precise functional terms, and this makes it easier to relate observations at the single-cell level to the operation of the entire system.

Wilson and Melvill Jones have done a commendable job of summarizing the progress made in vestibular neurophysiology over the past 20 years or so. They concentrate on those areas of research where it is becoming possible to synthesize anatomical, physiological, and behavioral findings. Approximately the first third of the book is devoted to peripheral mechanisms. There follow chapters on the vestibular nuclei, on vestibulocerebellar relations, on vestibulospinal systems, and on vestibuloocular pathways. A final section of this last chapter provides a detailed consideration of the adaptive plasticity of the vestibuloocular reflex. Not only is past work summarized in a concise and lucid manner, but some of the more promising directions for future research are also clearly indicated. Some subjects have been deliberately omitted, including forebrain projections, the etiology of motion sickness, and the general problem of spatial orientation.

Even with these omissions, this is certainly the most comprehensive review of the vestibular system currently available. The book is well written and profusely illustrated. It should be of value as a reference work for those active in vestibular research and also as an introduction for others with more general interests in neurobiology.

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Quaternary Vegetation

The Equatorial Rain Forest. A Geological History. JOHN R. FLENLEY. Butterworths, Boston, 1979. viii, 162 pp., illus. $69.95.

The equatorial rain forest was long believed to be a stable vegetation growing in a stable climate. During the past 20 years, and especially during the past ten, this belief has been tested against fossil evidence of past climate and past vegetation in equatorial areas around the globe and has been found wanting.

Flenley has gathered the new information together, assimilated it thoroughly, and presented the main findings in a book that is clear, well illustrated, and thought-provoking. It contains new syntheses, such as plots of treeline movement on equatorial mountains, and enough original pollen diagrams to give the informed reader a basis for evaluating its conclusions.

Of particular significance are accounts of the pre-Quaternary history of equatorial forest and the influence of humans in the late Quaternary. The early record is most remarkable for its poverty; with such a factual base most current ideas about the age, time range, areal extent, and place of origin of the equatorial forest and its constituent taxa can be little more than reasonable conjecture. Human effects on vegetation, especially in the past 10,000 years, are more firmly established, and from tropical America a useful history of crop plants is beginning to emerge.

The heart of the book covers the Quaternary vegetation of equatorial Africa, America, and Indo-Malesia. The fossil pollen evidence for each region is accompanied by enough information about present vegetation and pollen rain to make it interpretable and enough information about biogeographic problems to make it interesting.

Signs of vegetational change are all but universal in sequences extending back more than 10,000 years. The vegetation from 14,000 to 20,000 years ago is strikingly different from that of the present. The mountain vegetation was of types generally found at lower altitudes, the lowland vegetation of types generally found today in areas with a more pronounced dry season. The late-Pleistocene climate was drier and cooler than that of today. Between 14,000 and 7,000 years ago, vegetation migrated to its modern locations, probably developing some new communities at the same time.

Flenley disputes the common view that equatorial forest owes its richness in species to long stability. The forest has existed in something close to its present composition and extent for only a few tree generations and seems still to be changing. Flenley concludes that "Quaternary climatic variations are sufficient to prevent any climax phase being reached." His information also indicates much individualistic behavior of tree species: "There is no simple upward movement of forest limits . . . one observes the gradual synthesis of the forest that we know today." Plant successions in newly colonized wet or dry habitats seldom follow the trends of classical Clementsian theory with slavish regularity.

This is a careful and reliable guide to the main features of tropical forest history. It is not a compendium of settled matters, for tropical paleobotany has hardly begun. Even at the present rate of research the next decade should uncover many more surprises than the last one. A research effort commensurate with the possibilities of ancient lakes in the African Rift Valley might yield sequences unbroken since the Miocene.

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