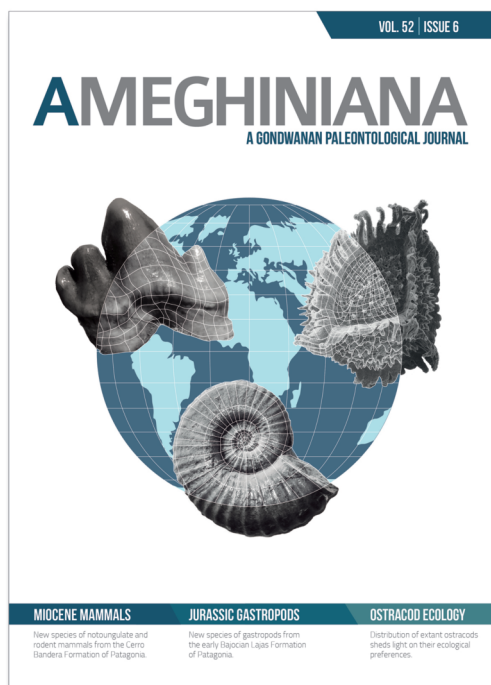




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EVOLUTION OF THE RODENTS. ADVANCES IN PHYLOGENY, FUNCTIONAL MORPHOLOGY, AND DEVELOPMENT

Philip G. Cox and Lionel Hautier

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EVOLUTION OF THE RODENTS. ADVANCES IN PHYLOGENY, FUNCTIONAL MORPHOLOGY, AND DEVELOPMENT.

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This multi-authored book edited by Philip G. Cox and Lionel Hautier highlights the evolutionary history of rodents, as revealed by complementary fields such as phylogenetics, paleontology, functional morphology, biomechanics, and developmental biology. It is the fifth published volume of a new Cambridge University Press series entitled "Cambridge Studies in Morphology and Molecules: New Paradigms in Evolutionary Biology". As such it allows for positively reconciling molecules, fossils and morphology as irreplaceable clues of a sole story.

I guess that for virtually any paleomammalogist, this book would irredeemably recall the volume "Evolutionary Relationships Among Rodents: a Multidisciplinary Analysis" edited thirty years ago by W. P. Luckett & J.-L. Hartenberger. The latter authors were opportunely invited to sign a foreword, punchy as usual and pointing wisely the rise of novel approaches and perspectives (open source data, 3D imagery, or developmental studies) addressed by a new generation of researchers open to holistic studies.

The book includes twenty chapters, encompassing complementary fields (molecular phylogeny, paleontology, geometric morphometrics, functional morphology, biomechanics, and developmental biology, among others) and mostly at large taxonomic scales. The synopsis of rodent history, as provided by P.-H. Fabre and colleagues on molecular grounds (pp. 19–69), is a real milestone as regards phylogeny-based classification, diversification pattern, and biogeography of extant rodents, a monophyletic order comprising three major clades (guinea-pig-, squirrel-, and mouse-related). The following chapters focus on the early evolutionary history of rodents, with late Paleocene-Eocene sciurognaths from Laurasia (squirrel-related taxa; Mary D. Dawson, pp. 70–86) and Old World hystricognaths (guinea-pig-related taxa; F. Barbière and L. Marivaux, pp. 87–138; with a damned-long character matrix!). D. H. Verzi and colleagues (pp. 139–163) explore the history of the

most diversified clade among South American rodents (octodontoids), providing a time-calibrated phylogeny and an integrative study of morphometric disparity within the super-family. An overview of giant fossil rodents related to the extant South American pacarana (family Dinomyidae), authored by A. Rinderknecht and R. E. Blanco (pp. 164–185), deals with their distinctive cranial features and attempts at unraveling the paleobiology of the largest rodent ever recorded (*Josephoartigasia monesi*, with a body mass estimated at ~1,000 kg). The next chapter (C. Denys and A. Winkler, pp. 186–220) provides an integrative taxonomy of African murid rodents, on molecular, morphological, and morphometrical grounds. Two chapters are devoted to evolution, phylogeny and ecology of sciurids (V. L. Roth and J. M. Mercer, pp. 221–245), and more specifically to marmots (P. D. Polly and colleagues, pp. 246–276), notably in the context of global changes posterior to the Middle Miocene Climatic Optimum. The following contributions involve most recent techniques, such as 3D-based geometric morphometrics or finite element analyses, and holistic approaches, for investigating the morphological variation of mandibles and infra-orbital foramina among rodents (L. Hautier and colleagues, pp. 277–299), the biogeographic variation in wood mice (outline analysis of molars of *Apodemus sylvaticus*; S. Renaud and colleagues, pp. 300–322), the oral apparatus of rodents as a gnawing and sharpening machine (R. D. Druzinsky, pp. 323–349), and the muscles involved in mastication, with a special emphasis on medial pterygoid biomechanics (finite element models for each major clade among extant rodents; P. G. Cox and N. Jeffery, pp. 350–372). This sequence dedicated to functional morphology follows up by a stunning description of rodent middle ear anatomy and morphological evolution through time, from an adaptive angle (M. J. Mason, pp. 372–404). Rodent teeth are explored from a developmental perspective, with a focus on dental anomalies as providing information on develop-

mental constraints and challenging computational models (e.g., supernumerary teeth and cusps; C. Charles and L. Viriot; pp. 405–423). H. Gomes Rodrigues (pp. 424–447) investigates dental patterns, structures and dynamics (enlargement, mesial drift, and enamel microstructure), their variety among major clades, and their bearing on the ecology of rodents through time. A full 3D topographic approach of crown morphologies and chewing modes among muroids by V. Lazzari and colleagues (pp. 448–477) shows that all derived “masticatory grades” within the mouse-related clade may have originated from independent evolutionary pathways, further revealing the prominence of convergent and iterative evolution as regards muroid crown topography in post-Paleogene times. The link between developmental processes and phenotypic novelty through time is illustrated through the evolution of both crown height and size in rodent molars and incisors (e.g., stem cell homeostasis and ever growing teeth) and cusp number evolution in lower molars of voles (E. Renvoisé and S. Montuire; pp. 478–509). The two last contributions are to be particularly acknowledged, as they focus on post-cranial skeleton, *i.e.* a data source widely under-investigated by neontologists and paleontologists. Locomotory modes are inferred for fossil taxa, such as the giant *Phoberomys* (guinea-pig related; ~400 kg), assumed to have been a terrestrial rather than aquatic form, or the ricochetal squirrel-related *Issiodoromys*. The study by L. A. B. Wilson and M. Geiger (pp. 515–538) in particular depicts the diversity and evolution of femoral variation among recent

Ctenohystrica (guinea-pig-related clade), based on original measurements and indices, scrutinized through principal component and canonical variate analyses. M. Vianey-Liaud and colleagues (pp. 539–588) provide a richly illustrated chapter devoted to the axial and appendicular skeleton of Paleogene rodents referred to extinct squirrel-related families, based on astounding material from various western European localities. A 16-page section clustering key color plates, with fantastic 3D virtual models, is curiously inserted between pp. 466–467 (*i.e.* within the chapter by V. Lazzari and colleagues). A special effort was done as regards the index provided (pp. 589–611), with multiple thematic entries such as taxon names (Latin and colloquial), fossil sites, evolutionary concepts, anatomical regions, or developmental features.

Thanks to this outstanding worldwide panorama of rodent-focused research, we now can take it for granted for the next thirty years: guinea pig *is* a rodent!

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