UFO's (L. E. Catoe, Ed., *UFOs and Related Subjects: An Annotated Bibliography*, U.S. Government Printing Office, Washington, D.C., 1969). Produced by the Library of Congress's Division of Science and Technology for the Air Force Office of Scientific Research to assist the Condon study, this bibliography of books, journal articles, pamphlets, conference proceedings, tapes, and so on contains more than 1600 entries.

Jacobs's account eschews technical arguments or analyses. This may be just as well, considering that he apparently does not realize, in one of the few semiscientific passages, that Alpha Orionis and Betelgeuse are the same object. Nonetheless, even without his having an extensive technical background, his resolute agnosticism might have given way to a sterner stance than this: "Although von Däniken had a certain amount of evidence to back up his ideas, he failed to discuss a wide range of anthropological theories that may have accounted for the data or to grant to ancient people the intelligence and creativity they deserved. Nevertheless, the book was stimulating enough to provide widespread discussion."

But the humanistic and sociological minutiae that are Jacobs's forte impress and inform the reader. Here we have Einstein's comment about UFO observers: "These people have seen *something*. What it is I do not know and I am not curious to know." In the early 1950's, however, the Central Intelligence Agency was highly interested in knowing, and that story too is here. A measure of the public's interest in UFO's can be gauged from the fact that between 1957 and 1966 NICAP members appeared on over 900 television and radio shows. Some of the media, however, tired of the flap, especially in the 1960's; *Time*, for instance, with inimitable elocution once called the sightings "primaveral deliriusion." And we learn of mistakes and excesses on all sides of the controversy. Some contactee-oriented clubs, for instance, held that if someone learned too much about UFO's he might be visited by the awful Men in Black. Not fanatic but equally implausible was an astronomer's explanation for the 1965 rash of sightings: they were caused by lunar dust dislodged by a Russian moon probe, caught in the earth's gravitational field, and made luminescent in the atmosphere.

The Condon study, meticulously reviewed here, probably spurred more controversy and animosity than any other occurrence in UFO history; yet, ironically, one of its founding purposes had been to facilitate a thorough, objective investigation, presumably thereby satisfying and mollifying all parties. Instead, dispassionate impartiality was often lost. Following months of public controversy about the study, in April 1969 Condon denounced UFO proponents, declaring: "In my view publishers who publish or teachers who teach any of the pseudosciences as established truth should, on being found guilty, be publicly horsewhipped, and forever banned from further activity in these usually honorable professions." The usually liberal *Nation* concurred with Condon that schoolchildren should not read about UFO's because they might get a warped view of science. And when the AAAS attempted to mount a symposium on UFO's, Condon tried, unsuccessfully, to get Vice President Spiro Agnew to stop the event.

Political leaders also appear in other contexts in the story. While director of the National Bureau of Standards, long before undertaking the UFO study, Condon encountered difficulties with the House Committee on Un-American Activities, headed by Richard Nixon, because he had fraternized with certain liberals and communists and because his wife was Czechoslovakian. In 1966, Congressman Gerald R. Ford, responding to constituents' concern, formally called for a congressional hearing on UFO sightings. And in the same year, when the federally supported UFO study was assigned to the University of Colorado, two congressmen from that state expressed delight because they reasoned that the Atomic Energy Commission would then be more inclined to place the National Accelerator Laboratory in Colorado.

The UFO controversy lingers on today, largely because after the crank and readily explicable cases have been excluded a nettlesome residue remains. At least three possible explanations exist for these baffling reports:

1) They would be understandable in terms of conventional science and known phenomena if the observational data were more extensive and precise.

2) They arise from purely natural phenomena, either not yet discovered or not yet understood.

3) They are, in fact, not of this world, coming from another place and time, constructed by an alien technology, and capable of seemingly impossible feats as gauged by our understanding of science.

The first of these appeals to the scientist's visceral response. According to current scientific methodology and training, when searching for explanations of natural phenomena one should not forsake the familiar and substantiated mosaic of contemporary science unless it has been demonstrated to fail. Moreover, many events in modern life—ranging from some UFO sightings themselves to the assassination of President Kennedy—have demonstrated the fallibility even of credible witnesses, especially under stressful, unexpected conditions. Mechanical evidence, such as photographs or radar sightings, can likewise be misleading, even though genuine.

The second type of explanation has been proffered by many scientists attempting to account for UFO's. Menzel's bizarre atmospheric occurrences, Klass's plasma theories, and Hynek's swamp gas were conservatively of this form. If extremes of this class of explanation were to prove valid for the implacably unidentified cases, the impact on science and public policy clearly would be colossal.

The third type of explanation repels most scientists on fundamental procedural and epistemological grounds. Such supraterrestrial, extraexperiential interpretations could always be right; but to overrely on them would trivialize science, dethroning repeatability and experimentation from their position as ultimate arbiters in research. Such fanciful explanations should be adopted only as the last resort; otherwise science becomes too easy and thereby misleading. Yet multitudes unquestioningly accept these explanations for UFO's. Those who know the least about science often seem the most inclined to abandon it, particularly for sensational alternatives. But some cautious, sober scientists are now concluding that no other explanation for UFO's is fully tenable.

Zealots abound in all these camps. Jacobs does not help us decide which group to follow, but he does exhaustively delineate the controversy. And, for better or worse, John Chancellor probably was right when he said in a news broadcast on 18 October 1973, "Many people would like the UFO's to go away. But the UFO's won't go away, and many scientists are taking them very seriously. It's likely that we will hear more and more about the UFO's."

RICHARD BERENDZEN
Department of Physics, American University, Washington, D.C.

Paleozoic Fossils

Trilobites. A Photographic Atlas. RICCARDO LEVI-SETTI. University of Chicago Press, Chicago, 1975. x, 214 pp. $27.50.

Trilobites were marine arthropods whose existence spanned nearly all of the 350 million years of the Paleozoic era of earth history. Their symmetrical, segmented bodies and often elaborate morphological variation have made them sought-after prizes for the amateur collector and a rich source of information about many geological problems for the profes-

sional paleontologist. This book presents information for both groups, prepared by a physicist whose interest in optics and whose love for trilobites are both abundantly reflected.

Introductory chapters provide an overview of trilobite morphology, and a short appendix discusses the author's photographic techniques as well as some problems of specimen preparation, but the meat of this book is the 150 pages of trilobite photographs.

As the author admits, the selection of illustrations was made more for esthetic than for scientific reasons. They represent materials from his personal collection, specimens photographed on visits to a few museums with large trilobite collections, and unusual specimens or morphologies the photographs of which were obtained from paleontologists working on trilobites. Photographs made with various techniques, often of the same specimen, illustrate the values and limitations of the techniques.

For the paleontologist, the book assembles a variety of photographs of generally complete trilobites of many ages. The coverage of trilobite groups is neither complete nor balanced. Furthermore, photographs that are esthetically pleasing are not necessarily scientifically useful. Nevertheless, there are many fine photographs in the book, and an imaginative teacher could use it to effectively introduce students to many aspects of trilobite morphology. A section on the structure of trilobite eyes and the physics of trilobite vision is excellently illustrated, and its detail reflects the author's special interest in this subject. This is perhaps the most scientifically valuable part of the book. In addition, there are many x-ray photographs of trilobites showing rarely preserved appendages and some fine photographs of complete Middle Cambrian trilobites discovered by the author in eastern Newfoundland and previously unreported from North America.

For the amateur, the illustrations provide a good indication of the range of trilobite morphologies and a good cross section of the kinds of trilobites most likely to be encountered in major trilobite collecting areas.

There are only a few technical errors, of concern only to specialists, and hardly any errors of typography. Although the book is of limited scientific interest, it is an attractive conversation piece for trilobite-lovers and a good introduction to trilobites for the nonspecialist and for the creative teacher of paleontology.

ALLISON R. PALMER
Department of Earth and Space Sciences, State University of New York, Stony Brook

Lipids in Fungi

Fungal Lipid Biochemistry. Distribution and Metabolism. JOHN D. WEETE with contributions by Darrell J. Weber and William M. Hess. Plenum, New York, 1974. xiv, 394 pp., illus. $25. Monographs in Lipid Research, vol. 1.

The biochemistry of fungal lipids is one of the more diffuse areas of biochemistry. Biochemical research on fungi consists of many diverse efforts and has not focused on phylogenetic and comparative themes. The yeast *Saccharomyces cerevisiae* and the ascomycete *Neurospora crassa* are probably the two fungal organisms that have had the most sustained biochemical research history, and work on them has left a vast number of research fragments to be consolidated. This book provides a much-needed ordering of the literature on fungal lipid biochemistry. Weete has organized the volume around the structural classes of lipids, and for each class analytical biochemistry, biosynthesis, and phylogenetic relationships are discussed.

The first section of the book is an introduction to fungal lipids. The total lipid content of many fungi is reviewed along with the occurrence of lipids in characteristic fungal structures, such as vegetative hyphae, yeast cells, and spores. Brief surveys of the effects of such cultural conditions as temperature, *p*H, carbon source, and inorganic nutrients make it clear that few generalizations can be expected concerning the environmental factors governing fungal lipid metabolism. Section 1 also introduces the subject of the subcellular location and function of lipids as related to their composition and metabolism. Concern with these relationships is maintained in the more detailed discussions of the specific classes of lipids and is a welcome feature of the volume.

Section 2 is based on a detailed review of the literature concerning the composition and metabolism of the following major lipid classes: aliphatic hydrocarbons, fatty acids, sterols, acylglycerides, phosphoglycerides, and sphingolipids.

The chapter on aliphatic hydrocarbons relates the discovery of these compounds in fungal spores to their postulated function in the spore wall or coat. The author cautions against such an interpretation since scanning electron micrographs show that the spore surface does not change after extraction with organic solvents and freeze-etch replicas of spore walls have not revealed a discrete cuticular layer similar to the waxy coating of plants. The discussion is illustrated with both freeze-etch and scanning electron micrographs of spore surfaces.

The chapters that follow on the occurrence, distribution, and biosynthesis of fatty acids and sterols are the strongest presentations in the book. They provide complete and lucid descriptions of the biochemistry of fatty acid biosynthesis and degradation and relate the major classical concepts in the study of fatty acid metabolism in plant and animal systems to the fungi. The discussion draws heavily on the literature concerning the higher plant and yeast systems in order to provide a coherent format.

The chapter on the distribution of fungal sterols consolidates many new data provided by the application of gas chromatography and mass spectrometry to analysis of fungal lipids. As in the chapters on fatty acid biosynthesis, a very complete discussion of both classical and current concepts of sterol biosynthesis is accomplished through the use of plant and animal models to fill in gaps in the research on fungi. The review of sterol biochemistry is highlighted by a discussion of the phylogenetic implications of sterol distribution and biosynthesis. Plants, fungi, and animals are compared with respect to such parameters as the ability to synthesize major sterols by alternate routes, primary cyclic intermediates (lanosterol and cycloartenol), and the stereochemistry of the desaturation of the $\Delta 22$ position and nuclear double bond shifts such as the $\Delta 8 \rightarrow \Delta 7$.

The final two chapters of the book summarize current concepts of the physiology and concomitant ultrastructure pertinent to sporogenesis, with emphasis on lipid metabolism. The physiology is summarized well, but ultrastructure is described primarily in words and is not represented by an adequate number of electron micrographs. Only one thin-section micrograph is presented. The use of scanning electron micrographs and freeze-etch replicas is certainly interesting, but the vast majority of ultrastructural research in fungi has been done with thin-section transmission micrographs, and these would provide the reader with a familiar base from which to interpret SEM and freeze-etch data. Thin-section micrographs of membranous cellular components would certainly enhance discussions of relationships of structural lipids such as sterols and phosphoglycerides.

The book will be valuable to all researchers concerned with fungi and their metabolism. The clear discussions of the relevant general biochemical concepts provide good background for researchers working in closely allied fields such as plant pathology. The book succeeds in placing the many fragments of research on fungal lipids in a framework of classical and current concepts in lipid biochemistry.