on entering Asher's laboratory looked at a new piece of apparatus and exclaimed, "Good Lord! What is that?" The book will be fun for anyone who enjoys observing a scientific virtuoso. It will probably be most useful to those who teach optics and ophthalmology.

Pain is a verbose and pseudo-philosophical work. Its general tone can best be indicated by quotation: "An analysis of pain shows that what we call the 'vital' should be regarded as a particular manifestation of an ethical order rather than as a specific instance of conformity to the laws governing the 'vital' sphere" (page 137). Buytendijk then continues to elucidate his views as follows: "Painfulness is therefore an insult and injury to the sense of what is right . . . and we notice in it the three typical effects of physical injury: inevitability of impression [which he elsewhere denies], 'dynamization,' and accentuation of the self-conscious." His point that the degree to which pain is experienced is profoundly influenced by psychological factors and that pain in turn influences the outlook of the victim is well enough taken, but this was expressed far more clearly a decade ago by W. K. Livingston, who is not mentioned.

Except in a very brief "annex" at the end of the book, the references, and there are many, date from the 1920's and the 1930's, with negligible exceptions in the early 1940's. The reader will look in vain for modern knowledge in this field. Beecher's extensive studies on pain in World War II casualties are barely mentioned in this little "annex," and there is nothing about the newer work on the central nervous system and pain. The investigations of Hall and Stride in England, of Thompson and Melzack in Canada, or of Hernández-Peón, Hill, Erwin, Mark, Wall, and others in this country are not mentioned.

Bewilderment that a man who has held a series of professorships in ancient and distinguished universities in the Netherlands should write such a book is lessened by the knowledge that he is also the author of books on the psychology of football, on Dostoevsky, and of what is said to be a broadly sympathetic work on women. But what is to be said of a distinguished university press for placing its seal of approval on this sort of volume, which is neither up-to-date nor a worthy classic?

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Education: Then and Now

The Search for a Common Learning. General education, 1800–1960. Russell Thomas. McGraw-Hill, New York, 1962. xi + 324 pp. $6.95.

Since before World War I, a movement against mere specialization has spread in American education, a movement toward requiring all students to spend some time examining varied matters that all men should understand. A basic cause of the movement, as Russell Thomas shows in *The Search for a Common Learning*, has operated for much longer: a reaction that began early in the 19th century against the divergence of scientific and vocational from classical studies. The reaction sought teaching that would retrieve a community of culture and that would favor the individual as such, apart from and above his work. Such teaching should also have served, within the sciences, to dispose men toward the pure, basic end of that dimension which shades off into vocationalism at its other extreme.

Thomas's book is divided into a historical narrative, which he cuts off at 1930, plus a longer description of recent general education programs at 18 selected colleges. He believes that certain schools, such as Chicago and Minnesota, had made all the basic qualitative innovations by 1930 and that what came afterwards was proliferation and spread and, sometimes, confusion. While this claim may reveal some pride of locality in Thomas, who is professor of humanities at the University of Chicago, the positive aspect of the claim is fair.

Innovation and principle mean much in his view of how practice develops. The historical section of his book unfolds in terms of the policy pronouncements and the formulations of program put forward by college leaders. The longer section catalogs, in college-by-college snippets, the incarnation of policy in detail. He acknowledges the ways that administrative dealings, social conditions, and economic necessity have affected programs, but the structure of his book assumes a more schematic notion of cause: that some men have worked out broad principles of educational policy, based on more or less clear philosophical analysis, and that programs have resulted from such principles. Defects in programs have resulted from incorrect or eclectic philosophy.

The book is oriented to the special vocationalism of the educational spokesman and administrator, assuming as it does the efficacy of the administrator's ideas. It thus shows little of the educational results in which Thomas himself believes and which he wished to realize through placing present practice in historical context. The underlying difficulty may be, as his own approach might consider, philosophical. Educators have often paid lip service to the fact that much learning takes place outside schools. There are men in all fields who do not limit their perceptions to their own specialties. The conditions that have produced such men are facts in the history of general education. The conditions that continue to produce them are part of the whole educational process which society supports, sometimes without administration. Investigating such conditions can never be an easy task, but it is the task without which any description of educational programs must fall into routine.

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Imprints from the Past

Fossils. An introduction to prehistoric life. William H. Matthews III. Barnes and Noble, New York, 1962. x + 337 pp. Illus. Paper, $2.25; cloth, $5.75.

This attractive handbook, written mainly for the amateur collector of fossils and the student of historical geology, contains a wealth of information about the various plants and animals that have left their imprint in sediments of the geologic past.

The first seven chapters (92 pp.) give a brief summary of what fossils are, of the various kinds and types of these ancient remains, and of how they came to be preserved; they relate the manner by which fossils provide evidence of organic evolution and are used to identify and correlate strata and to determine paleoclimates and pathways of former seas; and they furnish basic instruction for the beginner to follow in finding, collecting, preparing, identifying, photographing, cataloging, and exhibiting fossils.

Chapters 8 to 11 (86 pages) deal with the physical history and life record of the various geologic periods and sys-

tems; they contain a short narrative of paleontology from the ancient world to the present, and offer a résumé of organic evolution, including evidence of such, and its theories and mechanics as well; they describe the earliest primates, manlike apes, fossil men, and *Homo sapiens* himself. Even the story of the Piltdown hoax is retold with interest.

The appendices (A to F), comprising 40 percent of the book, provide a source of material useful to the more mature student. Here are included a synopsis of the divisions of the organic world and their distinguishing characteristics, geologic ranges, and relative importance or unimportance as guide, or index, fossils; a glossary, a list of readings and references on historical geology and paleontology, a register of agencies and dealers supplying maps, publications, fossils, and collecting equipment; and a partial listing of the larger museums where fossils are on display.

We have in *Fossils* a book that should become a welcome addition to the library of anyone interested in knowing more about prehistoric life.

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Science Today Series

Radio Astronomy. J. H. Piddington. Harper, New York, 1961. 128 pp. Illus. $2.50.

Although radio astronomy began in the United States with the discoveries of Jansky and the solitary work of Reber in the 1930's and the early 1940's, after the war this country inexplicably passed the ball to England and Australia, and also to Russia in terms of theoretical interpretations. A gradual resurgence over the last decade has seen the United States make up most of the deficiency in instrumental facilities, but the loss of much of a generation in the training of students and in the seasoning of senior personnel has not been easy to recover. The effects of this lag appear strongly in the field of monograph publications, none of which has so far been written by an American. The work under review continues this tradition, the author being a distinguished Australian radio astronomer.

Piddington's *Radio Astronomy* is ninth in the Science Today series, a series in which authors are apparently required both to cover their subjects and to quit after precisely 128 small pages.

Since radio astronomy is already a vast subject, this may have been the principal factor imposing an exceptional terseness of text and a relative sparseness of illustration on *Radio Astronomy*. Further, the book is marred by extreme carelessness of production, featuring frequent misprints, sloppy setting of equations, and even occasional questionable grammar. The type is so closely packed as to encourage the reader to seek a strong light. While reasonably priced as a hard-cover, the book is essentially a paperback in content and might better have appeared as such, at a still lower price and with a more generous and careful format.

Such faults, while real, are peripheral, merely tending to obscure what is, apart from a few inaccuracies, basically a good book. The author has packed a remarkable amount of explanation and factual detail into his treatment of instrumentation and techniques, the background and sources as seen in continuum radiation, hydrogen-lines studies, lunar and planetary emissions, and radar astronomy. Nearly a third of the book, and much the best part, is devoted to two of the author's specialties —the generation of radio waves and radio waves from the sun. In fact, this is the only book in which one can find satisfactory brief discussions of the known major source mechanisms, including the important class of space-charge or growing-electron-cloud effects; likewise its brief summary of the complex variety of solar noise events is uniquely good.

The jacket suggests that this book will be interesting to the reader with little scientific training, a statement I question. (So far the only book on radio astronomy which could really appeal to and be read profitably by both scientists and laymen is the splendid and sprightly recent Penguin paperback by F. G. Smith of the Cavendish group.) The author more modestly and more correctly states in the preface his goal of producing a complete but not detailed account, useful as an introduction for scientists working in other fields. Such relatively sophisticated readers, and graduate students first approaching the field, will indeed profit from a close reading of this deceptively simple appearing book.

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Geochronological Sequence

Prehistoric Life on Earth. Kai Petersen. Edited, adapted, and supplemented by George Zappler. Dutton, New York, 1961. 163 pp. Illus. $4.95.

This beautifully illustrated, clearly written, semipopular book presents a geochronological sequence of animals since pre-Cambrian time. It is a refreshing approach to the origin and succession of life on earth. A pictorial geologic time chart is included. The author states that the continents, as we know them today, have always been approximately in the same relative position to each other. Life is said to have originated somewhere far back in pre-Cambrian time when inanimate substances, in some way unknown to us, changed into organic compounds that could reproduce themselves.

Petersen stresses evolution, dispersal, and distribution of the vertebrates. The evolutionary transitions between the major groups that we now recognize in our classification are described and their selective adaptations toward more efficient means of reproduction, the prevention of desiccation, temperature control, better nervous and circulatory systems, and locomotion are elucidated. The earliest vertebrates are thought to have originated in a fresh-water environment.

Most of the discussion and description of invertebrates is centered on the early and middle Paleozoic assemblages. Reference to plants is usually in connection with vertebrate environments and the first land plants are said to have appeared during the Silurian-Devonian transition.

There are chapters that include discussions of the early history of paleontology, of fossils and of how these remains were buried, of heredity and selection, and of classification. Relationships of the different groups are illustrated with numerous phylogenetic figures. There are 44 black-and-white figures and 83 stimulating color illustrations, but there is no bibliography. This book will be useful to both high school and college students.

The following comments about some of the illustrations may be useful to readers: on page 20, the names *Merychippus* and *Miohippus* should be reversed; on page 25, the large extinct mammal is a glyptodont, not an armadillo; on page 121, the cranium of *Andrewsarchus* is elongate and probably as long, or longer, than the entire