rior. Special attention is given in these sections to evidence from geochemistry, sedimentary structures, electron microscopy, and (surprisingly) trace fossils in discussing the origin of bituminous shale horizons, nodular limestones, and chamosite oolitic iron ores. Hallam is quite fair in presenting alternative points of view on these controversial topics.

Places and times of mountain building and igneous intrusions are considered as the expected results of processes tied to plate tectonics. Mountain building is believed to have been increasing through the Jurassic, coinciding at the end of the period with a pronounced marine regression and faunal extinction. No new paleogeographic reconstructions are presented. Paleoclimatology is well discussed in a separate chapter, but in the next edition Hallam may wish to improve the discussion by including charts of inferred climatic zones. Hallam expresses serious doubts about the worth of paleotemperature estimates based on oxygen isotope ratios: "The more thorough the work, the more complications have arisen." Thus, "it seems extremely unlikely that [oxygen isotope analysis] can add anything to what we can already infer from fossils and sediments about Jurassic climates" (p. 196).

In matters biologic, the major debate among those concerned with the Jurassic is how to account for diversity gradients and biogeographic provinces in a world in which the latitudinal temperature gradient was much weaker than it is today. The range of sea temperature from the tropics to the poles is about 30°C today and in the Jurassic was only about 15°C, with the polar region much warmer than at present. Explanations for the paleobiogeographic patterns have centered on establishing a correlation with the inferred Jurassic trends in temperatures, physical barriers, salinity, and bathymetry. Hallam indicates that any explanation in terms of a single factor would be insufficient. He appeals to a correlation between overall environmental instability and latitude, instability presumably being greater at higher latitudes.

Regardless of whether any specific correlation between an environmental factor and a paleobiological pattern is apt, this approach highlights a lack of focus on causal mechanisms. For example, the zoogeographic influence of ocean currents is probably not, as Hallam states, "primarily one of temperature" (p. 211), but rather may be to enable (and prevent) dispersal and gene flow. A couple of degrees of latitude may make very little difference in temperature but an enormous difference in a current system and therefore in species distributions. Hallam's discussion of Western European and North American biogeographic provinces (in the appropriate Jurassic geographic framework) is well done and interesting, but again the approach is strictly empirical. There is little effort to establish a deductive model of what biogeographic provinces should have been expected. Hallam's discussion of diversity and provinces therefore is not as rigorous as the facts of the case may warrant.

Hallam is also not particularly rigorous in his paleoceanographic models, which, nevertheless, are well presented and stimulating. Of greatest interest is the claim that the presence of a reduced latitudinal temperature gradient resulted in a weaker atmospheric circulation to the point that ocean circulation was measurably more sluggish, thus leading to a significant reduction in mixing of nutrients and oxygen. Indeed, he writes, "In the more equable periods of the past, such as the Jurassic, much of the ocean bottom could have been more or less stagnant" (p. 60). A firm paleogeographic basis for this model is nowhere developed. To cite another example of assertion that could have been better substantiated, Hallam concludes that the Jurassic epicontinental seas were "quite possibly almost tideless over large regions." Hallam presents some sedimentological evidence to support this claim, but one might reasonably expect that a paleogeographic analysis would also be forthcoming.

The counterbalancing and considerable strength of Hallam's book is that these hypotheses force us to address directly the new paleoceanographic questions, and they therefore move us a major step beyond customary stratigraphic reporting. Hallam has played an active role in work on Jurassic geology for the past 20 years. It is to his great credit that he endorses the view that the appropriate Jurassic research question is not only What are the Jurassic sediments of (say) Greenland? but also What would be the effect of a lower temperature gradient on ocean circulation? Hallam's book not only clearly shows us the necessity for students of geologic history to ask both geologic and oceanographic questions, but also tries to provide reasonable answers.

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The Interstellar Medium

Atomic and Molecular Physics and the Interstellar Matter. Proceedings of a summer school, Grenoble, France, 1974. ROGER BALIAN, PIERRE ENCRENAZ, and JAMES LEQUEUX. Eds. North-Holland, Amsterdam, and Elsevier, New York, 1975. xxii, 632 pp., illus. $66.75.

It is difficult to view in perspective the diverse recent developments in research related to the physics of the interstellar matter. Many new interstellar molecules have been discovered and mapped by radio astronomers. The diffuse interstellar medium has been studied to advantage in the far ultraviolet by instruments on spacecraft. Advances in infrared astronomy have made possible probes of relationships between gaseous and solid material and between cloud structure and the process of star birth. Collectively, the 11 lecture courses of the 26th Les Houches Summer School of Theoretical Physics provide a much-needed, broad perspective on the field. Although some of the details may be ephemeral, the lectures in this volume all reflect sound physical intuition and will therefore remain useful for some time to come.

The chapters on atomic physics (H. Nussbaumer), collision theory (D. Flower and R. McCarroll), and gas dynamics (F. Kahn) are well organized in the manner of textbook presentations and generally succeed in covering vast amounts of material concisely. S. Green provides a theoretical treatment of molecular structure and collision processes with attention to recent work relevant to interstellar clouds. W. D. Watson's very thorough course on molecule formation handles the subject with physical insight. Watson shows how molecules provide probes of conditions in clouds and also discusses in detail the physics of interstellar grains. D. Flower contributes a clear, concise treatment of ionized nebulae. A. A. Penzias's discussion of dense neutral clouds makes clear the connection between instrumental measurements and physical conditions of the clouds. It reflects, however, a somewhat parochial view, dealing only with observations at millimeter wavelengths. The intricacies of interstellar maser processes and the baffling body of observational data are reviewed by P. Goldreich. The lecture on heating and ionization by G. B. Field is a provocative treatment of the thermal and dynamical state of the interstellar gas. Field deals with the large questions of the evolution of diffuse matter in the Galaxy by painting global pictures while paying attention to micro-

scopic detail. H. Reeves discusses the cosmological significance of the abundances of elements and isotopes in an interstellar medium composed partially of primordial material.

The price of the book deserves comment, particularly in light of the informality of the printing (photoreproduced typescript replete with extraneous black marks) and the apparent lack of editorial attention (there are numerous misspellings and occasional grammatical errors). The benefits of summer schools like Les Houches could surely be spread more widely if sponsoring agencies were to underwrite more of the cost of publishing their proceedings.

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Mycology

The Fungal Spore. Form and Function. Papers from a symposium, Provo, Utah, 1974. DARRELL J. WEBER and WILFORD M. HESS, Eds. Wiley-Interscience, New York, 1976. xvi, 896 pp., illus. $30.

The last 15 years have seen an increasing interest in the study of cryptobiotic systems as models for studying developmental changes in microorganisms. Although the formation, maintenance, and breaking of the cryptobiotic state in dormant spore systems have been among the most intriguing of biological processes, the basic control mechanisms are not yet clearly understood.

Intensive conferences on the technology, biochemistry, and molecular biology of bacterial endospores have contributed to significant progress in understanding these endospores in the past 20 years, but fungal spores have until recently received insufficient attention. This book is an important contribution that highlights the nature of fungal spores, their unique structures, and the mechanisms that may be involved in breaking the dormant state. In addition, the book gives accounts of a variety of fungal spores. Detailed cytological descriptions of organelle changes and structures are included, as are interesting discussions of self-inhibitors, activation mechanisms, and problems related to the physiology of the dormant state and germination.

Although knowledge of the molecular basis of cryptobiosis in these eukaryotic spore systems is no more advanced than it is in bacteria, some important differences have been observed. Among matters deserving of further study are the stable messenger RNA that is carried to the spore state, the level of regulation, and the importance of structural elements (for example, polarity on mitochondria) as determinants in morphogenesis. The combination of detailed studies of structure and consideration of physiological and biochemical functions holds promise for future research on fungal spores. Of particular interest is the record in the book of the session in which the various participants discussed their perspective on future developments in work with this system.

Fungal spores are of interest to scientists concerned with developmental systems. This book includes relatively little information concerning the initiation of and the developmental changes involved in spore formation. One hopes that future conferences on fungal spores will deal with sporulation and will also compare fungi with other spore-forming organisms. Detailed analyses of fungal spore formation, maintenance of the dormant state, and germination are appropriate bases for comparative studies of sporology. This book, therefore, serves as an excellent introduction to the field.

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Growth Inhibitors

Chalones. JOHN C. HOUCK, Ed. North-Holland, Amsterdam, and Elsevier, New York, 1976. xiv, 510 pp., illus. $63.50.

Chalones are naturally occurring inhibitors of cell proliferation whose function is supposedly to control the growth of tissues. Chalones that act in the G_1 and G_2 phases of the cell cycle have been isolated. The purpose of this book is to present an up-to-date review of chalone research, which has been trying to get off the ground for some time but has had difficulties. The book reviews current knowledge of the principal chalones, such as those isolated from epidermis, fibroblasts, melanocytes, granulocytes, lymphocytes, bronchial epithelium, liver, smooth muscle, colon, and tumors. The purity that has been achieved in the isolation of chalones varies greatly, the preparations ranging from crude extracts, such as those obtained from smooth muscle, to very pure ones, such as the G_1 chalone of the epidermis isolated by Mark and his co-workers. This book also clearly attests that it is relatively easy to obtain an extract that is capable of inhibiting cell proliferation of the tissue or organ from which it was obtained, but that it is much more difficult to present convincing evidence that the control of cell proliferation is indeed the physiological role (or one of the physiological roles) of the substances isolated. Certainly this is one of the important areas for future investigation in the field, as most workers are well aware.

In the past, the chalone field has suffered from being somewhat insular. The book indicates that the situation is changing. Perhaps one of the best indications of this is the willingness of many of the authors to admit that stimulators (interestingly, usually referred to as antichalones) exist and that they may have a role in growth control. Discussions of the problems of isolating chalones and characterizing their role also seem more open-minded. The book does a special service by including several chapters on the technical problems that arise in the isolation and assay of chalones.

The "chalonists" still have some odd quirks. Many of them refer to M. Abercrombie as the chief proponent of the theory that growth control is effected by stimulators, and cite his paper on the wound hormone hypothesis (*Symp. Soc. Exp. Biol.* **11**, 235 [1957]) as the chief source of the theory. Even a not very careful reading of that paper will reveal that Abercrombie did not propose that growth was universally controlled by stimulators. He kept an open mind, suggesting inhibitors where the available data indicated them. Only in wound repair did he suggest that an endogenous stimulator, a wound hormone, might be operating, and in that situation it probably does.

In spite of some unevenness in the quality of writing, the book gives a good account of the status of the field.

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Books Received

The Aerospace Environment. Tom Beer. Wykeham, London, and Springer-Verlag, New York, 1976. xiv, 146 pp., illus. Paper, $8.60. The Wykeham Science Series.

Ancient Maya Pottery. Two Folios of Maya Pottery from the Site of Barton Ramie in British Honduras (Belize). Folio 1 by James C. Gifford. Folio 2 by James C. Gifford and Muriel Kirkpatrick. Color illustrations by Muriel Kirkpatrick. Available from Muriel Kirkpatrick, Laboratory of Anthropology, Temple University, Philadelphia. Folio 1, $6; folio 2, $6.50.

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