

### Mammals

#### **1. When Clocks Collide, By Christopher A. Brochu**

The outcome of this particular conflict colored the nature of the **debate** for many years. New fossil discoveries eventually put the human-chimp split much closer to the molecular estimate (Fleagle, 1998). Page 1

#### **2. Late Neogene Dwarf Tapir, By Richard C. Hulbert Jr.**

Because of these limitations, the phylogenetic affiliation and chronologic range of “*T.*” *polkensis* have remained **enigmatic**. Page 238

There had been considerable previous **debate** about whether the fossil vertebrates found in the phosphate mines consisted of one or two faunas, and how this fauna (or faunas) correlated with those from the central and western United States and Europe. Page 238

#### **3. Ancestor Of Wild Dogs, By Adam Hartstone-Rose**

The evolutionary origin of *L. pictus* **is poorly understood**. Despite numerous morphological (Tedford et al., 1995; Van Valkenburgh and Koepfli, 1993; Zrzavy and Ricankova, 2004) and molecular studies (Bardeleben et al., 2005; Lindblad-Toh et al., 2005; Zrzavy and Ricankova, 2004), its phylogenetic relationship to other canids, especially the genera *Canis* (Linnaeus, 1758; wolf-like dogs) and *Cuon* (Hodgson, 1838; the Asiatic dhole), has remained controversial (see also nomenclatural note in Material and Methods, below). The phylogenetic uncertainty of the lineage is heightened by the extremely sparse record of fossil African canids, which means that the evolutionary path leading to *L. pictus* is poorly known. Page 299

#### **4. Metaphiomys (Rodentia: Phiomysidae), By Nancy J. Stevens**

The evolutionary history of the living African rodent families is a topic of considerable **debate**, yet it is generally agreed that the modern cane rats (*Thryonomys* Fitzinger, 1867) and dassie rats (*Petromus* Smith, 1831) have an evolutionary history within the infraorder Phiomorpha (e.g., Wood, 1968). Page 407

#### **5. Super Family Of Marsupial, By Jeanette Muirhead**

Relationships among peramelemorphians (commonly called bandicoots) and their relationships to other marsupials **are contentious**. Page 512

#### **6. Windows On The Evolution Of Picrodus, By Craig S. Scott**

By contrast, the position of picrodontids within plesiadapiforms has not been easily resolved and at present no consensus concerning this important issue has emerged. Page 656

#### **7. Evaluating Internal Versus External Characters, By Lindsey R. Leighton**

Debate over the relative phylogenetic value of internal vs. external characters is roughly analogous to the **debate** in mammalian systematics over the value of dental, cranial, and post-cranial characters (Szalay, 1985; Van Valen, 1993; Sanchez-Villagra and Williams, 1998). Page 659

#### **8. Implications For Mammalian Paleobiogeography, By Pieter Missiaen**

**Uncertainties** about the ancestor of Eotitanops and the exact phylogenetic relations of the species included in the genus, together with the apparently frequent intercontinental dispersal of brontotheres (Mihlbachler, 2008), still prevent us from providing a conclusive answer to the geographic origin of brontotheres. Page 675

#### **9. The Phylogeny Of Bunodont Marsupials, By Robin M. D. Beck**

The complex combination of plesiomorphies, apomorphies related to bunodonty, and striking autapomorphies present in *Numbigilga* n. gen. render its phylogenetic **affinities obscure**. Page 758

#### **10. Identification Of A New Species, By G. D. Wesley**

The relationships among the earliest carnivorans or carnivoramorphan (“miacoids,” Flynn and Galiano, 1982; Hunt and Tedford, 1993; Wyss and Flynn, 1993; Flynn, 1998), especially regarding their position relative to the crown clade Carnivora, are still unclear. One reason for this uncertainty is the scarcity of relatively complete fossil material for most early taxa. This is certainly true for *Tapocyon*. Page 769

### **11. The Oldest Skull Of The Order Carnivora, By T. J. Meehan**

There are several hypotheses on the systematic of early carnivorans, including recognition of a third family (Didymictidae; Flynn and Galiano, 1982), and there has been uncertainty about the relationship of each family in relation to one another and to the Suborders Feliformia and Caniformia. Page 1091

The oldest known carnivoran, *Ravenictis*, is of earliest Paleocene age (Puercan) and has been assigned to Miacoidea with uncertain familial affinities (Fox and Youzwyshyn, 1994). Page 1091

### **12. Early Mammalian Radiations, By Richard L. Cifelli**

For organizational purposes, it is convenient to follow some broad systematic framework for mammals, notwithstanding the fact that placement of several major groups is unsettled and the subject of intense **debate**. Page 1214

This morphological transition remains unchallenged, and molar pattern justifiably continues to figure prominently in **debate** about the relationships of early mammals. Page 1218

All workers since Ride (1964) have recognized the enormity of marsupial diversity by placing them in multiple orders, though relationships remain **debated** in many cases. Page 1220

### **13. The late Oligocene of Eritrea, By Jeheskel Shoshani**

In addition, the phylogenetic connections of elephantimorphs to more archaic taxa were uncertain and subject to considerable **debate** (2, 8, 16–17). Page 17296

### **14. The vertebrate fossil record, By Johannes Muller**

The use of this date, however, has not been free of controversy, which recently culminated in an open **debate** involving both paleontologists and molecular biologists. Page 1069

### **15. Early origins of modern birds, By Michael J. Benton**

Two major current phylogenetic questions are hotly **debated**, however: the origins of Metazoa (multi celled animals), and the origins of modern bird and mammal groups. In both cases, molecular evidence suggests that the point of origin is twice as old as the oldest known fossils. This implies either that half the fossil record of animals, and of modern birds and mammals, is cryptic, or that the molecular conclusions are flawed. Either way, there is a strong challenge to the integrity of molecular phylogenetic analytical techniques, or to claims by palaeontologists that the history of life can be divined from the fossil record. The question of metazoan origins has been **debated** already in BioEssays. Page 1043

These dramatic claims are one of many challenges to “traditional” morphology-based views. Past experience does not indicate which way the **debate** will go, whether the molecular challenge, or the status quo, will be upheld. Nonetheless, **debates** such as these have often been heated, and it is worth reviewing the current position. Page 1044

In cases of conflict and error, molecular trees suffer many of the same methodological problems as morphological, for example the choice of taxa in the in group, the choice of out group taxa, the choice and definition of characters, and the choice of algorithm. Results obtained using either technique may be confused by problems of convergence, long branch attraction, and rapid splitting of lineages (star phylogenies). In addition, special features of molecular phylogeny reconstruction cause problems: variable rates of substitution at different sites, differential rates of transitions and transversions, and multiple substitutions at sites. Page 1044

The postulation of rare or cryptic ancestors does not really resolve anything, and is just a restatement of the problem; there is no independent evidence for the proposal that ancestors were cryptic other than the assumption that such ancestors were there and yet have not been found. The proposal fails absolutely on a probability argument: why should some 20–30 lineages, the modern bird and mammal orders reputed to have existed undetected through most of the Cretaceous, all uniformly have remained cryptic until they blossomed forth in abundance and with autapomorphies in place and fully displayed between 70 and 55 million years ago? Page 1047

There are numerous other substantial problems to be considered before accepting date estimates founded on molecular data. As Bromham and colleagues point out, current estimates of specific dates of divergence between various clades of mammals vary enormously, and sometimes by as much as 100%. Page 1049

However, from a strictly paleontological perspective, the mammal–bird split is problematic because: (a) there are not enough fossil localities from the early Late Carboniferous that predate the earliest known evidence of the split, (b) the same is true for the number of fossil localities immediately after the first appearance of amniotes and (c) there are still several long ghost lineages in the phylogeny of early amniotes and their sister taxa. Page 1074

### **16. Human Evolution, By Bernard Wood**

It is the extent to which those regional characteristics are continued within the regional populations that succeeded them that lies at the root of ongoing **debate** about the origin of anatomically modern humans. Page 952

### **17. Phylogeny of Old World monkeys, By Jinchuan Xing**

Branching order within the Asian lineage is one of the more hotly **debated** areas in Old World monkey phylogeny. One view, based on fossil and morphology studies, indicates that *Nasalis* was the Wrst to diverge from the rest of the group (Peng et al., 1993). On the other hand, karyotypic studies indicate that the *Pygathrix* was the Wrst to diverge and a relatively close relationship between *Nasalis* and *Trachypithecus* exists (Bigoni et al., 2003, 2004). Page 876

Using a consensus approach, Disotell (2003) was unable to resolve the relationships between many of these genera. The *Alu* insertion data presented here are useful in resolving some of these problematic relationships. Page 876

### **18. Phylogeny of the bears, By Li Yu**

The taxonomic classification and phylogenetic relationships within the bear family remain argumentative subjects in recent years. Page 480

### **19. Phylogeny of musk deer, By Saurav Guha**

The phylogenetic status of the infra order Pecora is controversial, even though it is supported by paleontological, morphological, and molecular evidence. Page 585

However, the relationship among the pecoran families remains open for some **debate**, as the phylogenetic analyses have been complicated by numerous cases of morphological convergence among the pecoran families. Page 586

### **20. Mitochondrial DNA coding, By Corey S. Davis**

Despite extensive interest in the systematics of Pinnipedia, questions remain concerning phylogenetic relationships within the Phocidae or “true” seals. Page 363

Although the arctoid (bear-like) affinities of all pinnipeds are readily accepted, there has been significant **debate** over whether the pinnipeds originated from one (monophyletic) or two (diphyletic) ancestral stock(s) (Mitchell and Tedford, 1973). Related to this **debate** is the question of which specific group of terrestrial carnivores gave rise to the pinnipeds (Flynn, 1988). Page 363

Monophyly of the Phocinae has not been questioned since King (1966), yet considerable **debate** exists over relationships within the group. Page 364

In contrast to the lack of study focusing on the relationships of the major caniform lineages is the substantial attention given to resolution of the **debate** over a monophyletic versus diphyletic origin of the pinnipeds, the identification of the sister group of the pinnipeds (if monophyletic), and the related **debate** concerning the relationships among the three pinniped families, Phocidae, Odobenidae, and Otariidae. Page 372

In the context of an increasing acceptance of the monophyletic origin of the pinnipeds, considerable **debate** still exists concerning their affinities. Page 372

### **21. Phylogeny of Oriental voles, By Jing Luo**

A comprehensive phylogeny based on unambiguous characters and appropriate phylogenetic reconstruction methods is still required to shed light on the classification and evolutionary history of this group. Page 351

### **22. The effect of branch lengths, By Austin L. Hughes**

The relationships among the orders of eutherian (placental) mammals represents an unresolved phylogenetic question to which issues of both taxon sampling and LBA are relevant. Page 82

Because only three mammalian species were involved, the present analyses cannot resolve the controversial question of the branching order of the major lineages of placental mammals. Page 87

### **23. Phylogeny of old world deer, By Christian Pitra**

Despite the continuous accumulation of palaeontological, morphological, karyological, and behavioural data, the evolution of this group of deer has been a matter of much speculation and **debate**, as is reflected in uncertainties about evolutionary relationships at different taxonomic levels (Table 1). Page 880

### **24. Phylogeny of the squirrels, By Scott J. Steppan**

However, the utility of this body of knowledge is compromised by an incomplete understanding of their phylogenetic relationships. Page 703

### **25. Bat Phylogeny, By Francois-Joseph Lapointe**

This **debate** is an epistemological as well as a methodological one. Page 55

For all these reasons, we believe that the answer to the matter which is at issue in the **debate** will come through a global approach involving total evidence as well as consensus. Page 55

This last combination illustrates the implications of our distance-based approach to the total evidence versus consensus **debate**. Page 58

### **26. A complete species-level phylogeny, By Zoltan Takacs**

The Hylobatidae (gibbons) are among the most endangered primates and their evolutionary history and systematics remain largely unresolved. Page 456

While gibbons represent one of the three major adaptive radiations of anthropoid primates in Southeast Asia, and despite several revisions of gibbon systematic (e.g. Geissmann, 1995; Groves, 1972; Marshall and Sugardjito, 1986; Pocock, 1927) and various scenarios proposed to explain the radiation of this group (e.g., Chivers, 1977; Groves, 1993; HaimoV et al., 1982), their evolutionary history and systematics remain largely unresolved. Phylogenetic relationships, even among the main divisions of the Hylobatidae family are unclear, and the total number of species is contested. Page 456, 457

Fossil evidence applicable to gibbon evolution is very limited and its interpretation is considered problematic (Fleagle, 1984, 1999). Earlier studies applying morphological, behavioral or vocal characters to address the evolutionary relationships among gibbons have produced inconsistent results (Creel and Preuschoft, 1984; Geissmann, 1993, 2002a; Groves, 1972; HaimoV et al., 1982). Page 457

Fig. 2. Published representations of the phylogenetic relationships among gibbon taxa. (A) Groves (1972); (B) Chivers (1977); (C) HaimoV et al. (1982); (D) Creel and Preuschoft (1984); (E) Garza and WoodruV (1992); (F) Hayashi et al. (1995); (G) Purvis (1995); (H) Zhang (1997); (I) Zehr (1999); (J) Roos and Geissmann (2001); and (K) Geissmann (2002b, vocal data). Page 458

However, we recognize, that assigning generic-level status to these four clades remains open to **debate**. Page 464

### **27. Phylogeny of mysticete whales, By Amanda L. Rychel**

By combining data into a single analysis, a better estimate of the true phylogeny may be obtained and/or overall clade support may be improved. However, this is based on the assumption that the several data partitions are not strongly incongruent. In the **debate** over whether to combine data or not, both possibilities have been shown to occur. Page 899

Even though combining data will continue to be a contentious issue, an argument for combining data, even between data sets with different phylogenetic histories can be made (Wiens, 1998). Page 899

### **28. Evolution of RNases, By Lin Xu**

In this short communication, we reanalyzed a recent study (Zhang, 2006) and demonstrated that the uncertainty of inferred phylogeny may lead to different conclusions about parallel evolution of DNA substitutions. Page 397

### **29. Evolution of South American rats, By Yuri L.R. Leite**

The phylogenetic relationships between capromyids, Myocastor, and other echimyids have long been a matter of **debate**. Page 460

### **30. Living squirrel monkeys, By Kenneth L. Chiou**

In the absence of fossil data, molecular phylogenies offer the opportunity to evaluate the tempo and mode of speciation in extant taxa (Moritz et al., 2000). Page 737

### **31. Toothed whale monophyly, By Masato Nikaido**

However, research published in the last several years has made the issue of the monophyly or paraphyly of toothed whales a subject of **debate**. Page 216

Despite extensive **debate** for more than ten years, the phylogenetic position of sperm whales has not been definitively determined with strong bootstrap probability (Milinkovitch et al., 1994; Adachi and Hasegawa, 1995; Milinkovitch, 1995; Arnason and Gullberg, 1996; Smith et al., 1996; Cerchio and Tucker, 1998). Page 216

Although the position of beaked whales has been the subject of **debate** too, we focus on the three lineages of dolphins, sperm whales and baleen whales in order to simplify the problem. Page 219

### **32. The red panda's ancestry, By Jun J. Sato**

Few species have been of more disputed affinities than the red or lesser panda (*Ailurus fulgens*), an endangered endemic Southeast Asian vegetarian member of the placental mammalian order Carnivora. This peculiar carnivoran has mostly been classified with raccoons (Procyonidae) or bears (Ursidae), grouped with the giant panda (*Ailuropoda melanoleuca*) in their own family, or considered a separate lineage of equivocal ancestry. Page 907

Even though the bear nature of the giant panda was convincingly demonstrated almost half a century ago (Davis, 1964) and the perception of this species as part of a sister lineage to all other living ursids has become ultimately widespread (O'Brien et al., 1985; Bininda-Emonds et al., 1999; Bininda-Emonds, 2004), the relationships of the red panda have remained puzzling and highly controversial despite a variety of data classes examined. Only over the last two decades, attempts to decipher the enigma of the red panda's affinities, whether based on morphologic or genetic grounds or both, have resulted in an impressively broad range of hypothesized relationships. Page 908

For a discussion of the limitations of these two measures of phylogenetic confidence and an ongoing **debate** on their interrelationship, see Suzuki et al. (2002), Wilcox et al. (2002), Alfaro et al. (2003), Cummings et al. (2003), Douady et al. (2003), Erixon et al. (2003), Huelsenbeck and Rannala (2004), Simmons et al. (2004), Zander (2004), Pickett and Randle (2005), Yang and Rannala (2005), Alfaro and Holder (2006), Simon et al. (2006), Svennblad et al. (2006), Wheeler and Pickett (2008), and references cited therein. Page 909

### **33. Chacoan peccaries, By Jaime Gongora**

There is ongoing paleontological, cytogenetic, and molecular **debate** about phylogenetic relationships among them. Page 181

There are two hypotheses about the location in the New World of the divergence of the tayassuids. Page 181

Whichever hypothesis is true, at the present the oldest known Tayassuidae family fossil found in North America has been dated at about 33–36 MYBP. Page 182

The divergence time estimates from this study should be viewed with caution as there is incomplete information on fossil dating and history of New World peccaries as well as ambiguity of extinct and extant New World peccary relationships based on fossil and morphological data. Page 186

### **34. Phylogenetic studies of pantherine cats, By Li Yu**

The pantherine lineage, as the most recently evolved (within 1–8 MYA; Janczewski et al., 1995; Pecon Slattery et al., 1994) and largest felid group (around 20 cat species; Janczewski et al., 1995) has demonstrated great confusion in their taxonomy and phylogeny. Page 483

They had been disputably assigned to 2–13 genera under various classification schemes in past studies (Ewer, 1973; Hemmer, 1978; Leyhausen, 1979; Nowak, 1999) and moreover, phylogenetic relationships among these pantherine species have also been controversial. Page 483

Our results demonstrate that individual genes, including the six previously published gene data (tree not shown), and the combined nuclear dataset, fail to recover a satisfying phylogeny. This lack of resolution is largely due to insufficient phylogenetic information in individual loci. Page 493

### **35. The Praomys group, By E. Lecompte**

The basal relationships within the Praomys group are poorly resolved, suggesting a rapid radiation at about 7–9 million years ago based on genetic divergence rates calibrated from the fossil record. Discrepancies between molecular and morphological results probably reflect of numerous convergences as well as variations in the rates of morphological evolution among lineages. Page 899

The systematics of the group long has been and remains a matter of **debate** (for review, see Lecompte et al., 2002b). This is partly due to the low level of morphological differentiation among the species as well as between the genera, making it difficult to find phylogenetically informative characters (but see Lecompte et al., 2002a, however). Page 899, 900

The conflict between morphological and molecular trees is presented in Figure 6. Page 910

The conflict between morphological and molecular data shows important discrepancies between them, probably resulting from numerous morphological convergences in relation with the habitat type occupied (“savannah” or “forest”). Page 916

### **36. Unraveling ancient segmental duplication, By Amir Ali Abbasi**

This contention famously known as 2R hypothesis has been the subject of intense **debate** over the past couple of decades (Skrabaneck and Wolfe, 1998; Martin, 1999, 2001; Hughes and Friedman, 2003; Furlong and Holland, 2004; Donoghue and Purnell, 2005; Kasahara, 2007; Abbasi, 2008, 2010; Abbasi et al., 2009; Furlong and Holland, 2002). Page 836

### **37. Haemadipsoid leeches, By Elizabeth Borda**

Few deep historical biogeographic studies exist for soft bodied invertebrates that leave no fossil trace. Our robust phylogeny for the terrestrial blood feeding leeches, leaving perhaps as many questions unanswered as answered, beckons more extensive consideration of these notorious annelids. Page 153

The phylogenetic relationships between recent Elephantidae (Proboscidea, Mammalia), that is to say extant elephants (Asian and African) and extinct woolly mammoth, have remained unclear to date. The prevailing morphological scheme (mammoth grouped with Asian elephant) is either supported or questioned by the molecular results. Recently, the monophyly of woolly mammoths on mitochondrial grounds has been demonstrated (Thomas et al., 2000), but it conflicts with previous studies (Barriel et al., 1999; Derenko et al., 1997). Page 421

Yet, some of them, as the large dorsal parietal bulges and concave fronto-parietal region, although evolving in parallel are already more comparable in early Mammuthus and Elephas species, known so far. Yet, because the skulls of earliest African mammoths such as Mammuthus subplanifrons and Mammuthus africanavus are still poorly known, the **debate** is not closed. Page 431, 432

### **38. A newly discovered baleen whale, By Takeshi Sasaki**

Molecular systematists have invested much effort to elucidate the evolutionary history of balaenopterids and their relatives. Nevertheless, the phylogenetic relationships among the species of the monophyletic clade comprising the families Balaenopteridae and Eschrichtiidae have been difficult to resolve (Adegoke et al., 1993; Arnason et al., 1993; Arnason and Gullberg, 1994; Rychel et al., 2004). Page 40

Moreover, molecular phylogenetic studies that are based on the traditional view of the genus Balaenoptera (such as Wada et al., 2003) may be insufficient to definitively establish the complete evolutionary history of these

species given our current knowledge of the phylogenetic relationships among the species of the Balaenopteridae+Eschrichtiidae clade, which cross conventional taxonomic ranks (Arnason et al., 1993; Arnason and Gullberg, 1994; Nikaido et al., 2006; Rychel et al., 2004; Sasaki et al., 2005). Page 41, 42

The number of possible trees was 105. Page 45

### **39. A phylogeny of Diprotodontia, By Robert W. Meredith**

Even though the marsupial order Diprotodontia is one of the most heavily studied groups of Australasian marsupials, phylogenetic relationships within this group remain contentious. Page 554

Much of the **debate** has focused on relationships among the families of possums and whether possums are monophyletic or paraphyletic. Page 554

Resolving higher-level relationships within Diprotodontia has proved difficult. Page 555

We recognize that the interpretation of these fossils as crown-group metatherians is not agreed on by all workers (e.g. the cladistic analysis of Sánchez-Villagra et al., 2007). Page 558

The inclusion of fossil taxa (if they existed for these nodes) would help resolve these issues in that they could be transitional forms. Page 569

### **40. Inference of whale phylogeny, By Laura May-Collado**

Several issues of Cetacean phylogenetics have been intensely **debated**, as a result of independent datasets (morphology, nuclear DNA, and mitochondrial DNA) suggesting conflicting hypotheses. These **debates** include the phylogenetic placement of Cetacea as sister to Artiodactyla. Page 344

### **41. Phylogeny of muroid rodents, By Sharon A. Jansa**

One of the outstanding **debates** in muroid systematic is whether the burrowing muroids form a monophyletic group, or whether the morphological adaptations associated with underground life (reduced eyes and pinnae, reduced limbs, well-developed fore claws, fusiform body shape; Stein, 2000) have evolved independently. Page 267

The pattern of relationships among these lineages is still an open question, and we refrain from naming them pending further morphological and molecular studies of these taxa. Page 272

### **42. Improved resolution of Cetartiodactyla, By Xuming Zhou**

However, phylogenetic relationships within Cetartiodactyla remain controversial. For example, the root of Cetartiodactyla has proven to be elusive (Gatesy et al., 2002; Ursing et al., 2000), and three hypotheses have been postulated: a basal position for Tylopoda (Gatesy et al., 1999) or Suina (Matthee et al., 2001) or a monophyletic clade containing Tylopoda and Suina (Arnason et al., 2000) as a sister group to Cetruminantia (Cetacea + Hippopotamidae + Ruminantia). Page 1

Although great advances have been made in advancing our understanding of cetacean phylogenetics, these studies have also created some new controversies (Kingston et al., 2009). For example, the monophyly of Odontoceti has been challenged previously and sperm whales were placed in many positions according to different molecular studies (Arnason and Gullberg, 1994; Milinkovitch et al., 1994). Additionally, the phylogenetic relationships among river dolphins (Inia, Pontoporia, Platanista, and Lipotes) have also been **debated** (Cassens et al., 2000; Nikaido et al., 2001b; McGowen et al., 2009; Xiong et al., 2009), but the positions of Platanista and Lipotes have been difficult to resolve even with complete mitogenomes or concatenations of several nuclear genes (McGowen et al., 2009; Xiong et al., 2009). Another contentious issue is the relationships among the superfamily Delphinoidea, which contains three families, Monodontidae (beluga and narwhal), Phocoenidae (porpoises), and Delphinidae (dolphins). Page 2

### **43. Perspective on Mammalian Evolution, By Michael J. Stanhope**

The evolutionary relationships of the various orders of placental mammals remain an issue of uncertainty and controversy. Page 148

At present there is no single hypothesis of eutherian ordinal relationships that is widely accepted. One area of considerable **debate** has been the proposed superorder Archonta, a grouping of Primates, Scandentia (tree shrews), Dermoptera (flying lemurs), and Chiroptera (bats). Page 148

Many issues in mammalian phylogeny have in all likelihood remained intractable and controversial because of evolutionary splitting events that were close enough in time and in character that they represent a considerable challenge for phylogenetic analysis. Page 148

#### **44. *Lepus* in Eastern Asia, By Chunhua Wu**

In spite of several classification attempts among taxa of the genus *Lepus*, phylogenetic relationships still remain poorly understood. Page 45

#### **45. Nuclear gene sequences, By Emma C. Teeling**

Molecular and morphological hypotheses disagree on the phylogenetic position of New Zealand's short-tailed bat *Mystacina tuberculata*. Most morphological analyses place *Mystacina* in the superfamily Vespertilionoidea, whereas molecular studies unite *Mystacina* with the Neotropical noctilionoids and imply a shared Gondwanan history. To date, competing hypotheses for the placement of *Mystacina* have not been addressed with a large concatenation of nuclear protein sequences. Page 308

Although the mystacinid lineage is too young to have originated in New Zealand before it split from the other Gondwanan landmasses (80 mya), the exact geographic origin of these lineages is still uncertain and will not be answered until more fossils are found. Page 308

#### **46. The genus *Artibeus*, By Rodrigo A.F. Redondo**

Although *Artibeus* in the broad sense (including the *Dermanura* and *Koopmania* subgenera) is widely accepted as monophyletic (Simmons, 2005), the relationships among the species inside both subgenera (or genera) is a matter of intense **debate** (Van den Bussche et al., 1998; Lim et al., 2004; Guerrero et al., 2004; Guerrero et al., 2003; Marques-Aguiar, 1994; Owen, 1987, 1991; Handley, 1987). Page 44

Although *A. obscurus* is easily distinguishable from other large *Artibeus*, the phylogenetic relationship of this species is poorly resolved in morphological analysis (Marques-Aguiar, 1994). Page 54

#### **47. The prehistory of Central Africa, By Chiara Batini**

The origin of *L1c* and the processes leading to its present distribution are still a matter of **debate**, due both to lack of data concerning some crucial areas and to the low level of resolution used in most studies. Page 636

Any attempt to shed light on the peopling of Central Africa is made difficult by the incompleteness of the data accumulated so far and the limited value of some more indirect lines of evidence. Page 642

#### **48. Rare endemic Malagasy lemur, By I. B. Ravaoarimanana**

We are aware of that species recognition under different species concepts is a continuous matter of controversial **debate** among evolutionary biologists and taxonomists (Avice and Wollenberg, 1997; Cracraft, 1989; O'Brien and Mayr, 1991; Zink and McKittrick, 1995). Page 445

#### **49. African Hominoid Trichotomy, By Wendy J. Bailey**

However, the question of whether gorillas, chimpanzees, and humans separated ancestrally from one another in a simultaneous three-way split or in two well-demarcated speciation events has not been decisively answered despite three decades of research and **debate** (Goodman, 1962, 1963, 1976; Sarich and Wilson, 1967; Dene et al., 1976; Sarich and Cronin, 1976; Groves, 1986; Andrews, 1987; Andrews and Martin, 1987; Holmquist et al., 1988; Miyamoto and Goodman, 1990). Page 97

#### **50. Oligocene to Miocene diversification, By Cynthia Steiner**

Contradicting ideas about didelphid phylogenetic affinities result from the use of different approaches for the analysis of morphological characters, chromosomes, allozymes, and more recently DNA sequences (for a summary, see Jansa and Voss, 2000). Debates are principally focused around the phylogeny of mouse-sized opossums and the position of *Monodelphis* and *Metachirus* within Didelphinae. Page 364

#### **51. Letter to the Editor, By Zhixi Su**

At any rate, all of us (Zhang, 2009; Xu et al., 2009) agree that new experimental data from more leaf monkeys are crucial to resolve the disagreements. Page 610

#### **52. A Phylogenetic Study of the Gibbons, By J. Carlos Garza**

Advances in our understanding of gibbon phylogeny may resolve **debate**s about the evolution and adaptive significance of other variable traits, such as pelage and vocalizations. Page 209

### 53. Molecular systematics of Vampyressine bats, By Steven R. Hofer

Relationships among vampyressine bats continue to be **debate**d and have proven difficult to resolve with either morphological or molecular data (e.g., Owen, 1987; Porter and Baker, 2004; Wetterer et al., 2000), perhaps reflecting a rapid and contemporaneous radiation among these fruit-eating specialists. Most of the **debate** seems rooted in “molecules versus morphology,” and centers around two entangled issues about monophyly and rank status of Vampyressa and Vampyriscus, and their relationships with Chiroderma, Ectophylla, and Mesophylla. Page 424

Rank status of Vampyriscus (*bidens*, *brocki*, and *nymphaea*) and whether or not its species and those of Vampyressa (*melissa*, *pusilla*, and *thyone*) shared a most recent common ancestry has been **debate**d extensively. Page 432

Affinities of the monotypic genera Ectophylla (*E. alba*) and Mesophylla (*M. macconnelli*) have been the source of **debate** since the 1960s, which mostly is the result of incongruence between morphological and other types of data (“molecules versus morphology”). Page 433

### 54. Intraordinal phylogenetics of treeshrews, By Link E. Olson

While the monophyly of Scandentia is well-supported, the supraordinal relationships of this group have been a matter of great **debate** (see review in Sargis, 2002a). Page 657

Compared to the few **debate**s regarding the basal relationships among treeshrews, those concerning generic distinction have been more controversial (see Olson et al., 2004a for review). Page 658

### 55. In Memoriam, By Derek E. Wildman

This again proves the point, in my view, that consideration of the place of humans within the natural world will always be **debate**d. Page 2

### 56. Phylogeography of the armadillo, By Sebastián Poljak

It is important to note that the **debate** about the statistical validation of the inferences of NCA became stronger in the past 2 years (see Knowles, 2008 and Templeton, 2009a,b). Page 40

### 57. Phylogenetic position of Rhagomys, By Guillermo D’Elía

Therefore, a taxon-dense phylogenetic analysis including all species of both tribes is needed to optimize the geographic location of the sigmodontine common ancestor, which is one of the main points of the **debate** in sigmodontine historical biogeography (reviewed in D’Elía, 2000 and Pardiñas et al., 2002). Page 563

### 58. Nuclear gene sequences, By Heather Amrine-Madsen

Expanded concatenations of DNA sequences, improved models of sequence evolution, and other types of molecular data, including indels and SINEs, may help to resolve this **debate**. Page 194

### 59. Phylogenetics of red-backed voles, By Joseph A. Cook

The phylogenetic relationships and geographic limits of North American species of *Clethrionomys* have long been **debate**d (e.g., Bee and Hall, 1956). Page 774

### 60. *Rhabdomys pumilio* subspecies, By Ramugondo V. Rambau

In spite of the **debate** on the accuracy of molecular clocks (Avice, 1994; Gillespie, 1986; Martin and Palumbi, 1993; Rambaut and Bromham, 1998) they have nonetheless proved useful for dating cladogenic events in rodents (e.g., Ducroz et al., 2001; Jolley et al., 2000; Smith and Patton, 1999). Page 572

### 61. The *Sorex araneus* group, By G. Yannic

Therefore, investigation of genomic regions with different inheritance patterns, coalescence time and mutation rates is warranted in order to obtain an accurate picture of the species’ evolutionary history (e.g., Leache, 2010) (but see the recent **debate** on the use of mtDNA versus nuclear DNA in avian phylogeography; Barrowclough and Zink, 2009; Edwards and Bensch, 2009; Zink and Barrowclough, 2008). Page 1062

### **62. Divisions among Collared peccaries, By Jaime Gongora**

Genetic analysis of the Collared peccary can elucidate ongoing **debate** about taxonomy and differentiation. Page 2

### **63. History of the genus *Sus*, By Stefano Mona**

The systematic status of species belonging to the genus *Sus* has been a matter of **debate** for decades (Groves, 1981). Page 757

### **64. Phylogenetics of the Diprotodontia, By M. J. Osborne**

The affinities of the Burramyidae have also been **debated** with Szalay (1994) including this group within the Petauridae on the basis of pedal anatomy. Page 220

### **65. A novel family of tRNA, By Jurgen Schmitz**

While all these studies contribute to a better understanding of the superordinal clustering of mammalian orders, the evolutionary affiliations among the members constituting the four major eutherian groups emerging from these studies are still a matter of scientific **debate**. Page 341

### **66. Description of Mitochondrial DNA, By Louis G. Kessler**

The empirical and conceptual issues raised by these findings are highly analogous to those in the long-standing **debate** about rates of molecular evolution and times of separation of ancestral hominids from African apes. Page 109

Alternatively, if we question the reliability of the fossil assignments for waterfowl, a scenario arises that is analogous to the current **debate** over the divergence time of ancestral humans from African apes. Page 122

### **67. Support Patterns from Different Outgroups, By Adrian Schneider**

The very early divergences of the eutherian mammals into Afrotheria, Xenarthra, and Boreoeutheria (consisting of Euarchontoglires and Laurasiatheria) are still **debated**. Page 1265

The branching order of Primates, Rodentia, and Laurasiatheria (e.g., Carnivora and Artiodactyla) is also subject to **debate**. Page 1266

The position of Lagomorpha (here represented by rabbit and pika) has been long **debated** with the main hypotheses focusing on the relative positions of Lagomorpha, Rodentia and Primates. Page 1267

### **68. Evolution of the Metazoan PHD, By Kalle T. Ryttonen**

Our results are more equivocal about the relationships among the HIF-3 alpha genes in cartilaginous fishes, teleosts, and mammals, which is currently a matter of some **debate** (Law et al. 2006; Richards 2009). Page 1921

### **69. Philippine Mitochondrial DNA, By Kristina A. Tabbada**

Their origins have been the subject of scientific inquiry and discussion for over two centuries, and the study of the region's prehistory has played a key role in the broader **debates** over the first dispersals of humans out of Africa as well as the influence of agriculture and the role of demographic expansions in recent human evolution. Page 21

### **70. Quantifying the Phylodynamic Forces, By Marc Gottschling**

The felid phylogeny has long been a matter of **debate**, and the molecular tree of the felid hosts provided by (Rector et al. 2007) neither agrees with a comprehensive molecular phylogeny of cats (Johnson et al. 2006) nor with the phylogeny obtained in this study. The internal phylogeny of Pi-PVs is also not entirely congruent to the rodent host tree topology (Schulz et al. 2009). A solid case of cophylogenetic relationships between PVs and their mammalian hosts supported by identical tree topologies, even on a local scale, is thus still wanting. Page 2110

### **71. Testing for Ancient Admixture, By Eric Y. Durand**

Among anthropologists, there is a long-standing **debate** on the relationships between modern humans and different groups of archaic humans such as Neandertals. Page 2239

### **72. The Primates' Gliding Sister?, By Jurgen Schmitz**

Although a general agreement on the major groups of eutherian orders and their phylogenetic affiliations is emerging, the evolutionary affiliations among the members constituting these groups are still subject to **debate**. Page 2308

Early primate evolution between the late Cretaceous and the end of the Eocene continues to be an issue of lively **debate**. Of particular interest are the interrelationships between extant and fossil primates and other eutherians, where questions of phylogeny still largely remain unresolved. Page 2308

For the part of nuclear DNA-based evidence, this could provide a final settlement for the **debate** of primate origins. Page 2311

### **73. Early Y Chromosome Lineages, By Chiara Batini**

Finally, our study contributes to the **debate** on the geographical origin of Homo sapiens in sub-Saharan Africa, providing evidence for the retention of early Y chromosome lineages in East and Central but not in Southern Africa. However, we note that the current absence of significant palaeo-anthropological investigation, together with the possibility of different fossil preservation conditions in central Africa, makes the extremely long human fossil record in eastern Africa inconclusive in solving this issue. Page 2611

### **74. Diversity in Rhesus Monkeys, By Don J. Melnick**

Reconstructions of the human-African great ape phylogeny by using mitochondrial DNA (mtDNA) have been subject to considerable **debate**. Page 282

### **75. Large-Scale mtDNA Screening, By Qing-Peng Kong**

Hitherto, **debate** on whether the earlier hominid populations had been “completely” replaced by modern humans continues, especially for East Asia where abundant and successive hominid fossil records have been discovered and continuity of the morphological characters between Homo erectus and modern East Asians has been proposed (Wu 2005, 2006). Page 513

### **76. Representation for Convergent Evolution, By Yasuhiro Kitazoe**

The evolutionary history of placental mammals is also in **debate** (Easteal 1999; Benton and Ayala 2003). Page 705

### **77. Divergences of Human Gene Trees, By Michael G. B. Blum**

Two competing hypotheses are at the forefront of the **debate** on modern human origins. Page 889

The process by which modern humans arose has been the subject of much **debate** in paleoanthropology (Stringer 2002). Especially the extent of admixture between anatomically modern humans and archaic populations of Homo has been vigorously **debated** (Wolpoff et al. 2000; Templeton 2002; Garrigan and Hammer 2006; Plagnol and Wall 2006; Fagundes et al. 2007). Page 889

### **78. Nucleotide Compositional Plasticity, By Jurgen Schmitz**

The phylogenetic relationship of tarsiers to other primates has been a source of **debate** for many decades. Page 544

### **79. Philippine Mitochondrial DNA, By Kristina A. Tabada**

Their origins have been the subject of scientific inquiry and discussion for over two centuries, and the study of the region’s prehistory has played a key role in the broader **debates** over the first dispersals of humans out of Africa as well as the influence of agriculture and the role of demographic expansions in recent human evolution. Page 21

### **80. The Role of Landscape Barriers, By Gyaneshwer Chaubey**

Moreover, the southeast Asian populations have been underrepresented in all previous studies, and furthermore, no high-resolution autosomal evidence has been considered in these **debates**. Therefore, the genetic origins of Austroasiatic-speaking populations remain largely controversial. Page 1016

### **81. History of Niger-Congo Groups, By Cesare de Filippo**

Yet, because the results of such estimates depend to a large extent on the mutation rates used, which are very variable and subject to considerable **debate** (Zhitovovskiy et al. 2004), age estimations should be considered with due caution. Page 1260

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