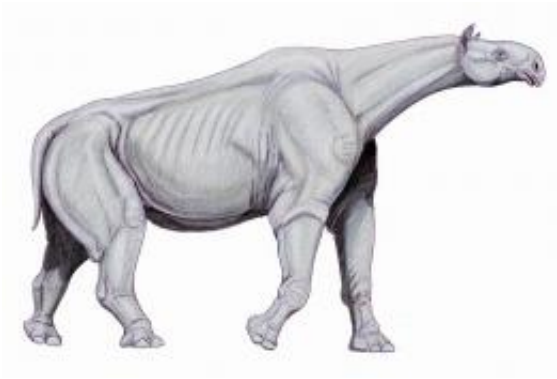
Giants among us: Paper explores evolution of the world's largest mammals

November 25 2010



Indricotherium, based on new skeletal reconstruction. Image: Wikipedia.

The largest mammal that ever walked the Earth -- *Indricotherium transouralicum,* a hornless rhinoceros-like herbivore that weighed approximately seventeen tons and stood about eighteen feet high at the shoulder -- lived in Eurasia almost 34 million years ago. In a paper just published in the journal *Science,* an international team of researchers has compiled and analyzed an enormous database of information about the largest mammals across time and around the globe, revealing striking patterns in their evolution.

The research, funded by a National Science Foundation Research Coordination Network grant, was led by scientists at the University of New Mexico, who brought together paleontologists, evolutionary biologists and macroecologists from universities around the world.

University of Georgia Odum School of Ecology dean John Gittleman and postdoctoral researcher Patrick Stephens were among them.

"We were invited to participate because the group wanted to take an explicitly evolutionary approach to size," said Gittleman, whose research focuses on large-scale ecological and evolutionary problems, from disease to extinction to organism characteristics.

"John and Patrick were indispensable members of our team," said Felisa Smith, associate professor of biology at the University of New Mexico and the paper's lead author. "This really was a project that took all of us to accomplish."

The goal of the research was to revisit key questions about size, specifically in mammals. "Size impacts everything, from reproduction to extinction," said Gittleman. "And mammals are a good test case. There is so much variation—everything from mice to elephants—and there is also far more data available about mammals than other taxonomic groups."

"There is a much better fossil record for mammals than for many other groups," Stephens said. "That's partly because mammals' teeth preserve really well. And as it happens, tooth size correlates well with overall body size."

The researchers spent two years assembling the data. "The database is powerful and unique," said Gittleman. "It includes information on the size of all mammals, living and fossil, from around the world."

With access to so much information, the group was able to test a hypothesis about the evolution of mammal size.

"During the Mesozoic, mammals were small," said Gittleman. "Once

dinosaurs went extinct, mammals evolved to be much larger as they diversified to fill ecological niches that became available. This phenomenon has been well-documented for North America; we wanted to know if the same thing happened all over the world."

The researchers found that the pattern was indeed consistent, not only globally but across time and across trophic groups and lineages—that is, animals with differing diets and descended from different ancestors—as well. The maximum size of mammals began to increase sharply about 65 million years ago, peaking in the Oligocene Epoch (about 34 million years ago) in Eurasia, and again in the Miocene Epoch (about 10 million years ago) in Eurasia and Africa.

"Having so many different lineages independently evolve to such similar maximum sizes suggests that there were similar ecological roles to be filled by giant mammals across the globe," said Gittleman. "The consistency of the pattern strongly implies that biota in all regions were responding to the same ecological constraints."

Global temperature and the amount of land available as an animal's range are two ecological factors that appear to correlate with the evolution of maximum body size, but Gittleman warned against assigning cause and effect. "A big part of science is seeing patterns, and then producing new hypotheses and testing them," he said. "We have now identified this pattern very rigorously."

Provided by University of Georgia