get his facts straight. In my areas of competence I scoured the text and found no faults of commission and scarcely any of omission. Perhaps some readers may fail to distinguish Galen's and Descartes's ideas from those of Galenists and Cartesians as presented by Frank. Or they may take ideas to be Oxonian which, if they were that, were also Cartesian, Scholastic, Galenic, or Aristotelian. But these are quibbles. What we have in Frank's book if taken as a whole is as enterprising, engaging, and enlightening an example of historical interpretation as this reviewer has recently read.

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Physiological Adaptations

Environmental Physiology of Fishes. Papers from an institute, Lennoxville, Quebec, Aug. 1979. M. A. ALI, Ed. Plenum, New York, 1980. xii, 724 pp., illus. $69.50. NATO Advanced Study Institutes Series A, vol. 35.

The relationships between structure, physiology, and environmental variables in the largest vertebrate class, the fishes, are explored at length in this collection of 25 papers. Most of the papers (one of which is in French) provide summary reviews of major topics of investigation, such as the effects of gas concentrations; the problems of water, ion, and acid-base regulation; photoperiodic effects on reproduction; physiology of the pineal organ; and circadian rhythmicity. In addition, some responses to factors peculiar to the aquatic environment are treated in various degrees of detail.

One of these factors is the enormous range of hydrostatic pressure found in the oceans. Fishes are known to live to depths of at least 7000 meters, at which there is a pressure of over 700 atmospheres. Fishes furthermore migrate vertically in the water column, and thus may experience pressure fluctuations of 100 atmospheres or more. In a paper by Pequeux, some recent information on the effects of pressure on membrane permeability is reviewed. Pequeux points out that these pressure studies provide new evidence for the independent transport of sodium and chloride ions across membranes and may be a useful way to study the effects of local charge on membranes and the effects of charge on permeability. He also discusses pressure effects on equilibria that involve volume changes and the consequences for biochemical processes other than permeability. In a second paper on pressure, Blaxter reviews some better-known pressure problems, such as swimbladder gas secretion against high gradients and also reviews some very recent literature on how fish prevent oxygen leakage at high swimbladder pressures by the deposition of oriented guanine platelets in the swimbladder wall and by changes in the lipid composition to favor longer-chain components with low permeability. The technical challenge of obtaining animals from the ocean deeps in suitable condition for experimentation is formidable and has delayed progress in this fascinating area, so it is satisfying to see these new results collected.

Several papers deal with the sensory systems of the fishes. Below the thin surface layer, fishes exist in a dim blue-green to yellow-green environment in which the detection of contrast, or even of light emitted by photoluminescent fishes, is the prime consideration for visual organization. In reviewing the visual pigment composition and neural integration scheme, Lythgoe emphasizes the often conflicting demands of sensitivity, contrast detection, and detection of movement as well as the differences between land- and sea-dwelling animals. Dale provides some new information as well as a short review of the acousticolateralis sensory system, a unique sensory mode in the fishes that serves to detect vibrations in the environment. Popper and Coombs provide a short review and some new ultrastructural information on the ear and its role in sound detection underwater. Conspicuously lacking from the volume is any treatment of the production and detection of electrical information, another unique sensory mode that occurs in at least six taxonomically distant groups of bony and cartilaginous fishes.

Another conspicuous phenomenon among the fishes, and one of some practical importance, is migration behavior. The physiological basis of navigational performance, especially in the open ocean migrants, has been a great puzzle in fish physiology. How is a migration of thousands of miles accomplished with no visual ("landmark") clues? Recent evidence that fish may be able to sense electrical currents induced geomagnetically, either by natural water currents or by the movement of the fishes' bodies through the water, is reviewed by Tesch, along with information on the seasonal movements of some well-known migrant species such as eels, salmon, and tunas.

Overall the book provides timely and provocative summaries of most of the major areas of investigation in the environmental physiology of fishes. No single volume can hope to be comprehensive—another much-used review now comprises eight full volumes—but within the framework of the possible this volume gets high marks.

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Subsistence in the Tropics

Parmana. Prehistoric Maize and Manioc Subsistence along the Amazon and Orinoco. ANNA CURTENIUS ROOSEVELT. Academic Press, New York, 1980. xvi, 320 pp., illus. $29.50. Studies in Archaeology.

Few topics in archeology have generated as much heated debate as the mode of life of lowland South American peoples in pre-Conquest times. Clearly, theoretical issues broader than the archeology of Greater Amazonia are at stake. What is being debated is nothing less than the "nature" of tropical forest environments and the impact they have had on human cultural developments. Are the tropics capable of sustaining concentrated and complex societies? What are the agricultural productivity, settlement patterns, and carrying capacity of specific tropical habitats? In the context of Amazonia these questions take the form of comparing pre-Conquest demographic densities in the floodplain of the Amazon and Orinoco rivers with population densities in adjacent interfluvial habitats.

The hypothesis proposed by the author of *Parmana* can be stated briefly. Roosevelt suggests that the higher carrying capacity of floodplain habitats vis-à-vis the hinterland is due to the adoption of maize by peoples who grew primarily manioc before. (Other scholars have argued that it was due to better soils or more abundant fish and game.) She contrasts manioc, which grows well in upland soils and is rich in calories but poor in proteins, with maize, which is nutritionally more complete and is better suited to the floodplains. Once maize-growing peoples are released from the need to hunt and fish in order to secure their proteins they can (ergo) grow in numbers, become more sedentary, develop chiefdoms, engage in war, in short evolve a more complex society.

But how does Roosevelt actually reach her conclusions? She begins by criticizing the ideas developed by previ-