No need to thank dinosaur-killing asteroid for mammalian success

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It is a natural history tale that every third grader knows: The dinosaurs ruled the Earth for hundreds of millions of years, until an asteroid struck the Yucatan Peninsula and triggered a mass extinction that allowed the ancestors of today's mammals to thrive.

The asteroid part of the story may still hold true, but a new study published in the March 29 issue of the journal *Nature* challenges the prominent hypothesis that a mass extinction of dinosaurs 65 million years ago played a major role in the diversification of today's mammals.

An international team of scientists including University of Georgia Institute of Ecology Director John Gittleman has constructed a complete evolutionary tree for mammals that puts the major diversification well after asteroid strike, casting into doubt the role the dinosaur die-off played in the success of mammals.

"The previous evidence showed that we did see a die-off of the dinosaurs and an increase in the rise of the mammals roughly 65 million years ago," Gittleman said. "But the fossil record, by its very nature, is patchy. We have found that when you fuse all of the molecular trees with the fossil evidence, the timing does not work. The preponderance of mammals really didn't take off until 10 to 15 million years after the demise of the dinosaurs."

Molecular evolutionary trees are constructed by comparing the DNA of species. Because genetic changes occur at a relatively constant rate, like

the ticking of a clock, scientists can estimate the time the species diverged from their common ancestor by counting the number of mutations. Using radiocarbon dating, scientists can also estimate divergence times from the fossil record. Gittleman and his colleagues combined more than 2,500 partial trees constructed using molecular data and the fossil record to create the first virtually complete mammalian tree.

"The end result is that the mammals we know today are actually quite old and just flew under the radar of everything that was out there, be they dinosaurs or now other ‘archaic’ mammals as well, for a lot longer than most people suspected," said Olaf Bininda-Emonds, lead author of the study and now on a Heisenberg Scholarship at the University of Jena, Germany. "This is just the first of many insights, if not surprises, about mammalian evolution to be mined with the help of the tree."

The researchers found that there was a small pulse of mammalian diversification immediately after the dinosaur die-off. Most of those species, however, died out without leaving descendants today. Diversification didn’t really take off until the Eocene epoch, about 56 to 34 million years ago, but the reasons are unclear.

"That’s one of the next big questions," Gittleman said. "Now that we have this complete tree, we can examine what ecological characteristics correlate with the upturn."

Gittleman points out that flowering plants first appeared during this epoch, possibly aiding the diversification of mammals by giving them new food sources. Clearly, Gittleman said, more research is needed.

The team of researchers, which includes paleontologists, ecologists and bioinformaticians, set out on their study not to debunk any dinosaur hypothesis but rather to help prevent future extinctions.

Surprisingly very little is known about the evolutionary relationships among the more than 4,500 species of mammals on the planet, and much of the world's biodiversity is uncataloged and understudied.

Because two closely related mammals in two different parts of the world likely share similar characteristics, the factors that put one species at risk of extinction likely pose the same risk to its close relatives.

The researchers are currently working on a model that can predict the risk of extinction to a species based on factors such as body size, reproductive patterns and habitat needs. Coupled with a previous study published in the November 2, 2006 issue of Nature that examined geographic distributions of nearly 20,000 species of vertebrates, the researchers hope to move away from the prevailing piecemeal conservation strategy to one that maximizes the benefit to the greatest number of species and those most at risk.

"The overarching philosophy is that we want to maximize the information we have for immediate conservation action," Gittleman said. "We want to conserve, manage and protect the maximum amount of biodiversity. Knowledge of the past gives us insight about what to conserve for the future."

Source: University of Georgia

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