Book Reviews

J. McArdle

Functional Morphology of the Hip and Thigh of the Lorisiformes

Contributions to Primatology, vol. 17 Karger AG, Basel 1981 VIII + 132 pp.; SFr. 32.- ISBN 3-8055-1767-X

As closely related strepsirrhine groups that exhibit very substantial locomotor differences, the lorisines and galagines present an ideal opportunity for studying the influence of divergent behavior patterns on the anatomy of primates descended from a single (presumably) relatively unspecialized ancestral morph. For many years primate anatomists have remarked on the clear-cut differences between the lorises and the galagos in their limb and body proportions, and some have convincingly related the form of these animals to function in a general way. Up to now, however, the most detailed analyses of lorisoid anatomy have been almost exclusively quantitative, and have suffered from the deficiencies inherent in reducing the complexities of anatomy to sets of numbers isolated from any qualitative appreciation of their significance. With the publication of John McArdle's account of the hindlimb in lorisoids we finally have at hand a study that combines an extensive sampling of these primates (both in terms of the numbers of species and of individuals examined) with metrical and qualitative approaches to the interpretation of their anatomy. These purely anatomical studies are further supplemented by captive observations on the locomotion of most lorisoid species.

An introductory section on methodology is followed by a review of the relationships between behavior and ecology among the lorisoids. The wide coverage of the literature in this section serves to point up the anecdotal nature of so much of the information available, but at the same time highlights the significant recent advances made by Charles-Dominique and others. Having been put into ecological perspective, behavior is next related to overall relative body proportions, and following this myology is discussed in the same context. Muscular origin/insertion maps are used to emphasize both differences and similarities of muscular disposition within and between lorisoid genera. In both sections distinctions are very clearly drawn between differences related to body size and those attributable to other factors. Finally, selected dimensions of the pelvis, femur, and calcaneus are expressed as indices, in which form they are compared among the various lorisoid genera and species and related to the proportional and morphological differences discussed previously.

McArdle not only finds fairly simple form/function/behavioral/ecological relationships that underline the obvious differences between the lorisines and galagines, but he also demonstrates a number of convincing relationships of this kind at finer taxonomic levels. As knowledge of the behavioral distinctions becomes more refined, many more such correspondences will almost inevitably come to light; meanwhile, McArdle has done a fine job of working with what is available.

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W.P. Luckett

Advances in Primatology

Comparative Biology and Evolutionary Relationships of Tree Shrews

Plenum Press, New York 1980 XV+ 314 pp.; US \$39.50 ISBN 0-306-40464-8

The tree shrews (family Tupaiidae) have in recent decades wandered in and out of the orders Primates and Insectivora in search of phyletic relatives. The goal of this volume's contributors is to end that search, but tupaids remain waifs despite their best efforts. The authors were requested to evaluate tree shrew ties to primates apart from other mammals (none stood up to inspection) and to a superordinal taxon Archonta, also including Primates, Dermoptera and perhaps Chiroptera; ordinal status for tupaids (as Scandentia) was broadly accepted. Almost all the authors employ variants of a cladistic approach to systematics and do seek serious answers to these questions about relationships of the tree shrews.

Luckett begins with a review of the history of tupaoid systematics and ordinal placement, including data from the succeeding chapters. He argues for the retention of a separate monotypic subfamily Ptilocercinae and considers the relationships of the five tupaoid genera in some detail: Tupaia and Lyonogale group closely, with the monotypic Anathana, Urogale and Dendrogale successively more distant. Combining Luckett's data with those of Butler (p. 198), I would suggest that Anathana and Urogale form a sister group, sharing derived hypocone enlargement and diastemata; this pair would link in turn to Tupaia and Lyonogale via the derived single-rooted C-, simplified anterior dentition and possibly scapholunate fusion (whose condition is as yet unknown and merits evaluation in Urogale).

The evidence from several body systems summarized by Luckett is analyzed in depth by the succeeding authors. Novacek examines orbital and auditory regions, limb proportions, and ankle morphology in a wide range of small mammals. He finds tupaids marginally closest to Primates and dermopterans, but not to bats, although alternative schemes are nearly as likely. Cartmill and MacPhee review the same cranial systems, often in an ontogenetic perspective. They end on the 'dismally conservative' note that tupaids show no clear links to any other placentals. Contrary to this uncertainty is Szalay and Drawhorn's strongly argued case for archontan ties among Scandentia, Primates and Dermoptera, based on shared derived features of the astragalo-calcaneal complex. They argue that archontans were the earliest successful climbers in an arboreal niche, suggest possible relationships to bats and further offer the guess that microsyopids may have been archontans as well. Butler describes the dentition of tupaoid genera in some detail, offering scattered comparisons to primates and other mammals. No special relationships are indicated by the teeth, as also agreed by the previous contributors here. Jacobs reviews the lack of early tree shrew fossils despite some prior claims and then describes Miocene tupaids from the Indo-Pakistani Siwaliks, including three new specimens; no global conclusions are attempted.

Following these five studies of 'hard parts', four more papers examine 'softer' anatomy.

Campbell reviews and extends studies of the tree shrew (basically Tupaia glis) brain. Luckett reexamines supposed primate-like features of the tupaoid male and female reproductive systems, fetal membranes, and maternal care related characters. He finds no sup-

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port for primate links other than from retained conservative features, and while a pendulous penis is present in most archontans, Luckett accords it low weight as the less derived state is found in Ptilocercus. As was the case with cranial and tarsal characters, two papers examine

molecular systematic results and each other. Dene, Goodman, Prychodko and Matsuda review the methods (very clearly) and data of amino acid sequencing and immunology (both immunodiffusion and microcomplement fixation which is subjected to harsh criticism). The former results do not support archontan linkages, but the latter do, although Dene et al. realize that this may be biased by the use of rabbits as host producers of antisera. Cronin and Sarich report their microcomplement fixation results on albumin and transferrin (with criticism of immunodiffusion, especially its computerized analysis) and also reevaluate some hemoglobin sequence work. They find strong support for primate-dermopteran ties, groups that pair with tupaiids, but do not place bats especially close to the thus-reduced Archonta.

In sum, after detailed evaluation of a wide variety of characters, often by two or more researchers, only a limited set of conclusions may be drawn about tupaiids. There are two distinct subfamilies, and some fine structure may be discerned within the polytypic Tupaiinae (see above). The tree shrews are best considered as an independent order, Scandentia, presenting few if any derived characters shared with other insectivores, either menotyphlan (elephant shrews) or lipotyphlan. There are some quite diverse synapomorphies with primates, but they also occur in dermopterans and rarely in other groups, such as bats (or insectivores). Szalay and Drawhorn argue that such links, even if only one or two are firmly supported, are sufficient to warrant formal recognition of Archonta, while Novacek and Luckett prefer to withhold judgment, in part because of doubts as to the homology of postcranial and macromolecular similarities. Nonetheless, this book has gone far to clarify the morphological attributes of tree shrews (and also of Primates). If other mammalian groups were subjected to comparably detailed and elegant analyses, the study of their interrelationships would surely be placed on a strong footing.

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