tions, and they provide a useful and interesting perspective on technologically desirable properties and the development of industrial capacity for producing different polymers. There is, however, virtually no material that directly concerns biologically significant macromolecules, which are understandably if regrettably the almost exclusive preoccupation of academic polymer specialists.

The half-dozen chapters on particular classes of polymers and catalysts are probably of special interest to organic or synthetic polymer chemists, that is "real" chemists. The other eight chapters should reach a broad audience of physical chemists and physicists concerned with physical properties and their molecular interpretation.

MARSHALL FIXMAN
Department of Chemistry, Yale University, New Haven, Connecticut

Dinosaur Biology

The Hot-Blooded Dinosaurs. A Revolution in Palaeontology. ADRIAN J. DESMOND. Dial, New York, 1976. 238 pp., illus. $12.95.

When I first saw the death of the dinosaurs in the Walt Disney movie *Fantasia*, I was greatly saddened. The poor creatures seemed so human. Years later I realized that Disney had taken some artistic liberties in his animated classic, for his reptiles demonstrated all sorts of mammalian behavior, including parental care, for which there was no paleontological evidence. Well, it now turns out that Disney may have presented a fairly accurate picture of dinosaurs, given what Adrian Desmond tells us about the wondrous archosaurs in *The Hot-Blooded Dinosaurs*.

The Hot-Blooded Dinosaurs is about both dinosaurs and the study of dinosaurs. The style is light, one of suspense and discovery. The book contains much historical material, often presented as asides rather than in tight chronological order. The historical notes range from informative and entertaining to somewhat distracting.

The main theme of the book is that the advanced archosaurs, that is, dinosaurs, pterosaurs, and their pseudosuchian ancestors, were warm-blooded or endothermic. Relying primarily on the work of John Ostrom, Robert Bakker, and Armand de Ricqlès on dinosaur ecology, energetics, posture, gait, and bone histology, Desmond presents the case that the dinosaurs were active, terrestrial creatures with a mammal-like physiology. As part of this scenario, a dinosaurian ancestor for the birds is seen as warm-blooded and intelligent long before its lineage acquired feathers or flight.

The author links endothermy with high intelligence and this in turn with complex behavior. The dinosaurs are perceived to have complex group behavior and parental care presumably denied cold-blooded ectotherms. The author asserts that "if an adult [reptile] remains near the young, its limited intelligence cannot overcome the temptation to eat them" (p. 171) and that "unlike solitary lizards, many dinosaurs were gregarious" (p. 130).

Although Desmond's perceptions of dinosaurs as vigorous, dynamic creatures seem reasonable, his major thesis, that they were therefore necessarily endothermic, is more difficult to accept. New data on crocodiles, which are ectothermic archosaurs and, with the birds, the closest living relatives to the dinosaurs, undermine Desmond's position. It is now known that crocodiles have a behavioral repertoire that rivals in complexity that of birds (see A. C. Pooley and C. Gans, *Sci. Am.* **234**, No. 4, 114 [1976]). Adult crocodiles cooperate in feeding activities. Parents help their hatchlings escape the egg and nest; a mother collects hatchlings and transports them to the water in her mouth. Complex behavior of the type posited for dinosaurs evidently does not require endothermy in the archosaurs.

Desmond's thesis is a victim not so much of the information explosion as of a dogmatic adherence to an extremist view. Vertebrates are presented as either strict ectotherms or strict endotherms. We are told, "The dinosaur adopted a mammal-like pose because it had a mammal-like physiology. It could not have been otherwise" (p. 121). But it could have been otherwise, and Ricqlès, whose work on bone histology is used by Desmond to support his thesis, has presented a more tempered and open view. In his recent review on the evolution of endothermy (*Evol. Theory* **1**, 51 [1974]) Ricqlès states, "If the origins of perfect 'warm-bloodedness' (endo- *and* homeothermy) are looked for among the primitive representatives of lineages of warm-blooded modern vertebrates, one cannot ask for a sudden appearance among them of all the associated features that one can find among living, modern warm-blooded animals." In Ricqlès's opinion "the big dinosaurs had a peculiar physiology by any standard, one which can hardly be regarded as 'typically reptilian' but must be better understood as something of its own."

A catchy title, coffee-table format, and simple glossary (where words like "fossil" and "physiology" are defined) suggest that *The Hot-Blooded Dinosaurs* was designed to be read by the nonpaleontologist. On the other hand, well over 100 authors are cited and almost 100 genera are mentioned in less than 200 pages of text. This documentation will interest the amateur or professional paleontologist with some familiarity with the names. It may overwhelm the layman.

While Desmond's assertiveness sometimes exceeds the data, his enthusiasm does succeed in vitalizing the dinosaurs. I'll believe a ceratopsian hen cared for her chicks!

RICHARD J. WASSERSUG
Department of Anatomy and Committee on Evolutionary Biology, University of Chicago, Chicago, Illinois

Haploid Transcription

Gamete Competition in Plants and Animals. Proceedings of a symposium, Lake Como, Italy, Aug. 1975. D. L. MULCAHY, Ed. North-Holland, Amsterdam, and Elsevier, New York, 1975. x, 288 pp., illus. $27.50.

The source of the interest in the subject of this volume can best be described by quoting from the paper by J. Cohen: "A man ejaculates some 350,000,000 sperms and a bull 1,000,000,000; of these multitudes *one* may be used for fertilisation, occasionally two or even, on occasions so rare as to make world headlines, six. It is usual among animals to produce very many more sperms than could ever be used in fertilisation and biologists have come to accept this monstrous overproduction as normal." Overproduction, especially of male gametes, is normal for plants, too. That only one of many million sperm finally fertilizes the egg raises the question of whether this is an accident or the result of some selection process, which would necessarily entail a high degree of competition among gametes.

The majority of the 28 papers in the book concern botanical systems, which seems to reflect the fact that haploid transcription is a relatively rare phenomenon among animals, whereas there is extensive evidence for haploid transcription in plants. The evidence for and against the existence of a haploid effect in animal spermatozoa is well reviewed by R. A. Beatty, who concludes that "there is perhaps no absolutely certain example of a haploid effect in animals." Cohen, on the other hand, presents the evidence for his theory that there is a "wholesale rejection of nearly all sperms on the basis of their haploid chromosome set having chiasma associated errors." Presumably the great majority of spermatozoa are genetically defective and for this reason are infertile.

J. Heslop-Harrison, in an excellent paper, reviews the extensive literature on male gametophyte selection and the interactions involving the male gametophyte and the female sporophyte in incompatibility phenomena in flowering plants. The evidence for both haploid transcription and gametophytic competition in plants is compelling.

Most of the other papers are research reports on various plant and animal systems in which there may be gamete or gametophyte competition. Many of the papers deal with pollen development and the factors that influence male transmission in flowering plants. This bias in favor of studies of pollen is open to criticism.

The book can be recommended to students interested in incompatibility and gamete interactions. The prompt publication of the volume makes it possible for researchers to find out what happened at the symposium before the information is outdated.

JOSEPH P. MASCARENHAS
Department of Biological Sciences, State University of New York, Albany

Plant Nutrition

Ion Transport in Plant Cells and Tissues. D. A. BAKER and J. L. HALL, Eds. North-Holland, Amsterdam, and Elsevier, New York, 1975. xiv, 438 pp., illus. $54.25.

The book under review is one of a spate of new books dealing with the mineral nutrition of plants or with ion transport, one of its central topics. The renewed emphasis on this aspect of plant physiology is most welcome, for the subject has to do with the primary acquisition by the biosphere of the great majority of the nutrient elements required for its functioning. And since toxic elements such as cadmium and lead also enter the biosphere largely by the same processes, the current interest is all the more apt.

The book is addressed to advanced undergraduates, graduate students, and teachers. It has much to commend it, above all the high caliber of the contributing authors. The writing for the most part is clear, and there are author and subject indexes. The production and the illustrations are good, as indeed they ought to be, considering the book's high price.

The price is not the only feature of the work that will create trouble for students and teachers. The introductory chapter outlining general principles condenses a vast amount of material and deals with some matters so briefly as to convey little information or understanding.

The greatest problem with the book, however, is its basic organization. With the exception of the first one, the chapters are given over to specific objects. This is justified for mitochondria and chloroplasts, which are highly specialized organelles, study of which requires correspondingly specialized, often unique, approaches. But is it helpful to break up the discussion of ion transport in cells and tissues into chapters devoted to algae, storage tissues, excised roots, and the like? This approach makes for both repetitions and omissions and forfeits the opportunity of illuminating general principles by reference to diverse plant materials. For example, ion fluxes in relation to cell electropotentials make separate appearances in the chapters on membranes, algae, storage tissues, seedling roots (both chapters), and salt glands, as well as in the introductory chapter. On the other hand, the kinetic approach is extensively discussed in one of the two chapters on roots and in the introduction, although it has been applied to algae, storage tissues, and other systems as well.

There are other problems. A chapter is devoted to storage tissue, most of which is inactive in ion transport and must be coaxed into activity by laboratory manipulations. The cells of leaf tissue, on the other hand, absorb ions delivered to the wall spaces by the transpiration stream. This process of absorption is a normal and essential function in the life of terrestrial plants, and it plays an equally important role in the leaves of floating aquatics. But there is no chapter on the extensive research that has been done on ion transport by leaf tissue, whereas salt glands and stomata, which are specialized leaf structures, both get the full treatment.

In spite of the shortcomings of organization and selection, the individual chapters are highly valuable, and serious students of ion transport in plants cannot fail to benefit greatly by giving them the close attention they deserve—and will require.

EMANUEL EPSTEIN
Department of Land, Air, and Water Resources, University of California, Davis

Books Received

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An Age of Fishes. The Development of the Most Successful Vertebrate. Joy O. I. Spoczynska. Illustrated by Melchior Spoczynski. Scribner, New York, 1976. 152 pp. $10.

Animal Biochromes and Structural Colours. Physical, Chemical, Distributional and Physiological Features of Coloured Bodies in the Animal World. Denis L. Fox. University of California Press, Berkeley, ed. 2, 1976. xvi, 434 pp., illus. $22.50.

Animal Migration and Navigation. Philip Street. Scribner, New York, 1976. 144 pp., illus. $8.95.

Annual Review of Energy. Vol. 1. Jack M. Hollander and Melvin K. Simmons, Eds. Annual Reviews, Palo Alto, Calif., 1976. xii, 794 pp., illus. $15.

Applied Pharmacology. American Edition. Walter Modell, Heinz O. Schild, and Andrew Wilson. Saunders, Philadelphia, 1976. xii, 926 pp., illus. $19.50.

The Arctic Circle. Aspects of the North from the Circumpolar Nations. William C. Wonders, Ed. Longman Canada, Don Mills, Ontario, 1976. xiv, 146 pp., illus. Cloth, $6.95; paper, $3.95.

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