The Yugoslav biologist Jovan Hadži, whose controversial and provocative views have stimulated a reexamination of the evidence concerning modes of early metazoan evolution, began his career 60 years ago. His first publication (in 1906) has been followed by 60 others, about half in Serbo-Croatian and half in German. *The Evolution of the Metazoa* summarizes the views he has developed, and those of earlier workers he cites extensively, rather than contributing new information or a balanced, heuristic synthesis. Hadži states at the outset that his main concern is the origin and position of the Cnidaria in animal classification, and the exposition and defense of his concept occupy more than half the book. The rest of animal evolution follows necessarily, and the remaining groups are more concisely treated. Despite its general title, the book's emphasis is thus also on lower Metazoa.

Hadži's main and most controversial points are (i) that Cnidaria evolved from turbellarian ancestors, the Anthozoa being primitive and fundamentally bilaterally symmetrical; radial symmetry developed as a consequence of a sessile mode of life, and the other classes evolved in turn from Anthozoa; and (ii) that bilateral symmetry is primitive in Metazoa, the acoel Turbellaria are the most primitive Metazoa, and their ancestors were very primitive ciliates. The latter shared characters with their flagellate ancestors, enabling Hadži to consider the Flagellata "direct antecedents of the Eumetazoa."

Much fruitful discussion in *The Lower Metazoa* was stimulated by some of Adolf Remane's equally provocative and controversial ideas, which are made easily accessible to American students in three valuable chapters of this book. Remane's view of metazoan origin is classical, flagellate colonization, and variations of the classical view are stoutly defended by P. Ax and V. N. Beklemishev, while Hadži's allies are O. Steinböck and E. D. Hanson. Hanson applies Remane's criteria of homology to evidence for the second point of Hadži's theory. The major criterion is not met; Hanson offers the striking evolutionary changes between ancestral ciliates and descendant acoels as the reason. The chapter in which Remane argues for the primitive nature of the coelum in the Bilateria and its origin only once and in an enterocoelous manner is next to "A critique of the enterocele theory," in which W. D. Hartman concludes that Remane's theory is supported by insufficient evidence to meet his own criteria of homology.

There are also several important chapters on relationships and evolution of sponges, turbellarians, and pseudocoelomates and on comparative biology of Cnidaria and Platyhelminthes. Half the chapters in *The Lower Metazoa* are by authors whose native tongue is not English, and the clarity of presentation places American readers much in debt to the authors and the editors, who translated several chapters and coped successfully with formidable differences in terminology and classification. The language problem is not so happily solved in Hadži's book. It is translated from German and has many rough and a few unintelligible passages. The editing is marred by many typographical errors and by disconcerting bibliographic mispellings.

Hadži, Komai, and E. Baldwin call for observations and experiments to provide new factual evidence relevant to animal phylogeny, especially from biochemistry, where modern analytical methods are largely untried but promise results of great interest. Hopefully, these volumes will stimulate the search for new evidence at all levels of organization.

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Paleoecology

Late Eocene Zoogeography of the Eastern Gulf Coast Region. Alan H. Cheetham. Geological Society of America, New York, 1963. xii + 113 pp. Illus. $3.75.

This work, a valuable contribution in the field of paleoecology, is on the whole an exposition of method rather than a solution to problems. In a region where it is difficult to offer an interpretation that has not been made before, this article superimposes the systematics and ecology of the Cheilostomata (order of Bryozoa) on the known geology, and constructs a model that might be used interpretively in other regions.

In the introductory chapter, Cheetham reviews the regional relationships of the lithologic units and the faunal zones. Aside from renaming as bryozoan zones two faunal zones in the Ocala Limestone that were formerly distinguished by Foraminifera and Ostracoda, no new terms are introduced.

The distribution of species and the ecologic associations of species are shown on maps and in lists. Diagrams that contrast the relative abundance of the different colonial morphs of cheilostomes with the abundance of other organisms in three different areal biofacies, and vertically within each biofacies, are skillfully presented.

Probably the point of greatest interest to geologists is the confirmation of the Ocala Uplift as a submerged Bahamas-like bank (Biofacies 4) in Jackson (late Eocene) time. A depth of 50 meters is postulated for the top of the Ocala Bank in early Jackson time. By late Jackson time the bank was tilted so that its north end was nearly awash and its south end was more deeply submerged. The Ocala Bank was separated from the continental shelf by the Suwannee Strait (Biofacies 3), which, although much shallower, is compared with the present Florida Straits. Sediments in the Suwannee Strait (the Gadsden Limestone of Moore) contain only buliminid and lagenid Foraminifera. Because the strait sediments include dolomite, it is inferred (after Fairbridge) that the depth of these sediments could not have exceeded 200 meters; 180 meters is accepted as the probable depth. A shallow carbonate facies is present on the shelf in western Florida and southeastern Alabama (Biofacies 2), but it passes into terrigenous clastic sediments in western Alabama (Biofacies 1).

The uppermost faunal zone studied is termed the *Spondylus dumosus* zone and is assigned to the Oligocene. It includes the Bumpnose Member of the Crystal River Formation (of Moore) and the Red Bluff Clay, both of which contain *S. dumosus*, and the Shubuta Member of the Yazoo Clay, which does not. The following statement is unsupported: "In central Alabama the Bumpnose grades into the Shubuta Clay and the Red Bluff Marl." I know of no surface continuation with either. That the cheilostome bryozoans of the Bumpnose, Red Bluff, and Shubuta "are more closely akin to those of the Vicksburgian than to those of the Jacksonian" and thereby establish an Oligocene age for all of these beds is no more justified than would be the assumption that the Vicksburg fauna is foreshadowed in late Eocene and early

Oligocene beds. The Red Bluff Clay rests disconformably on the Shubuta Member. It is perfectly clear from field relations that the Shubuta is a tongue of the Yazoo Clay, which, in western Mississippi, comprises the greater part of the Jackson Group.

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Plant Physiology

The Absorption of Solutes by Plant Cells. D. H. Jennings. Oliver and Boyd, Edinburgh, Scotland, 1963. viii + 204 pp. Illus. 30s.

This is a well-written and informative book in which the author presents a constructive analysis of important data that has appeared in the current literature. The presentation of subject matter follows a logical order with continuity of thought between chapters.

In the second chapter, which deals with theoretical considerations of solute movement, Jennings discusses the meaning of the terms *active transport, passive transport, free diffusion*, and *facilitated diffusion*. This discussion includes a thorough mathematical description of the several types of transport that have been investigated. The reader is thus given the basis for critical evaluation of data presented in later chapters.

Chapters 3 and 4 clearly point out certain of the pitfalls that may be encountered in interpreting generalized measurements of solute movement in plant cells if the cell is not considered as a multicomponent system and if the concept of free space is neglected.

Salt absorption and metabolism are reviewed in chapter 5, and the author compares the early findings of Hoagland and Davis and of Lundegårdh with the current concepts of active transport. Detailed discussion is given to papers that have treated demonstrations of the coupling of respiration and salt uptake with the use of metabolic inhibitors. In this chapter, as well as the following chapters, frequent references are made to transport studies carried out with the use of animal cells. The author also describes his own research in the area of active transport. Most of the remaining chapters are devoted to a discussion of the transport of particular solutes. Detailed attention is given to the uptake by plant cells of potassium and sodium, bivalent cations, phosphate, anions other than phosphate and nitrate, and organic compounds such as amino acids and sugars.

In chapter 14, the final chapter, the author summarizes the content of the book and describes his thoughts concerning the experimental data presented throughout the book. He considers these data in the light of traditional studies but suggests that a radical rethinking of the fundamental assumptions of solute transport may be required. As evidence of this, he discusses at length the transport hypothesis recently proposed by Mitchell.

This book will serve as a valuable reference work for the experimentalist and as an authoritative text for students of plant physiology.

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Zoological Sciences

Collegiate Dictionary of Zoology. Robert W. Pennak. Ronald, New York, 1964. viii + 583 pp. $8.50.

The appearance of a large new dictionary in any field of learning is always a notable event, especially so when it stands alone as does this one. Robert Pennak has dedicated this massive labor to his students, but he has written for zoologists generally—students, research workers, and teachers (high school, college, and university), as well as the general scientific public. It will be a very handy volume to have at one's elbow.

The approximately 19,000 terms are clearly and accurately defined, and they cover a very wide and up-to-date spectrum of the zoological sciences. The range of topics extends from ATP, the ampulla of Vater, and gnotobiotics to Nansen bottle, solenocyte, and zymogen. The emphasis is on North American usage and fauna, but I was hard put to it to find anything to which a British colleague would object, outside of essentially trivial differences in spelling.

Over 8500 genera and higher taxa are defined with cross references to common names when these exist. In the present unsatisfactory state of taxonomy, this sometimes becomes a tricky business. *Diemictylus* is not given under *Triturus* as a possible generic home for the common North American newt, *viridescens*, although *Diemictylus* has become fashionable again after 30 years of *Triturus*. Instead, *Notophthalmus* is suggested, which is going back even further. However, under *Diemictylus* the reader is referred to *Triturus*! *Nassa* is given but not the "older" term *Ilyanassa*, still used by many experimentalists and for which there is a vast literature. But such is the nature of taxonomy, and we can only extend our sympathy to any zoologist, including taxonomists, who must struggle with it. Despite such inherent difficulties, the wealth of material will be a ready source of necessary information.

A welcome feature is the inclusion of the names, dates, and brief characterizations of the work of a large number of zoologists, both American and European. O. C. Marsh (who collected the fossil horses that T. H. Huxley traveled especially to this country to see) must have turned over in his grave to have been omitted while his bitter rival, E. D. Cope, is listed. But the selection is generally both discriminating and adequate, and the ghost of Marsh can be appeased in a second printing.

There are a few surprising omissions: induction, circadian, centrifuge, morbidity, infectious, and all the terminology of soils such as mull, podzol, chernozem, horizon, and pedology itself. Of course these terms are geological, but they are fully as important to the zoologist as thermocline or epilimnion which are included. Actual errors are virtually absent, although I did notice that John Needham is credited with having aided in the demise of the theory of spontaneous generation when in fact he supported the theory against Spallanzani.

Unlike Samuel Johnson, Robert Pennak has not attempted to use his dictionary to reform the language. On the contrary, he explicitly states that in many cases he follows prevailing usage even when he does not agree with it. (No, Pennak was not one of the editors of the controversial new edition of Webster's *Unabridged*.) In what he set out to do he has succeeded, handsomely. There is a useful appendix that contains a taxonomic outline of the animal kingdom down through the level of families.

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