Book Reviews

Australopithecine Anatomy

Early Hominid Posture and Locomotion. JOHN T. ROBINSON. University of Chicago Press, Chicago, 1973. xii, 362 pp., illus. $15.

The origin of human bipedalism is an interesting and important subject. The first steps along the evolutionary pathway to man appear to have been just that: steps. The idea that the distinctively human pattern of walking using only the hindlimbs developed before the expansion of the brain or the advent of complex technology was proposed more than a century ago by Darwin and others, but the proof came with the discovery of the australopithecines of Africa in the second and third quarters of this century.

Now for the first time we have a full account of the fossil evidence for the origin of human bipedalism by the man who along with Robert Broom discovered most of the material. Over two decades have elapsed since the discovery of the bulk of the fossil evidence upon which this book is based. Certainly part of the reason for the delay is the thoroughness with which Robinson approaches his subject. There are 362 pages of small print describing and interpreting less than three dozen small bone fragments and one partial skeleton. The South African early hominid material is described in full with only passing mention of the East African fossils.

Robinson has approached the subject by giving first the detailed morphology of each bone, then the functional meaning of each fossil in terms of posture and locomotion, and finally the overall adaptations of the fossil species. This is no easy task, especially considering that the postcranial skeleton of one fossil genus, *Paranthropus*, is known from only about a dozen fragmentary bones. There is considerable room for different interpretations. Opinions vary widely as to the posture and locomotion of early hominids.

The book is obviously an important one, but it is nonetheless disappointing in several respects. The major part of the book consists of long and sometimes tedious descriptions of single fossil fragments without the benefit of accompanying diagrams, pictures, and tables, this apparatus being placed at the back of the book. Many important references are ignored, perhaps necessarily given the immensity of the literature in anatomy in general and early hominid anatomy in particular. And there is an overriding feeling that the author is too close to his material to be completely objective.

This last difficulty is most noticeable in the assessment of the difference between the two forms of early hominids. For many years Robinson has maintained that there were two different genera of early hominids living at the same time period but adapting to the environment very differently. One form, called *Homo africanus* by him but commonly referred to as *Australopithecus africanus* by others, is seen as a lightly built, unspecialized, human-like omnivore who hunted and made tools. This form evolved into *Homo erectus* and eventually into *Homo sapiens*. The other kind of early hominid, *Paranthropus robustus* (*Australopithecus robustus* according to many others), is characterized as a robust, heavy-jawed, pongid-like herbivore who was not actively culture-bearing. This form, according to Robinson, became extinct in the middle Pleistocene.

Until now this two-genera hypothesis has been based primarily on Robinson's interpretation of the cranial and dental evidence. This book examines the postcranial material and finds it consistent with the two-genera hypothesis. Robinson describes *Homo africanus* as a human-like, efficient biped, standing about 4 to 4½ feet tall and weighing from 40 to 60 pounds. *Paranthropus*, on the other hand, is more pongid-like, with adaptations for both bipedalism (less efficient than *Homo*) and tree-climbing. *Paranthropus* stood about 4½ to 5 feet tall and weighed 150 to 200 pounds according to Robinson.

There is no doubt that the two-genera hypothesis has colored Robinson's thinking about the postcranial material. He is quite candid in pointing this out in the last chapter: "The conceptual framework within which a student works shapes the viewpoint from which he approaches the material being studied and powerfully influences the conclusions that he draws" (p. 211).

A good example of how conceptual framework can influence judgment is Robinson's interpretation of the *Paranthropus* hindlimb. He has maintained for a long time that except for the canine teeth *Paranthropus* is more pongid-like and even adapted for tree-climbing.

The evidence for tree-climbing in *Paranthropus* is very weak, in the reviewer's opinion. It is based on what Robinson calls the "power-oriented" hindlimb of *Paranthropus*, which he maintains is a pongid feature unlike the "speed-oriented" hindlimb of *Homo*. The muscles involved are the hamstrings. According to Robinson, *Paranthropus* had a pongid-like arrangement with a long power arm (the ischium) and a short load arm (the lower limb). This arrangement adapts the hamstrings for powerful extension of the hip at the expense of speed. The reviewer finds several faults with this theory, however. First, the idea of power-oriented and speed-oriented muscles is too simplistic, ignoring differences in muscle architecture, neuromuscular interplay, and many other complicating factors. Second, the functional length of the ischium of *Paranthropus* is not relatively long at all. In the text Robinson argues that it is long, but his own figures show that relative ischial length in man, pongids, and *Paranthropus* are all very similar (well within three standard deviations). What is unusual is the shortness of the *Homo africanus* ischium. Third, there is no evidence that the lower limb of *Paranthropus* was short. All that is known in the fossils from South Africa is the proximal third of two femora. New fossils from East Africa show that the lower limbs were not at all short.

The point is that the author's preconceived theory of hominid evolution has so biased parts of his interpretation of the postcranial anatomy that he has arrived at some unsupported conclusions. To be fair it must be pointed out that Robinson clearly spells out his assumptions and carefully qualifies his interpretations so that the reader is aware of how much guesswork must go into analyses of fragmentary fossils. His interpretation could be correct, of course. We will only know for

certain after the discovery of further evidence.

The first and last chapters of the book present Robinson's views on the broad picture of hominid evolution and should be read by all students of the subject. His ideas are often at variance with what is usually taught. For example, he believes that *Ramapithecus* was a pongid, *Gigantopithecus* was a hominid and a possible ancestor to us all, *Paranthropus* was a descendant of *Gigantopithecus* and an ancestor to *Homo*, there were two genera of early hominids in the early Pleistocene with very different adaptations, and *Homo africanus* was an efficient biped. These controversial views will be debated for years to come.

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Parasites

The Biology of Trematodes. DAVID A. ERASMUS. Crane, Russak, New York, 1973. vii, 312 pp. + plates. $24.75.

The trematodes, or flukes, are parasites of incalculable importance in medicine and agriculture. The schistosome eggs found in mummies of ancient Egypt seem to mock the progress of medicine, for this tiny worm remains a scourge of that land today. According to Hulse it was *Schistosoma* as much as Joshua that "fit the battle of Jericho"; it plagued Napoleon's troops in Egypt and MacArthur's troops in the Philippines; and only a couple of decades ago it was held responsible for decimating an army in southern China. No less destructive when out of uniform, *Schistosoma* has blocked the construction of a vast modern dam. It is not, however, the spectacular episodes that count most. The disease is an insidious one. Even mild attacks can lead to lifelong debility, and millions of people are affected. In domestic animals the common liver fluke, *Fasciola hepatica,* has from medieval time been known to cause devastating losses in sheep, and though massive outbreaks of fatal disease have become increasingly rare as a result of modern chemotherapy, it still causes a major economic loss by reducing productivity of sheep and cattle. Many fluke species appear to do little harm to their hosts under natural conditions. Others have bizarre effects of little everyday concern; the English pearls that Julius Caesar dedicated to Venus were probably induced by trematode larvae in mussels; larval flukes frequently cause blindness in fish; and there is some evidence that the suicidal running aground of whales is due to flukes in the brain.

The schistosome and the liver fluke are only two of the many flukes that do threaten, in the most overt way, the welfare of man and his animals. Thus a book on the biology of trematodes is of importance to people in many disciplines. Erasmus has pitched *The Biology of Trematodes* toward those "already familiar with the basic characteristics of the group." No genus or species is described in full; information on a member of the group can often be excavated in great quantity, by means of the index—but you must first know your fluke.

Erasmus devotes major chapters to each of the basic larval stages of the trematode, with additional chapters on general features or biological processes. Information on, say, the cercaria is then to be found in six different chapters. Repetition is unavoidable; and some pieces of information, even when given only once, are to be found under surprising headings. Erasmus does try to wring some generalizations from batches of related findings, but has not attempted the degree of distillation and integration achieved by J. D. Smyth in *The Physiology of Trematodes.* Erasmus's book must rather be judged as a source of fairly detailed information and as a guide to the literature. Questions of balance, accuracy, and comprehensiveness then become of the greatest importance.

The medical and veterinary aspects of trematodes have been so thoroughly described that Erasmus wisely limits his treatment to a few brief summaries. The single paragraph on the pathogenesis of schistosomiasis creates an unfortunate impression of little experimental accomplishment—an impression apparently arising from an exaggerated view of the place of serum analysis in experimental pathology. The author goes on to warn that in helminthoses "the exact role of the helminth in producing disease can be determined only on gnotobiotic hosts." One wonders here if Erasmus appreciates the limitations of pathological studies in gnotobiotic hosts and if he knows of a single case in which such studies have revealed the exact role of a helminth in pathogenesis. In another section of the same chapter Erasmus offers three paragraphs on the immunology of schistosomiasis—all dealing with Smithers and Terry's renowned work, with no mention of other studies, such as those of Warren, that open up entirely different approaches. Morbid matters are almost incidental to *The Biology of Trematodes*, however, and in the rest of the book, Erasmus achieves a clear, though qualified, success.

The ultrastructure of trematodes is given special prominence, as is justified by the author's intent to present "some of the more recent discoveries and ideas developed through the use of modern techniques." Electron microscopy has in fact revolutionized our concept of the trematode tegument in the last decade. The recognition of the fluke (and tapeworm) tegument as a metabolically active body covering is having a profound effect on our understanding of nutrition, immunology, and what Erasmus calls the "host-parasite interface." Because of the absence of a mouth or gut, attention was long focused on the body wall as an absorptive surface in the tapeworms; but in the flukes, where these structures are present, oral absorption was regarded as more important. It is now clear that in their feeding, as in their sex life, flukes demand the best of both worlds, and Erasmus discusses the important role played by both the mouth and the tegument in the intake of nutrients. Similarly, the absence of an anus in flukes previously led to the assumption that the only means of expelling the by-products of digestion was by vomiting and perhaps, for soluble wastes, through the mysterious "flame cell" system; but now the tegument, too, should probably be accorded an excretory function.

In his treatment of the common liver fluke, *Fasciola hepatica*, Erasmus gives no hint of the controversy that has surrounded the very basic issue of whether the fluke is a blood feeder. Discussion of the topic is hidden under "pathology and host response" and not easy to track down even with the use of the index. Moreover, the matter is dismissed with the comment that some workers have suggested that the adult is a blood feeder and some have described the ingestion of blood. A few references are given but there is no mention of the arsenal of sophisticated technology that was brought to bear on the subject and that led nearly all workers (with the notable exception of Dawes) to the conclusion that the adult fluke is a very avid blood feeder.