Opossums: An Adaptive Radiation of New World Marsupials

Review by Robin M.D. Beck

With their unspecialised dentitions, largely insectivorous diets, and generalised postcranial skeletons, opossums (family Didelphidae) are often considered good living analogues of early therian mammals. This family of predominantly Neotropical mammals is also of interest as an example of a relatively species rich (>140 species described to date) mammalian clade that has radiated comparatively recently, and as a marsupial clade that has diversified widely despite the presence of numerous placental competitors. It is therefore perhaps surprising that the group has not been the subject of a dedicated volume until now. With their new book, Rob Voss (Curator of Mammalogy at the American Museum of Natural History) and Sharon Jansa (Professor at the University of Minnesota) have done an admirable job in filling this gap. These authors have published extensively on didelphid systematics (e.g. Voss and Jansa, 2009), but the current volume is far more ambitious and wide-ranging, attempting nothing less than a comprehensive summary of what is currently known about didelphid anatomy, physiology, behaviour, and ecology within an explicitly evolutionary context. The authors have succeeded admirably in this aim: the book is an outstanding example of how the scientific literature can be distilled into a coherent, detailed, and thought-provoking account of a mammalian clade.

The book is the ideal size to fit into a backpack, and, at 240 pages (excluding appendices and references), the content is relatively easily

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digested. Nevertheless, a huge amount of information is synthesised here. The first section comprises three chapters on the position of Didelphidae within the larger clades Marsupialia and Metatheria, the evolutionary history of mammals in South America, and the impact of the Great American Biotic Interchange. These chapters are necessarily highly condensed accounts of a vast and complex literature—readers with a deeper interest in the overall history of South American mammal evolution during the Cenozoic should check out Croft (2016), which covers these issues in much greater detail—but they are up-to-date and accurate, and provide a useful broader context to the chapters that follow. The next chapter summarises what is known (and, equally importantly, what remains unknown) regarding the taxonomy and natural history of members of each of the currently recognised didelphid genera. As well as generally (with members of the same genus typically adapted overview of the didelphid skeleton and soft tissues (including an outline of dental function in other congeners), but again the authors have done exceptions (e.g. the famous death-feigning behaviour of Didelphis virginiana and possibly other congeners), but again the authors have done an exceptional job of synthesising the available literature into a coherent summary.

The following section on natural history covers "Habitats", "Diets", "Parasites", "Predators", "Com- petitors and Mutualists", and "Population Biology"—once again, these are comprehensive and information dense, and deal with many concepts and principles that are of broad relevance to mammalogists, ecologists, and palaeoecologists. Of particular interest are the cogent summaries of the distinctive features of different habitats (e.g., as the construction of leaf nests by Hyladelphys members of the same genus segregating accord- (with the leaves "cemented together...by a mysteri- ing to specific vegetation type) is also a key infer- eous white substance of unknown origin"), and the erence, and one that may be applicable to small acrobatic copulation of Tlacuatzin, which takes mammals more widely. The chapter on diets takes place "with both partners suspended upside down an admirably sceptical view, noting that all methods by their tails". The chapter ends with a key inference that opossums occur- ring in sympatry appear to be stratified both verti- cally and horizontally (with the dark circumocular ma- sks of many species), but again the authors have done an exceptional job of synthesising the available literature into a coherent summary.

Three chapters on didelphid phenotypes (grouped as "Anatomy", "Physiology", and "Behavior") follow; again, these are rich in detail. The relationship between the didelphids and the medically important anatomy chapter provides an excellent, well-illus- trated overview of the didelphid skeleton and soft possibility that the "tweezer-like" first upper incisor tissues (including an outline of dental function in of didelphids might be an adaptation for removing the group that is likely to be of particular interest to ectoparasites, the observation that jaguars actively palaeomammalogists), but also informed speculation on the adaptive significance of the unusual possibility that the non-overlapping ranges of pelage and markings seen in some opossums females seen in many didelphid species is to avoid e.g., the unusual white underfur of Didelphis, the female-mediated infanticide. The chapter on didel- bright pink ventral fur of Monodelphis emiliae, and phid population biology provides an intriguing point the dark circumbregular masks of many species), of comparison to Australian marsupials: unlike the and a fascinating account of the (presumably sen- Australian family Dasyuridae, few didelphids are sory) papillae on the hands of the semi-aquatic genuinely semelparous, but extremely high annual Chironectes, among other intriguing tidbits. The population turnover (>80%) has nevertheless been physiology chapter is similarly diverse, covering observed in several opossums, which therefore topics such as metabolic rate, life history, and sen- represent excellent examples of mammal species sory ecology, as well as a detailed look at toxin with "fast" mammalian life histories. resistance among members of the group. The The final chapter synthesises the preceding behavioural repertoire of living opossums is unr-
covers chaperes into a persuasive overall scenario for the markable by mammalian standards, with a few diversification and adaptive radiation of modern
didelphids. The authors revisit the unusual period of zero diversification seen in a Lineage Through Time plot of didelphid diversification that they previously identified (Jansa et al., 2014), and consider it most likely that this reflects a mass extinction event ~11 Ma ago, caused by the arrival of novel predators (probably procyonid carnivores) in South America. The treatment of the didelphid fossil record—which includes some highly distinctive forms, many of which appear to have been more carnivorous than living species (e.g., Thylatherium, Hyperdidelphys, Sparassocynus)—is very brief, and it would have been good to have a more detailed treatment of this topic and a discussion of what additional information the fossil evidence might provide regarding the radiation of didelphids in time and space. But this is nitpicking: overall, this book is a remarkable achievement, combining broad scope with brevity, and written with rigour and refreshing honesty about what we do and do not know about this fascinating mammalian group. A book purely on opossums might sound rather niche, but it is crammed to the gills with information of relevance to mammalian systematists, palaeomammalogists, Neotropical ecologists, and evolutionary biologists with a general interest in the nature of adaptive radiations, and I wholeheartedly recommend it to all such researchers.

REFERENCES

