Book Reviews

Science Study Series. *The Birth of a New Physics.* I. B. Cohen. 200 pp. $0.95. *Waves and the Ear.* William A. van Bergeijk, John R. Pierce, and Edward E. David, Jr. 235 pp. $0.95. *The Physics of Television.* Donald Fink and David M. Lutyens. 160 pp. $0.95. *Crystals and Crystal Growing.* Alan Holden and Phylis Singer. 320 pp. $1.45. Doubleday, Garden City, N.Y., 1960 (available to secondary-school students and teachers through Wesleyan University Press, Columbus 16, Ohio).

These four volumes make up the second group of books released by the Physical Science Study Committee in their very ambitious "Science Study Series." The first five books were previously reviewed in *Science* [**130**, 616 (1959)]. Over 65 more books are planned for the next few years.

The "Science Study Series" is aimed primarily at two audiences—high-school physics students and intelligent laymen. It consequently cannot assume much mathematical sophistication or advanced knowledge of science. Nevertheless, it is intended to convey much of the excitement and flavor, as well as many of the details of modern physics to its readers. Judging from the first volumes, it is succeeding remarkably well.

The Birth of a New Physics (by I. Bernard Cohen, professor of the history of science at Harvard) traces the development of mechanics from the Greeks to Newton. To the physicist (although certainly not to the historian), this would seem to be a limited subject. However, this limitation permits Cohen to study the specific problem in more depth than is possible in the usual physics course, to show the interrelations between physical theory and other branches of knowledge, and to illustrate the way in which science constantly changes.

In the first chapters, Cohen poses the problem of explaining motion and relates the early answers of Aristotle and his successors. These approaches to physics are illustrated in Aristotelian and then Ptolemaic astronomy. Perhaps one of the major accomplishments of this section is its demonstration of the reasonableness and consistency of ancient science.

Copernicus' astronomy is then explained, with a discussion of its advantages and disadvantages. It is made clear that a choice between Copernican and Ptolemaic astronomy had to wait until Kepler's modifications and Galileo's physics. Perhaps Copernicus' most important contribution was in stimulating this later work.

This scientific revolution culminated in Newton's physics. Newton was able, among other things, to develop a mechanics incorporating and explaining the earlier work. Cohen discusses this magnificent achievement in terms of the intellectual revolution of Newton's times, and also examines it from the perspective of present-day nonclassical physics.

W. A. van Bergeijk, E. E. David, Jr., and J. R. Pierce, (Bell Telephone Laboratories) have written *Waves and the Ear.* A zoologist, an acoustical engineer, and an electronics physicist, respectively, they combine to write in the first person singular a work which touches on all these fields, and many more.

After an introductory section on sound as a means of communication, they discuss the physics of sound waves and devote two chapters to a review of the decibel system, wave phenomena in general, and sound waves in particular. In the middle section, the book shifts from pure physics into biophysics; this section discusses how sound is observed by the human being and examines the physiology of the ear, the nervous system, and the brain. The concluding sections touch upon sound production in animals and man and in high fidelity apparatus.

This book shares one characteristic with most of the works in the series. This characteristic, which is due to the selection of authors who are active in research and interested in writing well, makes the reader very aware of how much is still unknown in each field, shares with him the excitement of examining still unanswered questions, but does this without neglecting the enormous achievements that have already been made.

The Physics of Television (by Donald Fink, director of research at Philco, and David M. Lutyens, science editor of Penguin Books) is not a handbook for the repair of television sets, but, as its title indicates, is primarily concerned with the physical principles involved in television.

Like the previous book, this volume begins with a brief discussion of communication. It then gives a lucid, careful review of the physics of light and electricity. Atomic theory, solid state physics, and the wave-particle duality of light and matter are discussed, in addition to more conventional subjects such as Ohm's law and deflection of current by magnetic fields.

Given this background, the reader examines the problem of turning "light into electricity and back again." The components of a television camera, a transmitter, a receiver, and a television set are examined. The main emphasis is always put on the physical principles underlying each component and the function each component performs. Thus, circuit diagrams may be used in describing a vacuum tube oscillator, but the oscillators' over-all function is shown by block diagrams.

Alan Holden (Bell Telephone Laboratories) and Phylis Singer (Far Brook School) have collaborated in writing *Crystals and Crystal Growing.* This work is a fascinating discussion of the strange ways in which solids form, an excellent hobby book describing ways of growing crystals, and a lucid, penetrating introduction to solid state physics. It can be read on any of these levels, or, ideally, on all.

The book begins with a discussion of solids, the crystalline form, and the nature of solutions. It explains two methods of growing crystals—by sealed-jar and by evaporation—and proceeds to give "twelve recipes for growing crystals." Like a good cookbook, it always emphasizes the reasons recipes work and chooses recipes to illustrate important principles.

In the middle section of the book, the discussion covers the shapes of crystals, their symmetries, and the ar-

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