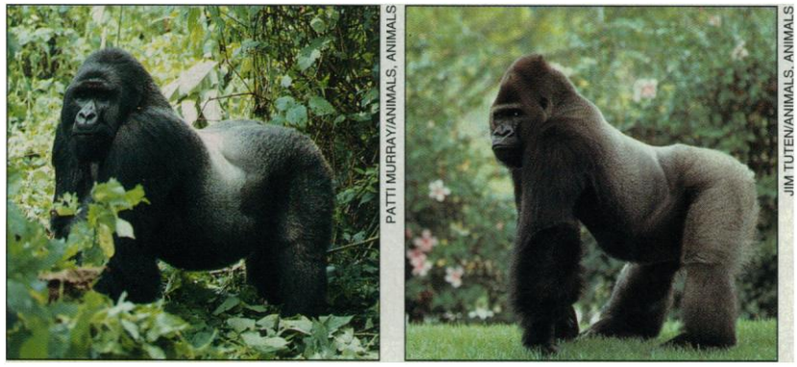
ANTHROPOLOGY

Will Primate Genetics Split One Gorilla Into Two?

To human eyes, our ape cousins look remarkably alike. But molecular anthropologists, probing the primate gene pool, are learning that appearances are indeed deceptive. New data indicate that members of the single gorilla species show a surprising degree of genetic variation—indeed, gorillas appear to be more distinct from one another than are members of the two established chimpanzee species. And some scientists suggest this may lead to the naming of a new gorilla species.

These new data were reported by Maryellen Ruvolo, a molecular anthropologist at Harvard University, and her colleagues in the 13 September issue of the *Proceedings of the National Academy of Sciences*. They found a striking genetic gap between the West African lowland gorilla (*Gorilla gorilla gorilla*) and the two eastern subspecies (G. *g. graueri* and G. *g. beringei*). And while Ruvolo's team is careful not to claim that a new species can be created on the basis of genetics alone, her data "do raise the possibility that there are two gorilla species," says Adrienne Zihlman, an anthropologist at the University of California (UC), Santa Cruz. "It tells us that we should look more closely at the animals' morphology, behavior, and ecology to see if there are differences we have missed."



Separated before birth? The western lowland gorilla *(right)* has enough genetic distance from the mountain gorilla *(left)* to suggest it might be a separate species.

This study didn't just examine gorilla DNA, however. Ruvolo also compared new DNA sequence data from several humans, chimpanzees, orangutans, and siamangs. Her findings support previous research showing that modern humans are remarkably less diverse genetically than are the great apes. "The most different humans on the face of the Earth are less different than two lowland gorillas from the same forest in West Africa," Ruvolo says. This lack of human diversity indicates a small ancestral population. And this raises anew the question of why "only a few hundred thousand years ago we were barely hanging on by our teeth, when the great apes were wildly successful," as anthropologist Henry Harpending of Pennsylvania State University puts it.

Ruvolo didn't set out to raise this question, but another one: Are chimpanzees more closely related to humans or gorillas? Previous studies, including one by Ruvolo, had largely concluded that the human-chimp link is the tightest bond. But some scientists are unconvinced. Among them is Jeffrey Rogers, a primate geneticist at Texas' Southwest Foundation for Biomedical Research. He contends that the genetic data leave open the possibility that chimps, gorillas, and humans parted ways at about the same time. "I know I'm squarely in the minority camp," says Rogers, "but I don't think we have sufficient data yet to resolve whether it was a two-way or three-way split."

Ruvolo attempted a resolution by examining mitochondrial DNA (mtDNA) from humans and the great apes. Mitochondria are cellular organelles, and their DNA is useful for tracking lineages because it is inherited from the mother and isn't scrambled during sexual recombination. The only changes in an mtDNA lineage come from spontaneous mutations, and—in the genes Ruvolo focused on—are estimated to occur at a steady rate of 0.8% per million years. By applying this rate to the differences between the mtDNA of different species, scientists can calculate the time that has elapsed since they diverged from a common ancestor.

Extending a study she began 3 years ago, Ruvolo looked at the sequence of the mtDNA cytochrome oxidase subunit II (*COII*) gene in apes and humans, examining several individuals of each genus. *COII* evolves fast enough to show differences, but not so fast that overlapping mutations, repeated over the course of time, drown out the actual number of mutational events that separate species. The differences in *COII* sequences indicated that gorillas separated from chimps and humans between 8 million and 10 million years ago. Humans and chimps, according to this calibration (and fossil evidence), separated about 6 million years ago.

But the data also contained a new twist: the genetic variation among gorillas. The West and East African gorilla populations are so different that, in an as-yet-unpublished study, Ruvolo calculated that the two groups have been separated for nearly 3 million years. That degree of diversity raises the possibility that the two gorilla populations might have evolved into separate species.

Only last month, geneticist Philip Morin from UC Davis and his colleagues made a similar suggestion about two subspecies of chimpanzee (*Science*, 26 August, p. 1172). But the issue is far from settled for either gorillas or chimps. Although the western and eastern gorillas are markedly different in their mtDNA, differences in nuclear genes also need to be determined, as well as distinct morphological and behavioral patterns.

One conclusion that is on firmer ground is the idea that, because gorillas are a genetically diverse bunch, they are descended from a large ancestral population. Ruvolo's studies also led her to a similar conclusion about orangs, siamangs, and chimps. Humans, however, are the odd species out. The mtDNA sequence data show that humans are very alike genetically, mirroring a 1980 finding from the late geneticist Alan Wilson's lab at UC Berkeley that relied on a less exacting method of genetic analysis.

The implication is that our ancestors went through a population crunch, which restricted the gene pool. Harpending, using a different method of mtDNA analysis, came to similar conclusions last year (*Science*, 1 October 1993, p. 27). "Our low amount of genetic diversity suggests that most of the populations that were alive 200,000 years ago didn't leave any descendants," says Harvard paleoanthropologist David Pilbeam, who is married to Ruvolo. "And the question then becomes, why? What caused the bottleneck? It's an issue that needs to be addressed." Ruvolo and others suspect that some great catastrophe occurred, but its nature remains unknown.

What is known is that Ruvolo's study still doesn't satisfy Rogers and others who argue that chimps, gorillas, and humans diverged at about the same time. "It's new, important data," Rogers says. "But until we see an unambiguous convergence between the mtDNA sequences and the nuclear DNA sequences [of humans and chimps], the issue is not closed." If that convergence happens, the split in opinions may disappear as well.

–Virginia Morell