Evolution

Hidden from view

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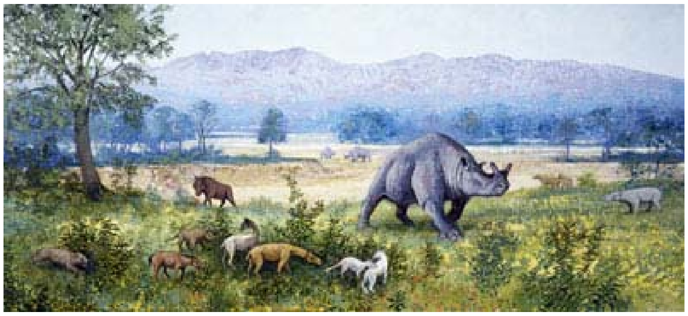
National History Museum



Rewriting the history of the mammals

AS WITH other fields of human endeavour, science has its myths. One of the best known goes like this. Once upon a time, the world was dominated by dinosaurs. Mammals were tiny, nocturnal and crept around minding their own business. Then one day a big, bad asteroid came along and wiped out all the dinosaurs. The mammals shouted “Yippee”, leapt out of their burrows and took over. In the end, therefore, *Homo sapiens* rather than *Tyrannosaurus rex* became top animal.

Like all the best myths, there is some truth in it. But not the whole truth, as a paper in this week's *Nature* helps to make clear. The myth is based on fossil evidence, but these days genetics can trace the path of evolution, too. Olaf Bininda-Emonds of the Technical University of Munich and his colleagues have done that with the mammals. What they have discovered is that most mammal groups alive today came into existence long before the asteroid arrived 65m years ago. The idea that the absence of dinosaurs created a huge evolutionary spurt that led to man is therefore not quite precisely the truth.

Dawn's early light

In fact the myth never did quite match reality. What the fossils actually show is a false start. The Cretaceous—the last period when dinosaurs ruled the roost—was followed by the Palaeocene. During this time mammals, along with some large flightless birds, did take over. Then they became extinct. It was during the Eocene, which began 56m years ago, following the Palaeocene, that the ancestors of mammals around today are supposed to have diversified. The trouble is that if the genetics researchers are right, these modern groups did not actually originate in the Eocene. In fact, their ancestors appear to have emerged between 100m and 85m years ago—a time when the dinosaurs were still alive and chomping.

The team came to this conclusion by looking at 66 genes in 4,510 living mammal species. Only 44 known species escaped their trawl. Using well-established statistical techniques, they compared the DNA sequences of these genes in a way that not only shows who is related to whom, but also provides an estimate of when two genetic lines parted company.

Modern mammals divide into three overarching groups: the placentals (most species, including man), the marsupials (kangaroos and their like) and the monotremes (the egg-laying platypus and echidnas). The monotremes split off about 166m years ago and the marsupials parted company with the placentals 148m years ago. That, however, was not news; the fossils tell a similar story.

Nothing much then happened for 50m years when, all of a sudden, the placentals (or, at least, those with surviving descendants) split into four so-called superorders. That was followed by further splits over the next 15m years, in which most of the big groups found today seem to have originated. What caused this diversification is not known for certain, but it coincides with the rise of the flowering plants, which is suggestive.

The really strange thing is that there is absolutely no hint of anything happening at the end of the Cretaceous. The characteristic Palaeocene fauna seems to have come and gone with the ancestors of modern mammals still skulking unchanged in their burrows.

As might be expected, the genes suggest that the pace of change hots up after the end of the Palaeocene, resulting in the sort of species illustrated above. As to what happened to the Palaeocene fauna, the evidence points not towards an errant asteroid but to a giant burp from the oceans, which released a huge amount of methane. Since methane is a potent greenhouse gas, things would have got very hot very quickly, to the detriment of any big animal that could not shed heat easily.

Having missed their opportunity 9m years earlier, man's ancestors and their kin now grabbed it, moving into the niches vacated by their recently exterminated cousins. The fossils show what is known as an adaptive radiation. This is biology-speak for a period of diversification so fast that the individual splits cannot be distinguished. What Dr Bininda-Emonds and his colleagues have shown, at least in this instance, is that the most important splits had already happened. It was just that they had happened in groups hitherto so rare that they do not feature much in the fossil record. In this case the meek truly did inherit the Earth.