written for laymen by that intrepid explorer and photographer, Haroun Tazieff. As stated on the book's jacket, Tazieff is "probably the most daredevil geologist alive today." He is indeed a modern Empedocles, and he conveys to the reader much of the thrill, esthetic pleasure, and feeling of awe that he himself feels in watching volcanoes erupt. But his narrative is haphazard, more entertaining than instructive, more descriptive than analytical, and the translation does not read as smoothly as it should. There are 64 illustrations, most of them spectacular, including 12 color plates and several reproductions of old engravings; these constitute the most valuable part of the book. Unfortunately, however, the illustrations are not adequately described, and they bear no relation whatever to the adjacent text. Maps and diagrams are conspicuous by their absence.

Volcanoes in Action by Lynn and Gray Poole is intended for youngsters, aged 9 to 13. Among this audience, it will appeal more to those who like exciting stories than to those who look for answers; it dwells too much on accounts of dramatic eruptions and too little on their causes. The illustrations are excellent, but it should be noted that one is wrongly labeled an eruption of Mount Katmai (Alaska), a volcano which, contrary to many published accounts, did not erupt in 1912 and which has not been photographed in eruption since that date! Inaccurate statements and incorrect explanations mar the text. It is wrong, for example, to say that the famous eruption of Krakatoa in 1883 was a steam explosion caused by the heating of downward-seeping seawater, or to say that the glowing avalanches which raced down the Valley of Ten Thousand Smokes in 1912 were caused by fumaroles that "belched forth watery sand" which "trickled across the Valley floor." Bright youngsters will wonder if volcanoes can be simply divided into three types—the "explosive or blast-out" type, the "tame or oozing" type, and the "intermediate" type. And they may ask if volcanic formations built from falling bombs, cinders, and dust are called *cinder cones*, whereas other cones, "made of both cinders and lava flows, are known as *big cones*." They should not be misled by errors of this kind.

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IAEA Symposium, 1961

Tritium in the Physical and Biological Sciences. vols. 1 and 2. Proceedings of the Symposium on the Detection Use of Tritium in the Physical and Biological Sciences. International Atomic Energy Agency, Vienna, 1962 (order from National Agency for International Publications, New York). vol. 1, 369 pp., $7; vol. 2, 438 pp., $8. Paper. Illus.

These volumes suffer, like most symposia, from the common problem of late publication. Many of the papers presented at the symposium, which was held in early May 1961, have been presented, and in some cases published, elsewhere since and are therefore now well known. Exciting experiments, such as those by J. H. Taylor on the timing of DNA synthesis in the chromosome, have already been widely publicized. The value of this symposium, as in all cases of valuable symposia, is two-fold: (i) it brought together scientific personnel from diverse fields to discuss their own work and to hear about that of others, and (ii) publication of the volume places the papers in an unusual and valuable juxtaposition. In these volumes the relationship of the use, distribution, and counting techniques for tritium is related by the actual act of correlating the collection of papers with those on the biological uses and the biomedical effects of tritium. The advantages of such a symposium and of the subsequent publication of its papers are far too often overlooked. Growth of the physical and biological sciences, has at times, been inhibited by their increasingly artificial separation.

Two of the most interesting of the many papers presented at this symposium are (i) the study by Speirs and his associates and (ii) the study by Pelling. The Speirs paper reports the use of tritium to investigate inflammatory cells; the formation of plasma cells by inflammatory mononuclear cells and the migration of inflammatory cells back into the lymphatic and blood vascular systems as the inflammation subsides is discussed. In addition to these interesting findings, Speirs and his associates present most lucidly the techniques used for autoradiography and, in an appendix to their paper, a list of the difficulties commonly encountered in autoradiography as well as remedies for these difficulties. The study by Pelling is on DNA, RNA, and protein synthesis in the giant chromosomes of the midge, *Chironomus*. In this presentation Pelling demonstrates by the simultaneous use of tritiated uridine and thymidine that RNA and DNA synthesis may take place concurrently in the chromosome. Pelling searches for replicating chromosomes, and then, as an index of RNA synthesis, he examines the nucleolus and Balbiani rings which synthesize much more RNA than DNA and which are only slightly labeled with tritiated thymidine. In this work, as in much recent work, asynchronous DNA synthesis in the bands of the giant chromosomes is indicated.

The two volumes include many papers and subsequent discussions which are of interest to anyone now using or considering the use of tritium in physical or biological research.

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Vistas of Science Series

Challenge of the Universe. J. Allen Hynek and Norman D. Anderson. Scholastic Book Services, New York, 1962. 144 pp. Illus. Paper, $0.50.

This attractive, pocket-size paperback is one in the "Vistas of Science" series conceived by the National Science Teachers Association to present current and accurate scientific information to junior and senior high school students and to the general public. Facts and ideas are presented in a stimulating fashion: this is not just another book. For example: "It is virtually impossible . . . that our particular star should be the only one to have planets with physical and chemical conditions able to support life. It would be like saying that out of trillions and trillions of cats, only your pet cat has kittens."

Difficult topics, such as the celestial sphere, orbits, Kepler's laws, and relativity, are presented in easily understood language, and the three-dimensional illustrations by Helmut Wimmer are well done and most helpful. In the final section, "Projects and experiments," Norman Anderson describes building and using simplified versions of a theodolite, a sundial-shadow stick, a globe sundial, and a spectroscope. This section is the best thing of its

kind I have seen, and it should be especially useful to teachers.

A list of selected readings is given. My own choice would be somewhat different and would include, for example, some of the Harvard books on astronomy, some beginning college texts, and the *Larousse Encyclopedia of Astronomy*. A few of the definitions in the glossary are fuzzy to the point of being incorrect. A chapter on radio astronomy is needed. The discussion about distances to the distant galaxies could be usefully enlarged, and Allen Hynek falls into a common error when he implies that such distances all depend, in the final analysis, on trigonometric parallaxes. A half dozen other statements need modification: for example, "Nevertheless the moon is man's greatest challenge." There are many greater challenges; for example, man's learning to live in peace with his fellow man.

Although books like this one are needed, the main problem in teaching high school astronomy is in teaching the teachers. Antiquated curriculum requirements make it almost impossible for an ambitious teacher, during summers, to learn astronomy as it should be learned, from an expert university professor. The summer institutes for teachers sponsored by the National Science Foundation are a step in the right direction, but they are woefully inadequate when one considers the number of teachers that need training.

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The Evolutionary Process

The Evolution of Life. F. H. T. Rhodes. Penguin Books, Baltimore, Md., 1962. 302 pp. Illus. Plates. Paper, $1.45.

Introduction to Evolution. Paul Amos Moody. Harper, New York, ed. 2, 1962. xi + 553 pp. Illus. $7.50.

The two books under consideration here approach the science of evolution from different standpoints. Rhodes has written a semipopular description of the history of organisms, with only a brief synthesis and discussion of causes. Moody's book, which is about twice as long (in content), is a college textbook that concentrates more on general features than on the fossil record, although this is presented at adequate length. Neither book requires previous knowledge of biology. Rhodes' book is suitable for general readers; Moody's is more academically written but it is not dry and could be read with profit by any intelligent adult.

Rhodes's account is generally conservative, but it is up to date in most respects. I noticed about a dozen errors of fact and twice that many questionable interpretations, but almost none are at all serious. The coverage is well balanced, considerable attention being given to plants and to post-Paleozoic invertebrates as well as to the usual sequence of Paleozoic invertebrates, a diversion into fish, and a culmination in tetrapods; nevertheless, rodents are scarcely mentioned. Many reconstructions are given; these are quite variable in quality, although most are adequate. The book is vividly and occasionally lyrically written, but it does not convey, as does Moody's (or Beerbower's, or Simpson's, or Dobzhansky's), that evolution is a living science with frontiers that change importantly and constantly. Nevertheless, only the Fentons, in a much more expensive book, have provided laymen with a better introduction to fossils and the history of life.

In this second edition of his well-known book, Moody again gives a clear and competent presentation. It is the most generally adequate and up-to-date treatment, available in English, of the whole of evolution. There are many improvements on the first edition and the results of much recent research are included. Notable among the improvements is a considerable increase in the discussion of evolutionary mechanisms. The number of errors that I noticed is about the same as in Rhodes's book (a small number, considering the scope of the book's subject); the theoretical chapters are somewhat weaker than the factual ones. Every author has his pet subjects, but I was surprised to find 18 pages on serology and only slightly more than one on the origin of life, in which neither colloids, viruses, nor the experimental evidence is mentioned.

Several subjects of considerable importance (as I see it) to the study of evolution are omitted from Moody's book, and from most other books on the subject; these gaps can be filled by the instructor, but they seem worth mentioning. Psychology has not yet contributed significantly to evolutionary theory, but this cannot be said of ecology, from the predecessors of Malthus (who is mentioned) onwards. Ecosystems and the evolution of adaptive zones are ignored, some factors of the control of population size are enumerated and then forgotten, and the fundamental process of general adaptation is omitted.

Embryology has a chapter to itself, and is also discussed elsewhere in the book, but the evolution of patterns and integrated units is not touched on, with the exception of allometric growth. The relations between adaptive plasticity and canalization are not made clear. Thresholds in development and in adaptation are not discussed, and the results of artificial selection, intermediates between races and species, and the significance of sex are also missing. If one were to judge by the treatment given them here, plants stopped evolving in the Permian. But the small size of this list of omissions should be an indication of the relatively complete coverage that Moody gives the evolutionary record and its interpretation.

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Progress Report

Direct Observation of Imperfections in Crystals. Proceedings of a technical conference held in St. Louis, Missouri, in March 1961. J. B. Newkirk and J. H. Wernick, Eds. Interscience (Wiley), New York, 1962. x + 617 pp. Illus. $21.50.

Although the arrangement of atoms in thousands of crystalline substances is known, it has been obvious since about 1934 that there are occasional flaws in these arrangements. In that year Taylor suggested a planar dislocation of the structure to explain "gliding" or "slip" in crystals, and in 1949 Frank suggested a screw dislocation to explain crystal growth; before the end of 1949 screw dislocations were actually observed, and a great impetus was given to the investigation of dislocations generally. In the brief dozen years that have since elapsed, this field of study has renovated our ideas about crystal perfection.

Although several books have already been published on the subject, the aim of this report is to "collect, describe and compare accumulated knowledge about modern methods for observ-