affinities between groups by using numerous characters in combination" but that since "not all characters are of equal importance" the data were not subjected to "formal numerical analysis." Beyond this there is little mention of general goals, principles, and procedures. There is no discussion of their character weighting procedure, or of the terms "natural group" (often used) or "monophyly" (seldom used). Although the authors seem to recognize (p. 333) the importance of determining which character states are ancestral and which derived, they rarely attempt to do so, and then without appeal to any criterion. No mention is made, for example, of outgroup comparison.

In the absence of any explicit logic it is fortunate that the evaluation sections have a standard format that facilitates an understanding of the approach. Pairwise comparisons are made between selected groups, with similarities and differences listed without regard for polarity. Each such comparison ends with an opinion on whether the similarities outweigh the differences or vice versa, and hence whether the groups are closely or distantly related. These opinions are difficult to evaluate, especially as it is unclear what evidence would compel the authors to reject their views.

In the final sections Dahlgren and Clifford try to determine which group of dicots is most like the hypothetical ancestors of the monocots. They conclude that the similarities between the Magnoliiflorae and some Liliiflorae indicate true relationship and that similarities between the Piperales and Ariflorae and between the Nymphaeales and Alismatiflorae are convergences. Their argument rests on an assumption that they never discuss, namely that the monocots are monophyletic. Perhaps their story is substantially correct, but in this case, as throughout the text, theirs is a plausibility argument that depends heavily on opinions about the weight of the character evidence and takes for granted the monophyly of groups.

Dahlgren and Clifford began their study with a preconception of higher-level relationships (their classification) and evaluated the character data accordingly. This approach seems backwards. It would be better, I think, to begin with lower-level hypotheses about monophyly and homology and then use specified principles to transform these data into a hypothesis of higher-level relationships. One wonders what picture of monocot phylogeny would emerge if "established groups" were abandoned and if the logic of phylogenetic systematics were rigorously applied. In this regard the authors' postscript is promising. Even though they think that "little is added by Hennig's concepts to the classical cladistic methods [sic]" (p. 333), and indeed they violate Hennig's principles repeatedly, they nevertheless confide that "a cladistic analysis of this material will be presented in due course" and might lead to "slightly different conclusions" (p. 345). I will not be too surprised if the results are radically different, but in any case I look forward to an analysis freer of preconceptions and based on an explicit logic for formulating and testing phylogenetic hypotheses.

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Organelles

Mitochondria. ALEXANDER TZAGOLOFF. Plenum, New York, 1982. xvi, 342 pp., illus. Cloth, $42.50; paper, $19.95. Cellular Organelles.

It has been almost 20 years since Lehninger's monograph *The Mitochondrion* first appeared, and now Alexander Tzagoloff has written a book that provides a good account of where the field stands today. A scan of the earlier book subsequent to reading Tzagoloff's is enlightening and indeed points up the remarkable amount of progress that has been made in our understanding of the functioning, organization, and biogenesis of the "powerhouse of the cell" in the interim. For example, the Mitchell chemiosmotic hypothesis, which now stands as the cornerstone upon which the currently conceived mechanism of mitochondrial energy conservation is based, was no more than an idea with no supporting data to speak of in 1964. Progress of a similar magnitude has been made on other subjects, particularly mitochondrial biogenesis and mitochondrial genetics.

Far from simply summing up the current status of a static field, this book serves to point out how fertile an experimental tool mitochondria have been and will continue to be. Add to that Tzagoloff's readable style of writing and the copious, well-done illustrations and you have a book that easily attains its stated goal of providing a thorough introduction for students who want to understand mitochondria in more depth than is provided in advanced cell biology textbooks. Further, the presentation is generally deep and broad-ranging enough that even established "mitochondriacs" should find the book worthwhile reading. One other useful feature is the frequency with which Tzagoloff provides brief explanations (with references) of the theory associated with different techniques when they first appear in the book.

Tzagoloff begins with a brief history of the study of mitochondria and an overview of general mitochondrial structure and terminology. The three chapters that follow consider the oxidative pathways associated with the mitochondrial matrix, the inner membrane, and cytochrome oxidase. Oxidative phosphorylation is the subject of the next two chapters, and all the preceding is brought together in a chapter that considers the resolution and reconstitution of electron transfer and oxidative phosphorylation. The last three chapters cover mitochondrial transport systems, biogenesis, and genetics. Though Tzagoloff has spent his entire career studying some aspect of mitochondria, his most recent interests concern mitochondrial biogenesis and genetics, and the chapters on these subjects are the most up-to-date ones in the book as well as the most insightful. Tzagoloff's tendency to point out unsolved problems becomes most apparent in these chapters.

Although overall the book is well worth recommending, there are two aspects of it that I found disappointing. First, speaking from my own perspective, it would have been helpful to have had a few pages devoted to a discussion of plant mitochondria, particularly the features associated with plant mitochondria that are not commonly found in mitochondria from animal sources (for example, cyanide resistance and the ability to oxidize external reduced pyridine nucleotides). Second, the chapters describing the mitochondrial electron transfer chain present a view that is not as current as that in the chapters on biogenesis and genetics. For example, none of the recent evidence that suggests that some form of protonmotive "Q-cycle" operates in complex III is cited.

The above complaints are relatively minor, however, and do not detract from my overall enthusiastic response to this timely book. It should become required reading for all people interested in mitochondria. Finally, it should be pointed out that the book is the first in a series devoted to cellular organelles. We can only hope that the rest of the series matches the standard it sets.

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