rangement of atoms within them. While this section demands no more formal mathematics than any other book in the series, its emphasis upon symmetry properties sets the reader thinking very mathematically. This section orients him toward the more professional study which he might someday make after mastering calculus and group theory.

The work concludes by studying cleaving, gliding, melting, the piezoelectric effect, optical phenomena, and ways of classifying crystals. It also contains excellent appendixes on relevant subjects, including some fascinating suggestions for small research projects. (I warn all future science fair judges to be prepared for a flood of crystal exhibits.)

These four books seem to me (a university physicist) to be performing their function admirably. The number of authoritative and well written science books for the layman has been increasing recently, but there is room for many more of this high quality. In addition, the books are well suited to supplement the high school physics course. (Indeed, I plan to recommend them to my college physics students.)

A student who reads Cohen's book carefully will gain valuable perspective on the way in which scientific ideas develop. He will learn much about mechanics and will be less likely than most students to insist on a final, definitive answer to a scientific question.

Waves and the Ear should prove fascinating to future students of biology and medicine. It will provide all readers with some more understanding of the ways in which various scientific disciplines overlap.

The Physics of Television should be ideal for students impatient with abstract principles and eager to dive into electronics. While satisfying their interests, the book never loses sight of the physical phenomena underlying the subject. In addition, it could be a valuable introduction to electronics for the layman or the theoretical physicist easily frightened by circuit diagrams.

Similarly, Holden and Singer's book should prove a delight to all readers. The chemist, the future solid state physicist, the rock gardener, and the ordinarily curious reader will find much that is satisfying in this book.

I look forward eagerly to more volumes in the "Science Study Series."

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Man's Journey through Time. A first step in physical and cultural anthropochronology. L. S. Palmer. Philosophical Library, New York, 1959. xvi + 184 pp. Illus. $10.

The evolutionary history of *Homo sapiens*, for reasons so obvious that they need not be stated here, holds a peculiar interest and even fascination for all sorts of people. Thus it is not surprising that this area of study is subject to invasion by well-intentioned amateurs with variable qualifications. A few of these have made contributions of undoubted value. Most, however, have merely succeeded in producing literary offspring of quite doubtful scientific value. In my opinion, this book falls into the latter category.

The author, a physicist, has set for himself the commendable but formidable task of precisely measuring the rate of man's physical and cultural development through geological time. Formidable, indeed, when one considers the regrettable paucity of primate fossils and the often striking lack of agreement among competent students with respect to their precise nature and affinities. The blithe certainty frequently exhibited by L. S. Palmer is scarcely shared by professionals. Firm belief in the ability to express evolutionary changes in a precise, mathematical manner pervades this entire volume. Probably this reflects the author's background—that of a physicist—which in turn probably accounts for his biological and anthropological artlessness. For Palmer clearly fails to recognize that most of the existing fragments of man's biological and cultural history cannot be measured by other than hazy, ill-defined parameters. Estimation of evolutionary rates is, of course, a legitimate procedure, but only when the material justifies it.

Palmer concludes that man's physical development has occurred at the rate of about 1 Haldane "darwin" (that is, a rate in which the measured characteristic changes by 1/1000 in 1000 years). The validity of this entire method of approach rests squarely on the validity of the absolute time scale which the author uses. This most certainly can be disputed. Concerning the post-Villafranchian Pleistocene, it definitely is incorrect to state that "the dates for the successive cold epochs and their approximate duration have now been agreed by most authorities." This fallacious premise is sufficient to vitiate the author's major conclusion. Moreover, the fossils with which he deals undoubtedly do not represent a single, straight line of descent. Although the author clearly recognizes this, he chooses for the most part to ignore it.

His analysis of man's physical development is based exclusively on four "anatomical indices" relating only to the skull (it is so convenient to forget the rest of the skeleton; but here, it is only fair to point out, the author is not unique in his sin): (i) the nuchal area height index; (ii) the condylar position index; (iii) the cranial capacity; and (iv) the lower dental arcade convergence angle. He employs the first two of these as measures of erectness of posture; yet there is reason to believe that the placement of the occipital condyles is not an infallible clue to posture. The assumption that the fourth index is a measure of "the potentiality for articulate speech" is too artless to require refutation.

Palmer is flogging a dead horse when he depicts classic Neanderthal man as a semierect, degenerate, ape-like fellow with a prehensile great toe, who shuffled along like a chimpanzee. This ancient paleoanthropological calumny has been exposed and abandoned by serious students; but here, as in other instances, the author either is not cognizant of the pertinent literature, or he ignores it. In fact, Neanderthal man obviously is Palmer's *bête noire*. Hence Neanderthal's remarkably large brain poses a difficult problem. Quite unable to explain the occurrence of such a large cranial capacity in such a stooped, ape-like creature, the author can only suggest naively that "during the last interglacial period man's skull was expanded by the internal pressure of the cerebro-spinal fluid." Quite a *deus ex machina*, indeed!

A few other examples of anthropological absurdities may be briefly noted. Rhodesian man is another uncomfortable fellow who "may well be an example of prehistoric acromegaly leading to gerontomorphism"; presumably this is a misinterpretation of some observations made by Sir Arthur Keith. Palmer's discussion of the evolution of articulate speech is flavored with clairvoyance. Mandibular morphology "strongly suggests" that the australopithecines "might have been able to speak"; and it is deduced, apparently from the temporal lobes of his brain, that "it is doubtful whether Rhodesian

man could speak." Finally, the gradient of the "lower dental arcade convergence angle" graph leads to the inference that "it may be anticipated that man's ability to speak may be appreciably increased in the near future." The author seriously considers Klaatsch's theory of polygenesis, which postulates that modern men were derived as three separate groups from three different anthropoid stocks, each of which also gave rise to one of the existing great apes. This theory, at best a historical curiosity, possibly is a foundation of the author's insinuation that the Australian aborigine is an inferior sort of *Homo*, and that the European white man is the undoubted pinnacle of all evolution.

The measurement of man's cultural development is assessed by three "quantitative" factors: (i) variation in the number of materials at man's disposal; (ii) variation in the number of his occupations; and (iii) variation in his speed of movement by mechanical means. The author's approach is based on a belief that it is possible to effect a "cultural 'grading' of man-made objects" by a point system. Even if one ignores the incompleteness of the archeological record, the validity of this *modus operandi* seems exceedingly doubtful, at best.

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Virus. Wolfhard Weidel. Translated from the German by Lotte Streisinger. University of Michigan Press, Ann Arbor, 1959. 159 pp. $4.50.

Virology, in the popular literature, is usually portrayed as a science which deals with agents of disease and their control. It is refreshing to find a little book, such as this one, which depicts this science as one which investigates and can decipher some of the innermost secrets of life. This book is well written, fluent, and witty.

The reader will encounter, throughout the book, several gems of scientific wisdom. However, he may or may not agree with some of Weidel's own opinions. For example, I would find it difficult to defend the following statement: "The most important virus diseases have long been known, and the tedious search for new ones seems rather less appealing than collecting butterflies. Basic research is usually concerned with delving more deeply into experimental material already at hand" (page 35). It is also surprising that the author has faith that it will be possible to produce viruses in a test tube, just as starch granules are synthesized today (pages 103–104), but, at the same time, has little confidence in the eventual discovery of effective chemotherapeutic agents to control virus diseases (pages 148 and 150).

The major portion of the book is devoted to a description of the cycle of infection and multiplication of the virulent phage and culminates in a discussion of the mechanism of transfer of genetic information from parent to daughter DNA helices. References to other problems, including lysogeny, are brief. Although this is to be expected because of the scope of the book, one finds a contrast between the careful and detailed development of the bacteriophage topics and the simplified version of other phenomena.

The translation of the German text is not literal. It is unfortunate that the subtitle "Die Geschichte vom geborgten Leben" (the story of borrowed life) has been omitted, because it tends to define the scope of the book. The general organization and most of the specific information has been retained, but throughout the book several paragraphs of an introductory or concluding nature have been omitted or abbreviated. By a liberal translation much of the flowing style and humor of the German text has been maintained, but some alterations of meaning have been introduced. There are also some mistakes. For example, on page 46 "Reindarstellung" was rendered as "isolation" instead of as "purification"; in microbiology "isolation" has a quite different meaning. On pages 28 and 80 a common mistake is found: "Typhus" was translated as "typhus," although the author quite obviously meant "typhoid," which is caused by an entirely different microorganism.

The book contains good illustrations and an index. The format is very attractive, but the price may lessen its popularity among the general public.

In conclusion, the author should be commended for having made an excellent effort to elevate virology from an applied to a basic science, in the public mind.

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Studies in Mathematical Learning Theory. Robert R. Bush and William K. Estes, Eds. Stanford University Press, Stanford, Calif., 1959. viii + 432 pp. $11.50.

This collection of papers grew out of a summer institute on the applications of mathematics to social science research, which was held at Stanford University in the summer of 1957. It is fairly representative of current experimentation in the construction of mathematical theories of learning. The reader needs some knowledge and sophistication in psychology, and at least a speaking acquaintance with notions of matrices, difference equations, and probability. Even so, the psychologist may at times get lost in the mathematical manipulations, and the mathematician is equally likely to be puzzled by the psychological discussions; for there is an unfortunate tendency to use highly specialized psychological jargon without definition, to introduce new mathematical symbols without explanation, and to skip over long calculations as if they were obvious. The result of these stylistic faults is that to all but a small group of initiates (and one wonders whether this group is very much larger than the group of authors themselves) many of these papers will be somewhat mystifying. Nevertheless, for any one interested in applying mathematics to psychology or in finding out what mathematical psychologists are doing, this book is worthy of careful study.

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New Instruments and Methods of Engineering Geology. N. V. Glazov and A. N. Glazov. Translated from the Russian by J. Paul Fitzsimmons. Consultants Bureau, New York, 1959. 91 pp. $3.25.

This interesting little book describes new techniques used in engineering geology, hydrogeology, soil mechanics, soil science, and drilling operations. It relates mostly to new procedures currently used in Russia, but it also describes several techniques recently developed elsewhere, which presumably are novel to the Russians. The main emphasis of the volume is on the use of radioactive procedures. These pro-