scheme according to which all of the polypeptide chains of hemoglobin-like molecules among the vertebrates, including myoglobin, are derived ultimately from a single basic unit, presumably a single ancestral gene locus. His scheme seems all the more plausible when one realizes that, as Ingram points out, the alpha chains of the human and the gorilla differ from each other by no more than two amino acid residues. Again this suggests intriguing potentialities. We may be closer than we recognize to an unequivocal demonstration of the genetic basis for homologous phenotypes.

From these two books then, both stimulating in their own ways, directions in current thinking and investigation become apparent. Mayr's book documents the culmination of the classic approach to evolution and, at the same time, recognizes the significance of physiological processes for an understanding of evolutionary phenomena. It thus foreshadows a future reliance of evolutionary biologists on the results from biochemical investigations. Ingram's discussion of the hemoglobins illustrates the activity of biochemistry as a maturing partner in the investigation of evolutionary problems. Together they point the way toward a more modern synthesis.

New World Primates

Primates. Comparative anatomy and taxonomy. vol. 3, *Pithecoidea. Platyrrhini (Families Hapalidae and Callimiconidae)*; vol. 4, *Cebidae*, pt. A; vol. 5, *Cebidae*, pt. B. W. C. Osman Hill. Edinburgh University Press, Edinburgh, Scotland; Interscience (Wiley), New York (vol. 3, 376 pp., 1957, $17.50; vol. 4, 523 pp., 1960, $27.50; vol. 5, 537 pp., 1962, $32). Illus.

With these three volumes, published while he was still prosector to the London Zoological Society, Hill extends his massive monograph to cover the New World Primates. The two earlier volumes in the series dealt with the prosimians: the first, on the lemuroids and lorisoids, was published in 1953 [reviewed in *Science* **119**, 558 (1954) by B. Patterson, and by myself in *J. Mammal.* **35**, 601 (1954)]; the second on the tarsioids, in 1955 [reviewed in *Science* **123**, 944 (1956)]. These latest three volumes introduce the simians and treat in detail the marmosets (volume 3), the smaller cebid monkeys (volume 4), and the large cebids with highly specialized prehensile tails (volume 5). According to a recent announcement, four or five more volumes will be needed to complete the work.

This is an enormous labor for one author; Hill attempts to cover all living and extinct primates in virtually their total biology, not only the comparative anatomy and taxonomy promised by the subtitle but also reproduction, development, behavior, paleontology, and their general natural history. No previous work by a single author approaches it in scope and detail. It is not surprising, then, that this survey is of very uneven quality, sometimes inaccurate, often disappointingly inadequate, but a unique and generally useful contribution.

The first section of volume 3 is a chapter that introduces the higher primates (that is, those beyond the prosimians covered in the preceding volumes) which Hill terms the Pithecoidea. This term was proposed by Pocock and championed by Wood Jones. It has been widely used and is clearly preferable to its commonest rival, Anthropoidea (which, in its adjectival form, anthropoid, has so curiously come to signify un-manlike and at the same time un-monkeylike). Fortunately the choice is purely one of names, not one of concepts of relationship. There is, of course, the question as to the validity of this linking of groups that quite certainly evolved independently from Early Tertiary prosimians in the Old and New Worlds. It would be better, in my opinion, to omit this artificial linkage and simply to elevate the Platyrrhini and Catarrhini to subordinal rank. One would expect to find in this chapter, which surveys monkeys, apes, and man, a discussion of the parallelism that is so well illustrated in these two groups, but this theme is not developed.

The second section of volume 3 is a 39-page chapter on the Platyrrhini in general. This is unique in the literature on primates, since most writers, struck with the basic cleavage of the group into marmosets and cebid monkeys, have treated these separately, with only very brief remarks on their common features. In the 19th century this would have seemed more justifiable; Thomas Huxley, indeed, took the extreme view of their separateness and elevated them to an independent rank, the Arctopithecini, coordinate with the New World monkeys and the Old World pithecoids. With the discovery of *Callimico* (described in 1904, but unappreciated until 1911), which shares the commonly used diagnostic characters of both groups, this cleavage seemed to have disappeared and either one or three families seemed called for. Hill had chosen to rank them in a separate family, and they are so treated in the text. But, after he received a specimen of this rare animal, he realized that it is clearly a tamarin, and he notes this in the preface. This explains the discrepancy between the volume's title on both its spine and dust jacket, which indicate only the Hapalidae, and that on the title page, which strangely was not changed and continues to list the family Callimiconidae.

The remainder of volume 3 is devoted to the marmosets. The taxonomy of primates is a notorious mess, and the plight of the platyrrhines is especially bad—but marmoset classification is the absolute nadir. Unfortunately, these volumes compound the confusion, even though they provide a very useful synopsis. The plague of names begins before one chooses a volume from the shelves. Volumes 1 and 2 are identified on their spines as treating the Strepsirhini and the Haplorhini. If he is to grasp that the second volume will yield information on monkeys, the reader must understand a term and concept that has been widely rejected and much criticized by reviewers of the earlier volumes. Then he must realize that the marmosets are considered in volume 3 under the name Hapalidae, a name which has been invalid for more than half a century. *Callithrix* has been universally adopted as the official name for the common marmoset not only by American workers, as Hill implies, but by most of the world's great museums, including the British Museum, and it is used in nearly all current literature, including the London Zoo's own *Zoological Record*.

Of all the possible classifications of marmosets, Hill has chosen the most fragmenting. He divides the marmosets into nine genera (including *Callimico*). This certainly is excessive splitting. Some of them surely deserve no more than subgeneric status, as Hill admits, and the distinctions between *Tamarin* and *Tamarinus* and between *Hapale* (= *Callithrix*) and *Mico* are too trivial even for that. (To add to the difficulty two marmoset names have been

changed since volume 3 was published, and Hill partially explains this in a preliminary note to volume 4. Repeatedly throughout these volumes, Hill has ignored, confused, and, on the flimsiest evidence, contradicted Hershkovitz's excellent work.

Fortunately the generic and higher categories of the cebids are comparatively clear. Few would argue with Hill's generic groupings. *Chiropotes* certainly deserves generic distinction from *Pithecia*, and *Brachyteles* from *Ateles* (though it is certainly closer to *Ateles* than to *Lagothrix*—not halfway between as Hill states). *Alouatta, Aotus*, and *Callicebus* have been placed in separate subfamilies, and there are some grounds for this. In the hardly significant but annoying matter of spelling, Hill has elected to use *Aotes* rather than *Aotus*. Personally I cast my vote for *Aotus*, the spelling that Humboldt, the original describer, finally settled on, and the one that, in the century and a half that have followed, has been adopted by the majority of workers, including almost all of the taxonomists who are best qualified to judge.

The structural and general biological data which make up the bulk of these volumes are organized under descending taxonomic categories. This, while natural and useful for certain purposes, results in a great deal of repetition and necessitates some laborious searching on the part of the reader. For example, data on the common marmoset will be found in volume 1 under the discussion of primates in general, in volume 2 in the section on the "haplorhines" in general, and in volume 3 at five different levels—under the successive categories of Pithecoidea, Platyrrhini, Hapalidae, *Hapale*, and *jacchus*. The nature of evolution and a natural taxonomy make this arrangement well-nigh inevitable, and the index, with its main entries indicated by boldface type and illustrations by asterisks, helps the reader find his way through this complex and repetitive scheme. But a more detailed index, one that provides a breakdown of the large number of page references into subtopics, would be helpful. The reader in search of information on the common marmoset, to use the same example, must make an arduous search through an unrelieved series of more than 200 page references to *Hapale* and Hapalidae, without a suggestion about the kinds of information to which they lead.

It is a melancholy task to review the portions of these volumes that deal with anatomy. On one hand, Hill should be credited with assembling a massive catalog of details from a large proportion of the primate literature including a very sizable contribution from his own dissections. On the other hand, the assemblage represents such a disproportioned and unassimilated collection of minutiae that there is a serious question whether they will satisfy many real needs. They are too frequently unrelated to any biological significance—functional, developmental, or evolutionary. An incredible number of misstatements are made, of which the following are a few samples: platyrrhines have only two sacral vertebrae; there is a ninth cervical nerve; the spleen is an endocrine gland; *Cebus* is "a slow-moving non-prehensile-tailed climber"; and there has been "a phylogenetic rise from marmosets to Man." Quantitative data are limited to a few raw measurements. Schultz's incomparable data, to cite one example, are either unused or misused. In repeated instances, excellent papers from recent decades, even after being cited, are ignored for some slight and antiquated 19th century ones. The illustrations, which should bear a large share of the burden of communicating anatomical principles and details, are in many cases, especially those of muscles and nerves, worse than useless. Many would not be acceptable from an elementary student in a comparative anatomy course: muscles float flatly in space, unattached to their origins or insertions; nerves take incredible courses—the obturator nerve dorsal to the sacroiliac joint, for example, and the radial between the coracobrachiales or through the quadrilateral space. That they inaccurately reflect the text (to say nothing of reality) must strike even the casual user. Just why so many clear and sometimes beautiful illustrations from the literature had to be redrawn is not clear; the result often strips them not only of beauty and clarity but sometimes of essential meaning.

Even the most inexpert primatologist should detect signs of haste and carelessness in what at first glance look like solid, scholarly examples of book making—particularly in the scores of misspellings; in the haphazard use of umlauts and hyphens in authors' names; in the unreliable table of contents; in the erratic use of type faces and style of headings throughout the text; in the poor cropping and wasteful use of space in certain of the plates; in the wide discrepancies between text and distribution maps, with both often being in error; in the annoying omission of titles of papers in the bibliography; and in the general inadequacy and inaccuracy of labeling in many of the illustrations. I cannot let pass an opportunity to correct one error that pains me personally. Hill correctly quotes a statement that I made to him about the striking contrast between the genitalia of the juvenile and adult female *Brachyteles*, and he clearly prints the photographs that I sent him, but labels them as two views of an adult!

Although these carping criticisms must be made, they must also be viewed in perspective. These volumes are a unique contribution to our reference shelves. They should be in every institution concerned with primates. They will be constantly turned to for all sorts of basic information, and they will often yield complete and accurate answers or they will point the way to more detailed references. I am eager to acknowledge my own gain from going through these volumes; even in the case of animals I know well in the field and in the laboratory, Hill has called my attention to unnoticed details, suggested new insights, and directed me to sources I had not yet encountered. It is easy to find faults in such wide-ranging works, but it must be remembered that with unrealistically high standards, these much-needed projects would never be undertaken.

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Lower Bagshot Flora

The Lower Tertiary Floras of Southern England. vol. 2, *Flora of the Pipe-Clay Series of Dorset (Lower Bagshot)*. Marjorie Elizabeth Jane Chandler. British Museum (Natural History), London, 1962, xii + 176 pp. Illus. Plates. £8 8s.

Forty years ago, J. S. Gardner reproved students of British paleobotany with the comment that "though rich in Tertiary fossil plants we are behind every other country similarly rich, in describing and identifying them." The present monograph is the second of a series, by M. E. J. Chandler, that is