higher primates. He endorses Parker and Gibson's hypothesis that extractive foraging, the procurement of embedded foods, predisposes toward tool use because it is facilitated by extension of reach and amplification of mechanical force, two major functions of tools. Beck then turns to two examples of extractive foraging: chimpanzees' fishing for termites with grass stems and herring gulls' predatory shell dropping. He concludes that tool use per se is not evidence for special cognition, since, in both cases the observable attributes of the performances can be equally well explained as extensions of such cognitive processes as concentration, purposefulness, selectivity, premeditation, imagery, plasticity with regard to subtle variations in environmental conditions, strategies, and play during ontogeny.

The final chapter discusses the relationship of tools to human evolution. Beck reviews the archeological evidence and suggests that the cutting and breaking-open functions of early stone tools fit with extractive foraging both for animal and plant foods. He concludes by arguing that human intelligence does not rest on tool use alone but on a socioeconomic complex involving extractive foraging, tool use, a hunting-and-gathering division of labor, and linguistic communication.

Beck's arguments are entirely convincing. Every generalization he makes is carefully formed and fully supported by the data. His documentation is thorough and informed. The book is valuable simply as an encyclopedia of knowledge about animal tool use, and the analyses of the data are often brilliant. I strongly recommend it as fascinating reading to readers interested in animal tool use, comparative psychology, and human evolution.

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Plant Biophysics

Photosynthesis. Physical Mechanisms and Chemical Patterns. RODERICK K. CLAYTON. Cambridge University Press, New York, 1981. xiv, 282 pp., illus. Cloth, $32.50; paper, $11.95. IUPAB Biophysics Series, 4.

Research on photosynthesis has gone through several stages in recent times. The development of radioactive tracer techniques in the late 1940's led to the application of this technology to the study of the mechanism of carbon dioxide fixation, which culminated in the elucidation of the reductive pentose phosphate cycle in the early 1950's. This was followed during the 1960's by what might be referred to as the biochemical stage, which resulted in a general picture of electron transport processes in photosynthetic membranes. What has followed in the 1970's could be referred to as the biophysical stage and has resulted in a detailed understanding of the photophysical aspects of photosynthesis including the nature of the interaction of light with pigments and the conversion of light energy into oxidized and reduced chemical products through the primary processes of photosynthesis.

R. K. Clayton's new volume considers in great detail this most recent stage of research, but the volume also includes numerous "digressions" that make it particularly suitable as a teaching vehicle. A major digression deals with the physics of spectroscopy, including a section on measurements with polarized light as applied to the photosynthetic membrane. The inclusion of such digressions tends to disrupt the flow of material in the volume, but it also will aid students who might be deficient in background in these subjects.

With respect to biophysical aspects of primary photochemistry, emphasis is placed on the results obtained with the bacterial reaction center, but Clayton stresses that in the more complicated oxygen-evolving system a similar mechanism of charge separation probably holds. The more rapid developments in the bacterial field are clearly linked to the availability of purified "reaction centers," and these entities and the processes that occur in them receive a great deal of attention. However, secondary electron transport processes and adenosine triphosphate synthesis involving chemiosmotic mechanisms are also considered, although in far less detail. To complete the coverage, Clayton includes a short chapter on carbon assimilation but does not attempt to make it comprehensive, since more detailed expositions of the subject are already available.

Clayton has taken the reader to the forefront in this field, and has presented a balanced view that indicates that not all questions are answered. Q-cycle models for electron transport in the cytochrome *b* and *c* region of photosynthetic bacteria could have been discussed more fully, since recent considerations of similar mechanisms in electron transfer reactions in chloroplasts are omitted. Such coverage would have again documented the striking similarity between the overall photosynthetic processes in these two cases. This is also a subject of interest to workers and students in the broader field of bioenergetics, particularly those concerned with mitochondrial energy transduction.

The volume succeeds in a most difficult task: it compiles and reviews a large amount of recent experimental work in a comprehensive and comprehensible manner. The level of presentation is suitable for advanced undergraduate or graduate students as well as for workers in the field. The work can therefore be recommended strongly both as a teaching volume and as a monograph for specialists.

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