleday, New York, 1961. Illus. $5.95.

Animals as Social Beings. Adolph Portmann. Translated by Oliver Coburn. Viking Press, New York, 1961. 249 pp. Illus. $6.

If you have a friend who annoys you with the old saw that science is ruining life by eliminating sweet mysteries, just give him a copy of Rostand's little book. It may not be, strictly speaking, science, but it has plenty of romance. The text is a capsule survey—15 minutes' reading time—of "amorous evolution." The style is in the best tradition of the yellow-jacketed French novel. Consider—

". . . they press themselves against each other mouth to mouth" (in referring to the paramecia).

". . . the fiancees chastely holding each other by the claw" (the scorpion).

". . . and when she is seduced, the couple drops down on the grass" (the meadow brown butterfly).

". . . her slim little belly seems to have a life of its own, endowed with some exquisite sensitivity" (the dragonfly).

Still there is little danger of overstimulation, for the climax of the book is the chilling statement, printed in bold, black capitals, "In the secret coming together of two human bodies, all society is the third presence." The book also has a message: artificial insemination would ruin the whole thing.

But this is quite unfair, because the book should be judged on the basis of its major contents, the illustrations by Pierre-Yvyes Tremois. His work is first-rate, flawlessly executed, part bold and free, part beautifully detailed. There is one drawing of two elephants, for example, which can only be described as awe inspiring.

Judging from the two books reviewed here, and from other recent works as well, there must be a strong interest among general readers in the social doings of animals. Some publishers have responded with new works like Rostand's; others have seen fit to reprint or to publish translations of books which are really somewhat out-of-date. For example, Portman's book was originally printed in German in 1953 and just now appears in English. But the prospective purchaser must take a vigilant look at the back of the title page to determine that this is not recent, up-to-date work. This is unfortunate, because the field is a swiftly moving one, and Portman took great care to have the book up to the minute at the time of original publication.

Portman skillfully presents many examples of social interaction in diverse animals species, in a spirit which is perhaps more admiring than analytical. The first chapter, on dragonflies, is particularly nicely done. His interpretations are based on an awareness of the limitations of trying to interpret an animal's behavior solely in terms of the stimuli just received from the external world, and a strong mistrust for the argument that natural selection is sufficient for the evolution of social behavior.

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Opaque Surfaces

Ore Microscopy. E. N. Cameron. Wiley, New York, 1961. xii + 293 pp. Illus. $10.50.

Cameron's *Ore Microscopy* fills a need long felt by people engaged in the study of polished surfaces of opaque minerals. It is really a pioneering attempt to explain the difficult complexities of elliptically polarized light and to systematize the optics so that they may be used for determinative purposes. The book brings together many widely scattered, miscellaneous data, and it should stimulate the study of opaque surfaces. It also demonstrates that quick and easy optical methods of opaque mineral determinations are possible.

The text presupposes a thorough knowledge of optical mineralogy and is designed for advanced students. The material it contains is excellent, but in places the reader becomes lost in a maze of Greek letters and other symbols. A table defining these letters would be most useful.

For the sake of complete coverage, the work of A. M. Gaudin and others, on the identification of sulfide minerals by selective iridescent filming, should have been mentioned. A brief paragraph on the possibilities of infrared light would also be helpful, and the very excellent loose-leaf folder entitled "Card index of ore photomicro-