

binaural hearing. They find that the dichotic pitch can be lateralized as a function of interaural delay and that the central patterns responsible for the perceived pitch also produce predictable binaural masking effects.

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Tree Physiology

The Structure, Biosynthesis, and Degradation of Wood. Proceedings of a meeting, Vancouver, B.C., Canada, Aug. 1976. FRANK A. LOEWUS and V. C. RONECKLES, Eds. Plenum, New York, 1977. xii, 528 pp., illus. \$49.50. Recent Advances in Phytochemistry, vol. 11.

The title of this important book is somewhat misleading because two of the 11 chapters have nothing whatsoever to do with wood and several others deal with wood only marginally. Some of the authors, for example Côté and Hillis, are familiar with the wood science literature, but others have obviously had no such adventures. Nevertheless there is a tremendous amount of useful information in the volume, and every serious wood scientist should have access to it.

Côté's chapter on wood ultrastructure provides an admirable overview that covers both normal and reaction wood. The chapter spans orders of resolution from light microscopy through scanning and transmission electron microscopy. One of Côté's theses is that the optical system used affects the nature of the structure observed. Unfortunately the resolution of the scanning electron microscope is incorrectly listed as 0.1 nanometer and that of the transmission electron microscope is somewhat underestimated. Côté views the cell wall as a continuous series of fibrils ranging in diameter from 1.7 to 150 nanometers or more. Côté suggests that the larger strands may be aggregates of the smaller ones or the smaller ones may be artifacts created from the larger ones by various mechanical means. This interesting idea should stimulate further debate. It is disturbing that only eight of the 52 references in Côté's chapter are from the present decade. At least in part, this is the result of inadequate funding of structural research.

Delmer reviews research on cellulose biosynthesis and provides some interesting information on the possible role of lipid intermediates in this process. Lamport's chapter on glycoproteins deals with such nonwoody matters as the evo-

lution of eukaryotes. He also supports the interesting thesis that extensin and collagen have a common ancestry.

There are several excellent chapters on lignin and microbial degradation of cell walls. Gross has written an outstanding chapter on lignin biosynthesis that reiterates Freudenberg's view that the process is enzyme-initiated but differs from the synthesis of other biopolymers in that subsequent polymerization is nonenzymatic. Gross does discard the Freudenbergian notion that cinnamyl alcohols are synthesized in the cambium and transported to the xylem in the form of glucosides. It is now known that lignifying tissues possess all the enzymes and intermediates for complete lignification. There is also good coverage of the ligase-mediated activation of cinnamic acids with coenzyme A and the subsequent reduction of the substances to cinnamyl alcohols.

Hillis has provided a monumental and definitive chapter on secondary changes in wood. Mullick's chapter on wounds and pathogenic responses nicely complements the chapters on degradation. The book concludes with a chapter on the status and potential of chemicals derived from bark and wood. The production and editing of the book are first-rate. Overall the book is a valuable addition to the literature.

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Riverine Landscapes

The Fluvial System. STANLEY A. SCHUMM. Wiley-Interscience, New York, 1977. xx, 338 pp., illus. \$22.

Erosion, transport, and deposition of sediment within river catchments concern a wide range of earth scientists and profoundly affect land management. Upland soil removal engages the attention of soil conservationists, hydraulic engineers deal with fluvial sediment transport and river channel morphology, and patterns of sediment deposition in riverine and coastal lowlands affect navigability, the habitability of valley floors, and the distribution of groundwater and minerals.

Schumm argues persuasively that fluvial geomorphology, sedimentology, and stratigraphy provide insights into each of these components of the river basin. He summarizes a great deal of recent geologic research to explain the relation between upland erosion, sediment trans-

port, channel morphology, and deposition.

Schumm is successful in conveying a sense of the interdependence of upland, channel, and depositional environments and in describing the types of change that each component can undergo during various spans of time. He repeatedly makes the provocative suggestion that fluvial systems characteristically undergo rapid changes due not only to alterations in external controls (such as climate, tectonism, or land use) but to internal adjustments that can produce a complex sequence of changes resembling the effects of alterations in external controls. Traditional interpretations of rapid change in the geologic or instrumental record usually assume quite simple cause-and-effect relations. Schumm stresses that an understanding of and ability to predict the complexity of response to external change allows the earth scientist to anticipate and avoid land management problems and to interpret in a more productive fashion evidence for the occurrence of economically valuable geologic materials.

The book does not deal with the mechanics of geomorphic processes and therefore does not present a unifying physical theory of hillslope erosion, sediment transport, or river morphology. Instead the effects of various controlling agents and of internal adjustments are illustrated with field relations, laboratory experiments, and, in cases where data are not yet available, hypothetical reasoning. In some places these qualitative arguments are vague and open to question, though formalizing them would require a much larger book and would be impossible in some cases, given the current state of knowledge. They are thus indicative only of directions of change and have little value for quantitative prediction in a particular situation. They successfully demonstrate, however, the author's points that the forms and operation of fluvial landscapes can be correlated with and explained in terms of their major controlling factors and that changes in these controls, although generally thought to be slow, are significant for the management and exploitation of drainage basins.

The chapters on river channels and depositional environments constitute the best parts of the book, and they will be of greatest use in geological and engineering applications.

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