

MEETING AMERICAN GENETIC ASSOCIATION

Genomes Reveal Kin Connections for Whales and Pumas

STATE COLLEGE, PENNSYLVANIA—At this year's meeting of the American Genetic Association, held here on 12 and 13 June, researchers discussed genomic data that shed light on both ancient evolution and the relationships among modern species.

A Puma Is a Cougar Is a Panther

Pumas are known by many names—panther and cougar among them. Indeed, experts on the animals thought they were so genetically diverse as to constitute a menagerie of 32 subspecies. Now an extensive genetic analysis has turned up just six puma subspecies. The finding sheds light on the evolution of the 60-kilogram cats and suggests that keeping some of these supposed “subspecies,” such as the Florida panther, from becoming extinct may be easier than previously thought.

As part of a DNA study of the world's cats, Stephen O'Brien and his team at the National Cancer Institute (NCI) in Frederick, Maryland, collected blood

Less diverse. Pumas turn out to have fewer subspecies than had been thought.

and tissue samples from 209 pumas in zoos, museums, and the wild across North and Central America, and from 106 of the animals in South America. They then looked for sequence differences in three mitochondrial genes and 10 microsatellites, short bits of repetitive DNA sequence that lengthen and mutate through time and thus indicate the relatedness of organisms.

The researchers found no differences in the mitochondrial DNA from North American pumas, and their microsatellites were “virtually indistinguishable,” NCI's Melanie Culver reported at the meeting. This suggests that only one kind of puma inhabits North America, rather than the 15 subspecies previously identified on the basis of where they live and differences in appearance. The DNA analyses also showed that only one subspecies lives in Central America and that just four others prowl South America. The NCI team found the most genetically diverse pumas in Paraguay and Brazil south of the Amazon River. This indicates that these populations are the oldest, dating back some 250,000 years, and that northward migrations

gave rise to the others over time, Culver adds.

The work is “a tour de force,” says Oliver Ryder, a geneticist at the Zoological Society of San Diego. Moreover, with North American pumas so closely related, zoos should be able to breed endangered Florida panthers with others from the continent without fear of contaminating the genome of that “subspecies,” notes geneticist James Womack of Texas A&M University in College Station. On the other hand, if the researchers hope to introduce more diversity into North American pumas, they will have to travel far afield for appropriate mates.

Whales and Hippos: Kissing Cousins?

Smooth, blubbery, and aquatic, whales and hippos look like plausible relatives. Now their DNA agrees. Based primarily on fossil comparisons, paleontologists had thought whales arose tens of millions of years ago from a hyena-like ancestor called a mesonychian. Over the past several years, however, comparisons of the genetic material of whales and other living mammals suggested that they belong instead among the even-toed ungulates, which include cows, deer, hippos, pigs, and camels. At the meeting two groups presented new molecular evidence that pointed to hippos, not cows or deer, as the closest cousins of sea-going mammals such as whales, porpoises, and dolphins.

Most molecular biologists try to sort out kinship between species by determining the degrees of difference in the same gene across species, then calculating the most plausible tree to fit them. But because whales, ruminants, and other close relatives, such as camels, have split apart so recently, their individual genes have few differences, making statistically significant results hard to get. So geneticist Norihiro Okada of the Tokyo Institute of Technology in Yokohama, Japan, and his colleagues used a different strategy.

They ferreted out “short interspersed repetitive elements,” or SINEs—bits of chromosomal DNA that at some point in history were transcribed into RNA and then, after being copied back into DNA, accidentally reincorporated in a new location in an organism's genome. Because these events

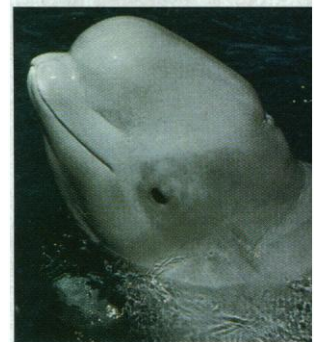
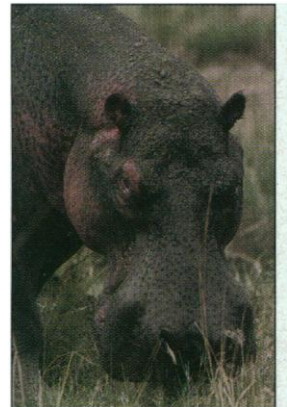
are rare and SINEs, which can be recognized by their distinct sequences, stay put once they get back into the genome, two species sharing a particular SINE at the same site must have a common ancestor.

In 1997, Okada showed that whales and ungulates, such as hippos, cows, and giraffes, share three SINEs, indicating that the species are related. Now, with almost twice as many SINE insertions in hand, the group has identified SINEs common to whales and hippos but not present in the cud-chewing ruminant branch of the ungulates, which includes cows and giraffes. Thus, they conclude that whales and hippos evolved from a hippolike ancestor that had split from the ruminants some 55 million years ago. (The results are in press in the *Proceedings of the National Academy of Sciences*.)

A more traditional comparison, but one that uses 8200 nucleotide bases from eight genes, not just a single gene, in two whale and 24 ungulate species, supports that conclusion. “Until now, no one had sequenced multiple genes to see what they can tell us,” says geneticist Conrad Matthee of Texas A&M University in College Station, who presented the work.

To geneticist Masatoshi Nei of Pennsylvania State University in State College, these data mean that the question of whale evolution has “finally been decided.” Not everyone is so sure, however. Anatomist and paleontologist Hans Thewissen at Northeastern Ohio Universities College of Medicine in Rootstown says that although the SINE data in particular make a “compelling argument” that whales and hippos are cousins, he is still “on the fence.” Even though Thewissen himself reported a fossil last year that weakened the ties of whales to the hyena-like mesonychian, he says more fossil evidence is needed to convince paleontologists that the molecules are telling the truth.

—ELIZABETH PENNISI



Relatives. Molecular data put hippos and whales on the same branch of the evolutionary tree.

CREDITS: (CLOCKWISE FROM LEFT) E. R. DEGGINGER/ANIMALS, ANIMALS, B. DAVIDSON/ANIMALS, ANIMALS, R. KOLAR/ANIMALS, ANIMALS