mise, the proliferation concerns won't disappear. The Germans say FRM-II cannot be redesigned to run without weapons-grade uranium. FRM-II is meant to run with very low power and use a very small core, yet still get a flux of neutrons comparable to the reactor in France. The small core requires highly enriched fuel, explains Wolfgang Böning of the Technische Universität in Munich. "This is not as ambitious as ANS. A redesign [to use less enriched fuel] would kill the project."

Nonproliferation activists are particularly worried about the German project because the fuel—imported from other countries, including Russia, and stored at the Bavarian lab—might be vulnerable to terrorist theft. And they accuse U.S. officials of soft-pedaling the potential risks because of a desire to build the ANS. "I think the U.S. government has not gone to the mat on this, and the main reason is ANS," says Kuperman. "We can't say it's wrong to build reactors with enriched uranium and then go ahead and do it ourselves."

Kuperman's organization is joining with the Natural Resources Defense Council and the Union of Concerned Scientists to oppose ANS unless it uses fuel with less than 20% enrichment. He says it's possible to do this if the project leaders build a much larger core—nearly twice the size of the original. Bari says the trouble with that option is that it would require an extremely dense fuel—denser than anything that now exists.

The White House official says the Clinton Administration may have trouble swallowing the 35% solution because of the signal it might send to other nations concerned about possible diversion of the enriched fuel for nuclear weapons. "The thinking is we shouldn't impose a new standard." But he says the overwhelming worry with ANS right now is its cost. So far, Congress has appropriated only small amounts of money each year to cover research and development, and has balked at spending the first dollar for construction. The political support must be found to reverse that trend, he says.

"[ANS supporters] don't need the opposition of the nonproliferation community and the people trying to save money," says the official. The fear is that, together, the two forces may be strong enough to push ANS off the Administration's agenda.

–Faye Flam

PALEONTOLOGY

Ninety Ways to Be a Mammal

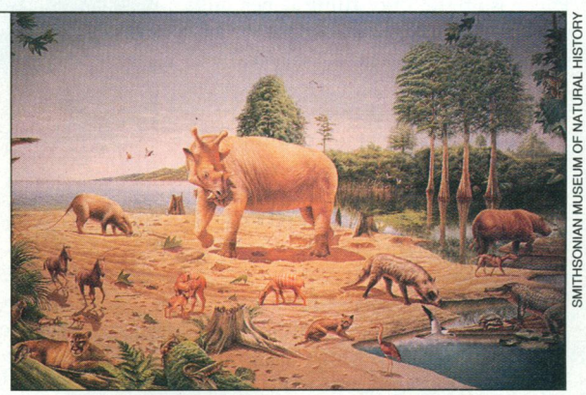
Mammalian evolution after the death of the dinosaurs is a long-running performance—65 million years and counting. Naturally, in a run that long, the cast has changed many times. But a new paleontological analysis suggests that, at least in North America, the number of players on stage at any given time has always returned to the same level.

According to a massive database compiled by postdoc John Alroy at the University of Arizona, the magic number of mammalian genera—groups of closely related species—is about 90. His analysis, the first to document an equilibrium in mammals with hard statistics, joins a growing number of studies showing that such steady states can persist for long stretches of time. "It's amazing—a system that not only approaches a steady state, but a relatively stable steady state for more than tens of millions of years," says diversity expert Michael Rosenzweig of the University of Arizona.

And Alroy's database, adds Rosenzweig, provides a solid basis for theoretical work on evolutionary rates, speciation, and extinction: "This level of sophistication in the data will allow us to get at the root causes of diversity patterns."

Paleontologists have praised the work too, because it proves what some have long suspected: That the pattern of increasing mammalian diversity through time, which appeared in some older analyses, was an artifact. "He's done exactly what was needed," says Philip Gingerich of the University of Michigan. "Some people tend to think that everything builds up and up to the present. And it's not so."

Alroy bases his conclusions on an analysis of the terrestrial mammalian fossil record in North America, excluding only airborne bats and marine mammals. His data were presented last month at meetings of the Society of Vertebrate Paleontologists and the Geological Society of America in Seattle and earlier at a meeting of the Ecological Society of America in Knoxville, Tennessee. They show that, after the Cretaceous-Tertiary extinctions 65 million years ago, the number of mammalian genera shot up to a high of about 130 genera 55 million years ago. Thereafter, the number of genera waxed and waned, sinking to as low as 60 and rising up to 120, presumably in response to climate change and immigration. These fluctuations lasted millions of years, but diversity always converged on an equilibrium of about 90 genera, says Alroy, who successfully tested the equilibrium hypothesis against a statistical model of random change.



SMITHSONIAN MUSEUM OF NATURAL HISTORY

Different faces, similar numbers. Mammal species have changed over the past 65 million years, but the number of genera has always returned to 90.

Paleontologists have previously explored the history of mammalian diversity, and some, such as Richard Stucky of the Denver Museum of Natural History and Jason Lillegraven of the University of Wyoming, have also suggested a steady state. But these analyses used a rougher time scale and older taxonomic data, and Lillegraven is still "pessimistic" about overcoming the sampling problems inherent in the fossil record: "I'm not sure the data are good enough to make such sweeping conclusions at this point."

Others think Alroy's labors have created a strong case. Alroy, who began this project as a junior in college, pored over more than 1500 papers and devised a new quantitative method to improve the time resolution in his analysis; the technique makes using statistics feasible. Alroy's work follows the path laid down by Jack Sepkoski of the University of Chicago, who charted the extinctions and radiations of marine invertebrates. "But he did it 10 times better than me," says Sepkoski.

Assuming that the equilibrium exists, what maintains it? To some, the long-term equilibrium suggests an ecological carrying capacity for the continent; Stucky speculates that energy availability—what's around to eat—may be enforcing the limit. Rosenzweig suggests species fare better when diversity is low, in part because they face less competition from other species; as diversity increases, however, speciation declines and extinction rates go up. The result is continual turnover at a constant number.

The true test of that idea is whether origination and extinction rates vary with diversity. Alroy's preliminary analysis suggests that damped speciation rates alone are keeping diversity in check, while Stucky's work points at extinction rates. There's still a long way to go before scientists understand what maintains diversity, but Alroy has given both ecologists and paleontologists a number of issues—and the number 90—to think about.

–Elizabeth Culotta