different people's DNA. The DNA is first cut up in fragments using enzymes, then separated by size on a gel. The radioactively labeled Y chromosome probes are then hybridized, or bound to the fragments, marking various haplotypes—unique sections of DNA that are like genetic fingerprints of an individual or population.

In contrast to Lucotte, none of the other researchers now using DNA hybridization methods claims to be able to narrow Adam's heritage down to a single population. For example, Nathan Ellis and Peter Goodfellow at the Imperial Cancer Research Fund in London, using a systematic approach, surveyed one polymorphism on the Y chromosome of men from around the world. They found the same polymorphism among the !Kung bushmen of the Kalahari Desert, two different groups of pygmies, and Ethiopian Africans—but not in non-Africans or Bantu-speaking South Africans. From this data they tentatively concluded that the first father did live in Africa.

Although the DNA hybridization methods have gotten the field of Y chromosome work off to a running start, even the researchers who are using it admit there are drawbacks to using polymorphisms alone. "We don't know the molecular basis of these polymorphisms," admits University of Calabra geneticist Silvana Santachiara, who is part of an Italian team studying the Y with Lucotte's probes. "We know they concern a certain part of the Y chromosome, but it's impossible to use these polymorphisms to make an [evolutionary] tree of populations."

And an evolutionary tree of the male Y chromosomes is clearly what is needed. Yet there are problems: mainly, that no one knows where on the Y these polymorphisms occur when they use Lucotte's probes to find them, or whether they were even caused by the same mutation. The bands in the gels are a relatively crude measure of the DNA, because they don't give researchers the nucleotide sequence of the polymorphism or a specific site. And there's no guarantee that his probes are always pulling out sections of DNA from precisely the same site. The Y chromosome is not well characterized geneti-

Was Adam Very, Very Short?

Paris—Although the study of the Y chromosome as an evolutionary tool is still in its infancy, that hasn't deterred one researcher—Gérard Lucotte of the Collège de France in Paris—from using it to pinpoint "Adam," the genetic father of us all. According to Lucotte's formulation (which some other researchers think is a bit premature), Adam was a pygmy who lived 200,000 years ago in what is now the Central African Republic. His Garden of Eden, Lucotte argues, was a triangle situated between the Oubangui, the Sanga, and the Lobaye rivers in that country.

Lucotte took advantage of the world's first Y chromosome bank, created at the Pasteur Institute in Paris by molecular biologist Jean Weissenbach to examine DNA from populations around the world and to look for polymorphic markers: short regions of DNA that may differ by one or more nucleotides. Most of the regions, he found, did not vary much from one individual to another, probably because the Y chromosome has no homologous chromosome to recombine with—and therefore doesn't undergo much exchange of genetic material.

But Lucotte did identify some polymorphisms on the long arm of the Y chromosome, and he utilized them to develop a probe, called p49. With that probe, he was able to locate many polymorphisms and haplotypes (specific combinations of genetic sequences) in a region of the long arm, containing about 100 kilobases, which is designated Yq 11.2. This is probably a noncoding region of DNA: a region that does not carry the code for proteins and therefore is unaffected by evolutionary pressure—but which does accumulate chance mutations.

Lucotte's group used the p49 probe to examine the Y chromosome in a variety of different human populations—beginning with a French population sample. With Serge Hazout of Paris VII University, he then formulated a computer algorithm that retraced the most likely branching pattern for the haplotypes that had been identified in the population survey. The most likely ancestral haplotype, the computer program said, was one known as haplotype XIII.

The group then looked at the distribution of Y chromosome haplotypes in several African populations and found that haplotype XIII was most prevalent among the Aka pygmies. Lucotte was delighted that his genetic findings coincided with some anthropological results. "It seems remarkable," Lucotte told *Science*, "that pygmies, who together with South African bushmen, are believed to be the first inhabitants of the African continent, have a clear-cut dominance of one haplotype that our calculations had pinpointed as the ancestral one."

Other researchers, however, say Lucotte is out on a limb when he begins building evolutionary trees for male populations using his DNA probe data. The main problem is that too little is known about the polymorphisms Lucotte's probes fish out: Their precise location on the Y chromosome and their nucleotide sequences haven't been worked out. Only with that information—or at least some of it—can researchers guarantee that specific DNA sequences aren't, in fact, late intruders in evolution (see accompanying story). Lucotte's polymorphisms, several U.S. researchers say, are useful at this point only for comparing existing populations.

Those investigators are also skeptical about the most specific elements of Lucotte's Adamic history: its timing and precise geographic location. Lucotte acknowledges that his dating of the appearance of Adam at 200,000 years ago is not based on any information specific to the Y chromosome itself or to the rate at which it accumulates mutations—which is not known. Instead, he has simply accepted the date proposed by Allan Wilson and his colleagues at the University of California at Berkeley for the appearance of the mitochondrial Eve, "the mother of us all."

His identification of the southern tip of the Central African Republic, the area wedged between Zaire, Cameroon, and Congo that today is occupied by the Aka pygmies, is also arousing controversy among evolutionary specialists. Classical anthropologists—relying on fossil data rather than genes—have enough data to argue that the original home of humankind was a long way east of Lucotte's "Garden of Eden," somewhere along the Rift Valley of East Africa.

These questions probably won't be settled soon. But in the meantime, Lucotte is pressing on with his work on the Y chromosome. Recently he formed an "international consortium" to study p49 polymorphisms and haplotypes in different populations. His collaborators come from Tunisia, Australia, Japan, and South Africa, among other places. Perhaps, in time, a suitable genetic mate for "the mother of us all" will emerge from this collaboration. ■ ALEX DOROZYNSKI

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