REVIEW

Price: Dfl. 130.00, US$ 59.00 (cloth).

Although many specialised books are expensive, this one does offer value for the money, and tends to live up to its title by offering the reader new insights. It represents the summation of symposia at the 13th International Botanical Congress in Sydney, 1981, symposia which marked the 50th anniversary of the founding of the International Association of Wood Anatomists.

William L. Stern's paper, 'Highlights in the early history of the International Association of Wood Anatomists,' is a refreshing vehicle for putting into perspective the organisation we know today and for giving us insights into its nature. The I.A.W.A. proves to have had difficulties like any fledgling group, but the enterprise and hard work of its early members overcame these. The I.A.W.A. is even more diverse in its membership than in earlier days.

Today, for example, a sizable number of I.A.W.A. members is interested in wood properties, so it is appropriate that a well-crafted paper in this field, J.D. Boyd's 'An anatomical explanation for visco-elastic and mechano-sorptive creep in wood,' be included.

Morphogenetic work is nicely represented by G.P. Berlyn's 'Morphogenetic factors in wood formation and differentiation.' P.R. Larson's paper on cambium terminology has the distinct merit of returning to anatomical data rather than arguing from the semantic side. B.G. Butterfield and B.A. Meylan, coworkers famous for their SEM exploits with woods, tackle a difficult question in their article: do cellulose webs across perforation plates disappear as vessel elements mature, or do they dissolve because of cellulase action? This question, now clearly stated, should be answerable by an ingenious worker who studies their examples. Their account of pit membrane hydrolysis is of far-reaching significance for concepts in long-distance sap transport.

Possible future trends in wood anatomy are suggested by J. Burley's paper, 'Genetic variation in wood properties.' The reader interested in variation within woods will value this paper for its abundant references and for its exciting forecast of things to come. J. Burley and R.B. Miller have included a paper on 'The application of statistics and computing in wood anatomy.' This paper is much needed not merely for its good sense, but because statistics and computation (knowledgeably used) are in the future of wood anatomy, just as in other fields of biology. One recent writer (Quirk, 1982), for example, analysed my concepts (indices) of Vulnerability and Mesomorphy in the family Vochysiaceae, and found them 'significant at the 5 per cent level. These data support the concept put forth by Carlquist for multiplying the vulnerability index value by the mean vessel element length to derive a mesomorphic index. The 57 species of Vochysiaceae do ordinate from xeric to mesic following a mesomorphic indexing.'

With regard to functional anatomy of woods, one must congratulate M.H. Zimmermann for his essay, 'Functional xylem anatomy of angiosperm trees.' It contributes original thinking matched with pertinent data. Is length of vessels within a plant significant? Zimmermann's data show that they are, and he should be encouraged for exploring this and other rheological aspects of wood anatomy.

The editor, Pieter Baas, contributes a long paper on 'Systematic, phylogenetic, and ecological wood anatomy—history and perspectives.' The first part of this paper, a historical review, is exquisite in its insights and its discovery of unpublicised work of Leeuwenhoek. Baas has clearly presented the best summary yet offered of the progress of wood anatomy prior to the 20th century. The portion of his paper on ecological interpretation suffers from the fact that this field is currently in such an active period of development that any summary in this decade is likely to encounter problems: too much must be answered on the basis of future studies. In particular, future exploration must be based upon a fusion between anatomy and physiology (e.g., Rundell & Stecker, 1977; Woodhouse & Nobel, 1982), and very soon the kind of work I do (a synthesis between anatomy, systematics, and ecology based upon field work) will be overtaken by a new synthesis between anatomy and physiology. One regrets the absence, in Baas's historical survey, of mention of an important pioneering paper (Webber, 1936).

The phylogenetic shortening of vessel elements during phylleis in dicotyledons, especially with relation to xeromorphy, is too pervasive to be ignored; Baas is not convinced by my previous explanation for this phenomenon, but I have offered another possibility (Carlquist, 1982) which he may find to have more validity. J.W. Bailey, whose work Baas endorses, was fully aware that adaptation to ecology guides wood evolution, but at the time I studied with him (1955) was unable to enter this new field. Surely Bailey would not agree with Baas that 'the phenomenon of heterobathmy does not
imply reversibility, but weakens the case for irreversibility.' Rather, what it indicates is that each group of dicotyledons has its own group of mutations and recombinations, and goes its own way rather than conforming to a single plan. Here as elsewhere, Baas seems uneasy with the concepts of Darwinian evolution.

I would like to reply to a few of Baas's comments on my own work. As Bailey did, I regard the loss of bars on a perforation plate as irreversible in at least some aspects. Baas finds arguments why scalariform perforation plates cannot be reinvented in groups which possess only simple ones 'not very convincing.' I find that loss of genetic information for a particular structure or kind of structure invariably means that a replacement or substitute, if evolved, will inevitably take a new form, so that in a group with simple plates exclusively, oddly subdivided plates or perforated plates might be expected — and there are groups which one could cite as examples.

Contrary to Baas's assumption, I would agree that rays of Melastomataceae can and do illustrate paedomorphosis. It is true that I have stated the syndrome of paedomorphosis features (1962, 1980) in terms of rosette trees and the like, but individual paedomorphosis features are to be expected in various groups. My approach seemed necessary in part because paedomorphosis has been incorrectly restated by two papers (Bierhorst & Zamora, 1965; Mabberley, 1974; see Carlquist, 1980). Also, two authors have attempted to use paedomorphosis to explain origin of primitive dicotyledon woods such as that of *Trochodendron* (Takhtajan, 1969; Young, 1981), although paedomorphosis is not applicable there (Carlquist, 1980, 1983).

When Baas states 'Carlquist's opinion (1980) that ecological trends in wood anatomy should not be expected to obey requirements for statistical significance seems a misunderstanding ...', I feel he is omitting the needed context on which my concerns were based. That statement was based on a defense of my 1977 paper from a criticism by Van Vliet (1979). In my 1977 paper, floras from various parts of Western Australia were compared. Although average vessel diameter, for example, of a particular flora was different (but not by a statistically significant factor) from that of a neighbouring flora, each flora was composed of various plants from various families — and included C$_3$ and C$_4$ plants, broad-leaved and aphyllous plants, etc. — in other words, a range of water-management systems. Despite the diversity of systematics and foliar apparatus, the averages of the floras did follow the rainfall figures. Where one deals with a single phylad in which radiation has occurred, and in which all species basically have the same water management system, statistical significance can be expected, and Quirk's (1982) work on Vochysiaceae shows clearly that statistical significance does emerge.

For many readers, however, the most questionable part of Baas's contribution will be his request for credence in non-Darwinian tenets: the *patio ludens* of Van Steenis. Despite Baas's colourful architectural analogy based upon the St. Mark's Cathedral in Venice, I feel most readers will still feel that a rigorous search for adaptation in the Darwinian sense, aware of the diverse patterns achieved by diverse groups, is preferable to a hypothesis that random variation or functionless patterns are at the bottom of one's research project. Indeed, younger workers familiar with the provenance of their woods find that wood anatomy follows ecology closely to an astonishing degree (Michener, 1981; Quirk, 1982).

In all, this book is surely one which will inspire thought and which ought to be available to all wood anatomists. Bierhorst, D.W. & P. Zamora. 1965. Primary xylem and xylem associations of angiosperms. Amer. J. Bot. 52: 657-710.


Quirk, J.T. 1982. Xylem tissue patterns as they relate to growth habitat of the Vochysiaceae. (Unpublished manuscript.)