extremely exciting period of physics just because the answer is not yet known.

This volume contains 41 lectures given at a Europhysics Study Conference. The papers are research reports that (with a few exceptions) are not intended for the uninitiated theorist. They are of as high quality as those in any research journal; conference and workshop proceedings like this one have become a well-accepted way to communicate results in particle physics.

The book includes: discussion of theoretical and experimental aspects of proton decay and neutrino masses and the formulation of unified models of electromagnetic, weak, and strong interactions; mathematical details of the construction of supergravity theories, including several efforts to make sense out of the phenomenology and structure of "$N = 8$" supergravity; and a range of comments on the application of supersymmetry to particle physics.

There has been little effort by the editors to arrange the papers in a pedagogically helpful order. The review and summary papers are spread throughout the book, and it takes some effort to sort out the specific topics that are covered. Nevertheless, serious readers will find this a trivial shortcoming; the book is not meant to be read serially.

An elegant review, "Supersymmetry, particle physics and gravitation," by Pierre Fayet gives an overview of the applications of supersymmetry to fundamental theories. This kind of algebraic system appears to be crucial for formulating theories that unify gravity with the other interactions. Important technical background material on supersymmetry is reviewed by Bruno Zumino in "Superspace." Peter van Nieuwenhuizen in "What is supergravity and which of its goals have been reached?" provides an economical presentation of background material and an overview of supergravity theory.

Many of the papers are reports of individual research. As often happens in science before a grand synthesis is made, there are many conjectures and much technical detail to be digested. This is not an elementary book, but many papers in it discuss ideas that may have lasting worth. One paper of this type deserves special attention: "Attempts at superunification" by John Ellis, Mary K. Gaillard, Luciano Maiani, and Bruno Zumino. The particle spectrum in $N = 8$ supergravity (the most embracing theory known at present) falls short of the mark if the elementary fields are associated with the observed elementary particles. These authors propose to identify the known quarks, leptons, and vector bosons with the currents of hidden symmetries of the theory. The particles we call elementary would then actually be composites. The logic of the authors' efforts is not totally satisfying, but the paper is provocative and inspiring; already several other papers (including some in this volume) have attempted to tighten up their arguments. Before the fundamental particle interactions are unified, many more such imaginative ideas may be required.

This volume is dedicated to Joel Scherk, one of the more valued contributors in this field of research; it is certainly a fitting memorial to him.

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Paleobotany

Biostratigraphy of Fossil Plants. Successional and Paleoecological Analyses. DAVID L. DILCHER and THOMAS N. TAYLOR, Eds. Dowden, Hutchinson and Ross, Stroudsburg, Pa., 1980 (distributor, Academic Press, New York). xii, 260 pp., illus. $27.50.

Biostratigraphy, or the sequencing, separation, and correlation of rock units according to their fossil content, is essential for determining the history of evolutionary change. Unfortunately, after initial interest—and some damaging mistakes—by paleobotanical pioneers such as Lesquereux, Ward, Newberry, and White, stratigraphic paleobotany tended, until the advent of palynology, to be neglected in favor of the biologic study of specific plants or floras. This collection of nine papers is symptomatic both of reawakened interest in and of long neglect of stratigraphic concepts among megafossil paleobotanists.

From the outset, Dilcher and Taylor seem uncertain whether their book will deal with biostratigraphy, as its title promises, or with paleoecology, as its subtitle and introduction indicate. To be sure, the two are closely related, yet biostratigraphic analysis is largely antecedent to environmental inference. Inclusion of the lucid but demonstrably nonstratigraphic review of the biochemistry of plant remains by Brooks and Niklas further obscures the editors' aims. In addition, it is most unfortunate that Dilcher and Taylor choose to broaden the term "paleosuccession" to mean "progressive changes in the ecosystem." They thus confuse the shift toward vegetational equilibrium that was the basis of Clements's concept of succession with much longer-term responses of plant assemblages to climatic, evolutionary, or tectonic events.

Despite this, the chapters by Banks on the Siluro-Devonian, by Phillips on the Carboniferous, and by Schopf and Askin on the Permo-Triassic are excellent biostratigraphy and likely to become the standard references for their respective time periods. In each of them, zones are clearly defined in terms of plant assemblages or ranges of taxa based on large samples and the career-long experience of the authors, who are fully aware of distributional patterns and successional trends that act to compromise zonation schemes. In addition, Banks's summary of the sequence of appearance of important structural features such as leaves, wood, megaspores, and seeds will be of great importance in determining the onset of major competitive, productive, and reproductive strategies in the rapidly radiating land flora. The chapters by Phillips and by Schopf and Askin are masterly demonstrations of the interplay of environmental and evolutionary factors acting on floras. In his massive summary, Phillips documents the change from lycopsid to seed-fern and cordaite domination in the Late Carboniferous, and Schopf and Askin grapple with the question of diachronism in the appearance of the *Glossopteris* flora on the southern landmass after glacial retreat in the late Pennsylvanian.

The other biostratigraphic papers in the volume are disappointing in various degrees. Pfefferkorn and Gillespie offer an extensive bibliography and summary of previous literature but no details of the zonation or occurrence of specific taxa in North American Pennsylvanian strata. Ash's Upper Triassic zones seem to have a rather shallow taxonomic base, with none of the possible climatic or regional influences on plant distribution taken into account. The reader is not reassured by an added note shifting the Santa Clara Formation of Mexico from the highest to the lowest of his three zones.

The two papers forming the paleoecological component of this volume are a study in contrast. The highly quantitative evaluation by Spicer of the influence of fluid versus biotic sorting of plant megafossils in a deltaic setting points up the dangers of intuitively reconstructing vegetational patterns by simple observation in such sediments. On the other hand, Taggart and Cross's largely palynological analysis of the Miocene Succor Creek flora is seriously compromised by

their failure to consider the mutual dependence of the percentage components of a relative analysis and other factors such as variation in the net pollen production of local versus regional vegetation that have long been recognized by palynologists.

From a purely mechanical standpoint, the abundant misspellings and typographic errors, a totally arbitrary use of the hyphen, and a concertina-like opening and closing of word-spacing make this a trying book to read. Fortunately, most of the better chapters are also the least flawed in this regard. This collection, despite its serious shortcomings, reaffirms the value of megafloras in biostratigraphy, while showing that most paleobotanists have a long way to go to reach the level of sophistication of their zoological compatriots in either biostratigraphy or paleoecology.

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Poriferans

Biologie des Spongaires. Sponge Biology. Papers from a colloquium, Paris, Dec. 1978. CLAUDE LÉVI and NICOLE BOURY-ESNAULT, Eds. Editions du Centre National de la Recherche Scientifique, Paris, 1979. 534 pp., illus. Paper, 185 F. Colloques Internationaux du CNRS, No. 291.

This volume contains the 61 papers presented at an international colloquium on the biology of sponges. The papers are grouped into seven sections: developmental biology, cytology and cellular relationships, cell recognition, ecology and physiological ecology, chemistry and biochemistry, microstructure and mineralogy of the skeletons of living and fossil forms, and systematics and evolution. In each section the first paper is a relatively long review, and those following it are generally quite short reports of recent research. The reviews are mostly broad in scope and often thought-provoking. Some of the reports are summaries of studies to be published more extensively elsewhere.

Collectively, these papers contain a wealth of information, many excellent scanning and transmission electron micrographs, and a most useful set of references. Unfortunately, subject and author indexes are not provided.

The complete volume probably will be most useful to sponge specialists and invertebrate zoologists, but there are many important papers that will be of interest to developmental biologists, physiologists, benthic ecologists, organic chemists, and paleontologists as well. This reviewer found the following contributions especially noteworthy.

There are three papers on the gemmules of freshwater sponges. Rozenfeld *et al.* have found evidence to support the idea that gemmulation is effected by the attraction of amoeboid cells toward a substance diffusing from forming aggregates of these cells. Papers by Ostrom and Simpson and by Harrison *et al.* report that gemmule hatching is associated with a transfer of soluble calcium to binding sites on the cells with the gemmule, with decreasing levels of cyclic AMP, with increasing levels of cyclic GMP, and with increasing ratios of cyclic GMP to cyclic AMP.

A particularly extensive and detailed review of the structure and development of both calcareous and siliceous spicules is presented by Jones, who also contributes a paper on the production and growth rates of calcareous spicules in *Sycon* as a function of calcium concentration.

A comparative study by Bergquist *et al.* on the morphology and behavior of larvae from 33 species belonging to six demosponge orders suggests that larval characteristics are often similar among related taxa and may be important in clarifying taxonomic relationships.

A study by Fell *et al.* on the sexual periodicity of postdormant and postlarval specimens of *Halichondria* provides further evidence that, at least in some sponges, sexual reproduction is under endogenous control.

Mackie reviews signal conduction and coordination and provides some new data on conduction velocities in the hexactinellid *Staurocalyptus*.

Several authors report important new findings regarding the structure of sponges. De Vos shows that the endopinacoderm of the inhalant canals of *Ephydatia* contain many porocytes, through which nutritive particles may pass directly into the cells of the mesohyl. Reiswig notes that the choanoderm of two hexactinellid species does not consist of separate choanocytes, as in other sponges, but sets of syncytia from which collar units project.

The phenomenon of cell recognition is well represented. Van de Vyver reviews the various mechanisms by which sponges can maintain their integrity when confronted with "foreign" cells—collagen-like barriers between the growing fronts of dissimilar sponges in nature, and adhesion-inhibitory factors, phagocytosis, and cytotoxicity in experimental cell aggregates and grafts. Six reports following this review are devoted to these matters.

An excellent long-term study on the growth and mortality of shallow-water Antarctic sponges is contributed by Dayton. Jackson and Palumbi show that sponges in cryptic, coral-reef environments regenerate more rapidly than co-occurring bryozoans and suggest that this ability permits them to better withstand partial predation and to dominate substrata even though the bryozoans have much higher recruitment rates and comparable growth rates. Tunnicliffe makes the rather surprising point that boring sponges may actually benefit the coral *Acropora cervicornis* by facilitating its fragmentation, which seems to be important for asexual reproduction, dispersal, and suppressing the growth of competitors.

Sponge chemistry and chemotaxonomy are well reviewed by Bergquist and further considered by Sodano, Faulkner *et al.*, and Castiello *et al.* It is interesting that some sponges produce unusual sterols via transformations of exogenous, dietary sterols and that the predators of such sponges can be identified by the presence of these sterols in their tissues.

Among the many papers devoted to fossil calcareous sponges and their living relatives, two are especially exciting. Hartman describes a new Bahamian sclerosponge that is similar to some Mesozoic stromatoporoids and helps in interpreting the structure of these ancient organisms. Vacelet gives a very detailed account of a living sphinctozoan, *Neocoelia crypta*, and concludes that these organisms, thought to be extinct since the Cretaceous, are sponges. He also proposes a new classification for those sponges that have calcareous skeletons not composed of spicules. In another paper, Vacelet describes the spermatogenesis and embryogenesis of *Neocoelia*, showing that this sphinctozoan is similar in these respects to demosponges.

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Books Received

Adolescent-Parental Separation. Michael V. Bloom. Gardner Press, New York, 1980 (distributor, Halsted [Wiley], New York). 178 pp. $22.95.

Advances in Agronomy. Vol. 33. N. C. Brady, Ed. Academic Press, New York, 1980. xiv, 374 pp., illus. $41.50.

Advances in Catalysis. Vol. 29. D. D. Eley, Herman Pines, and Paul B. Weisz, Eds. Academic Press, New York, 1980. xvi, 368 pp., illus. $45.

Advances in Child Development and Behavior. Vol. 15. Hayne W. Reese and Lewis P. Lipsitt, Eds. Academic Press, New York, 1980. xii, 264 pp. $28.

Advances in Food Research. Vol. 26. C. O. Chich-