Book Reviews

Mankind in the Making. The story of human evolution. William Howells. Doubleday, Garden City, N.Y., 1959. 382 pp. Illus. $4.95.

Dedicated to the memory of Earnest Hooton, *Mankind in the Making* is a legitimate successor to *Up From the Ape*; indeed, it was born in Hooton's laboratory in the awesome presence of the maestro's skulls. Like his predecessor, Howells is a master of English style, and this is the most civilized piece of anthropological writing I can remember. To accompany it Janis Circulis has drawn over 60 sets of excellent line cuts. Because he worked in Howells' laboratory under close supervision, awkward last-minute changes were eliminated, and the product matches the text. Although the eight plates of photographs are well enough chosen, they somehow break the spell and bring us back to business.

This business consists of tracing human evolution and the origins and movements of living races. The first eight chapters, more than one-third of the text, deal with principles of evolutionary change, general vertebrate paleontology, and primate history through the Australopithecines. Almost miraculously, Howells managed to squeeze in (page 122) a 16-line paragraph on Lewis Leakey's momentous discovery (17 July 1959)—the skull and tiba of a late Lower Pleistocene man, complete with chopping tools and fauna, in Olduvai Gorge, Tanganyika. The appearance of this specimen, dubbed *Zinjanthropus* by Leakey, will trigger-off as much tooth-gnashing and plate-hacking among textbook publishers as the laying of Piltdown's ghost. Howells crept under the wire, but only just. He lacked time to refer to the new man elsewhere in his text. But since Leakey's find fits Howells' reconstruction of hominid history, no harm was done, and the author's logic was, in this sense, fortified.

Sometimes paleontologists and other taxonomists marvel, and sometimes in a lofty way, at the confusions and disagreements among anthropologists over the descent of man, whose bones are scarcer than those of elephants and horses and whose global goings and comings are more widespread and complicated than those of prairie dogs and hornbills. As Howells indicates, the two main schools of thought, among others, interpret the same well-handled roster of fossil human remains in their own ways.

The "candelabra" school, with Weidenreich as its principal protagonist, traces each of the modern human subspecies—such as Australoid, Mongoloid, and the like—among several separate lines from a smaller-brained, chinless ancestor to its contemporary form. This school follows the well-known principles of parallelism and multiple crossings of a single adaptive threshold.

The "hat rack" school postulates the radiation of many related species at successive adaptive levels and the extinction of all but one species at each level. According to this system, all the well-known heavy-browed men of yore —Sinanthropus, Pithecanthropus, Rhodesian, and the like—became extinct, while *Homo sapiens,* who emerged either from one of them or from some undiscovered ancestor, expanded explosively from some unknown breeding-ground to replace all of the old forms and also to people the New World.

After due consideration and much discussion, Howells plumps for the "hat rack" interpretation. In so doing, he agrees with the majority of serious investigators. He differs from many of them, however, in his choice of ancestors for *Homo sapiens.* He accepts Swanscombe, Steinheim, Frontéchevade, and Kanjera, and rejects both the early (Third Interglacial) and the late (Würm I) Neanderthals. Instead of considering the Upper Paleolithic Europeans to be the ancestors of all living races, he makes them a group of invaders from some unknown cradle land—a land from which their equally sapiens (if not sapient) cousins, the ancient Australoids, Negroids, Mongoloids, and so on, spread to their modern loci.

When Howells comes to explain the modern distribution of these races in the world, he gets into serious traffic trouble, and no gendarme-*ex machina* drops out of the sky to straighten it out. In justice to Howells, let me add that few other writers are willing to risk censure by trying to explain the history of human races as a whole, and I know of no one who has done a better job. Still, I disagree with him on three counts.

(i) He has chosen to ignore, or soft-pedal, the resemblances between fossil and living populations in specific areas, resemblances which can hardly be due to chance or conversion.

(ii) He has, in my opinion, paid too little attention in this book to the archeological records of different areas, records which indicate a number of unbroken continuities between the tool-making techniques of certain "extinct" fossil men and their admittedly sapiens successors.

(iii) Although he questions the validity of the old taxonomy which gives fossil men multiple genera and even grants them synchronous separate species, Howells accepts the existence of such mutually noninterbreeding groups as a working hypothesis. This commits him to the thesis of multiple extinctions.

If one admits the importance of local continuities in morphology and culture, and adds Mayr's concept that man is and always has been a single genus which has never had more than one species at a time, then the candelabra and the hat rack theses become reconcilable. Parallel genetic changes in response to parallel cultural evolution, plus peripheral gene flow, occasional invasions, swampings, absorptions, and the reemergences of locally viable characters through natural selection—all this is made possible by acceptance of Mayr's thesis which permits gene exchange between human populations at all known levels. This unsnarls some of the traffic, particularly in Africa and Southern Asia, and allows time for the rise of some of the principal racial differences between living populations.

This critique cannot surprise Howells; what would surprise any anthropologist would be complete agreement on such

a thinly documented subject. Either of us may be right in our view of the descent of man, or we may both be as wrong as some of our predecessors who fumbled brilliantly in even deeper gloom.

In any case, I still consider *Mankind in the Making* the soundest exposition of its subject yet in print. It will be widely read (particularly at $4.95), and its influence should be wide. Some professionals will wish that the publishers had wanted more documentation in footnotes and bibliography and a few more technical terms. Students and fellow-scientists need this book more than other people, and with Howells' style to float these didactic aids, the book-club crowd could have stomached them painlessly. Anyhow it is a much needed and courageous book, and a graceful monument to a great teacher's memory.

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The Study of Rocks in Thin Section. W. W. Moorhouse. Harper, New York, 1959. xvii + 514 pp. Illus. $8.

This book is described accurately in its preface as "a brief review of the methods of optical mineralogy (with a minimum of optical theory), descriptions of the rock-forming minerals encountered in the more common rocks, identification tables to assist in the identification of these minerals, and descriptions of the common rock types." Although the book often rises considerably above the level of this rather reserved prospectus, many sections lack the data and critical discussions needed by the graduate student, and its greatest value will be for students and geologists who are concerned mainly with naming common rocks.

The book begins with a 36-page chapter on methods of petrographic mineralogy; with the exception of the parts on dispersion and the universal stage, it is reasonably complete. The user of the book will, however, require additional reading or course work in optical mineralogy. The next chapter consists of brief descriptions of 149 minerals. Many of the descriptions contain orientation diagrams and graphs of optical data. Chemical formulas have been omitted from some of the more complex silicates, for example, biotite and hornblende. Each mineral is given a consecutive number which keys it to several determinative tables, and these tables should be very useful to beginners.

The remaining 70 percent of the book consists of systematic descriptions of rocks, beginning with those of the volcanic and hypabyssal realms, proceeding to plutonic, sedimentary, and metamorphic rocks, and concluding with a brief chapter on ores. Each of the four main groups receives about equal space, but the chapters on igneous rocks seem considerably more complete, probably because it is easier to treat these rocks systematically. In any case, the preliminary discussions and classifications of the sedimentary and metamorphic rocks need amplification. For example, the beginner will sorely miss a summary of the sedimentation cycle, a table showing Wentworth's size scale and classes, and a definition and discussion of grain-sorting. In the chapters on metamorphic rocks, the reader is introduced to concepts and names of metamorphic grades and facies, but he is not told how to interpret them from thin sections; furthermore, several triangular facies diagrams are given, but without instructions for their use.

The descriptions of altered rocks and the chapters on metasomatism and ores are rather new in concept and should prove worth while. The 90 photographs of rocks and minerals and the 350 drawings of rocks are excellent, and they combine with a select format to make this an unusually handsome book.

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Handbuch der Physik. vol. 53, *Astrophysics IV: Stellar Systems.* S. Flügge, Ed. Springer, Berlin, 1959. viii + 565 pp. Illus. DM. 142.

This work, the fourth of five volumes devoted to astrophysics, or the art of applying terrestrially formulated laws of physics to the universe as observed by both optical and radio means, is concerned with the manner in which stars occur in systems—our own Milky Way galactic system and its subsystems of open and globular clusters (to which more than one-third of the volume is devoted), the myriad galaxies, and in turn, the systems of galaxies. The three earlier volumes in this subseries of the *Handbuch* treated stellar surfaces and binary stars, stellar structure, and the solar system, respectively.

The dynamics of the galaxy, the classical topic on which so many "astronomer-lives" have been spent, is discussed from both observational and theoretical viewpoints in two masterful chapters by Edmondson and Lindblad; despite the very great progress made, it appears that our understanding of the dynamics of our own galaxy-in-rotation is still imperfect.

In the field of galactic structures and dynamics, progress is being materially accelerated by the rapidly growing contributions of the relatively new techniques of radio astronomy. Oort gives, in his chapter, a learned résumé of these contributions, but any summary of this exploding field of research must necessarily be considered a progress report. This also applies to the discussion of the swiftly mounting contributions made by radio techniques to the study of exterior galactic systems, which are treated in the chapters by Hanbury Brown and Mills.

The structure of galaxies is intimately linked with the evolution of stars from dust and gas clouds, and the unique and signal place held by star clusters in this study is ably and comprehensively treated by Helen Sawyer Hogg. A valuable catalog of open and globular star clusters is included.

A large measure of the value of this volume lies in its presentation of a greatly needed, encyclopedic treatment of external galaxies (it is gratifying to note that the old, ambiguous term nebulae applied to galaxies has at last been discarded). A systematic treatment of the classification, morphology, and general physical properties of external galaxies, which includes many excellent photographs, is given by de Vaucouleurs, while Zwicky, in his inimitable style (almost one-half of the references in his ample bibliography are to his own papers), treats the organization of galaxies in multiple and cluster systems, for on a lower level of organization stars often exist in multiple groupings and in star clusters. Zwicky's photographs present impressive examples of physical linkage between galaxies.

The large-scale organization of galaxies is discussed statistically by Neyman and Scott, and the difficult and controversial cosmological aspects of the wealth of observational data are well treated in chapters by McVittie and Heckmann.

Many will regret, with me, that this excellent treatment of the universe of galaxies does not have a word from the dean of galaxy observers, Walter Baade.