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The Human Family Tree Has Become a Bush With Many Branches

By JOHN NOBLE WILFORD

Time was, fossils and a few stone artifacts were about the only means scientists had of tracing the lines of early human evolution. And gaps in such material evidence were frustratingly wide.

When molecular biologists joined the investigation some 30 years ago, their techniques of genetic analysis yielded striking insights. DNA studies pointed to a common maternal ancestor of all anatomically modern humans in Africa by at least 130,000 years. She inevitably became known as the African Eve.

Other genetic research plotted ancestral migration patterns and the extremely close DNA relationship between humans and chimpanzees, our nearest living relatives. Genetic clues also set the approximate time of the divergence of the human lineage from a common ancestor with apes: between six million and eight million years ago.

Fossil researchers were skeptical at first, a reaction colored perhaps by their dismay at finding scientific poachers on their turf. These paleoanthropologists contended that the biologists' "molecular clocks" were unreliable, and in some cases they were, though apparently not to a significant degree.

Now paleoanthropologists say they accept the biologists as allies triangulating the search for human origins from different angles. As much as anything, a rapid succession of fossil discoveries since the early 1990s has restored the confidence of paleoanthropologists in the relevance of their approach to the study of early hominids, those fossil ancestors and related species in human evolution.

The new finds have filled in some of the yawning gaps in the fossil record. They have doubled the record's time span from 3.5 million back almost to 7 million years ago and more than doubled the number of earliest known hominid species. The teeth and bone fragments suggest the form — the morphology — of these ancestors that lived presumably just this side of the human-ape split.

"The amount of discord between morphology and molecules is actually not that great anymore," said Frederick E. Grine, a paleoanthropologist at the State University of New York at Stony Brook.

With more abundant data, Dr. Grine said, scientists are, in a sense, fleshing out the genetic insights with increasingly earlier fossils. It takes the right bones to establish that a species walked upright, which is thought to be a defining trait of hominids after the split with the ape lineage.

"All biology can tell you is that my nearest relative is a chimpanzee and about when we had a common ancestor," he said. "But biology can't tell us what the common ancestor looked like, what shaped that evolutionary change or at what rate that change took place."

Although hominid species were much more apelike in their earliest forms, Tim D. White of the University of California, Berkeley, said: "We've come to appreciate that you cannot simply extrapolate from the modern chimp to get a picture of the last common ancestor. Humans and chimps have been changing down through time."

But Dr. White, one of the most experienced hominid hunters, credits the genetic data with giving paleoanthropologists a temporal framework for their research. Their eyes are always fixed on a time horizon for hominid origins, which now appears to be at least seven million years ago.

Ever since its discovery in 1973, the species Australopithecus afarensis, personified by the famous Lucy skeleton, has been the continental divide in the exploration of hominid evolution. Donald Johanson, the Lucy discoverer, and Dr. White determined that the apelike individual lived 3.2 million years ago, walked upright and was probably a direct human ancestor. Other afarensis specimens and some evocative footprints showed the species existed for almost a million years, down to three million years ago.

In the 1990s, scientists finally crossed the Lucy divide. In Kenya, Meave G. Leakey of the celebrated fossil-hunting family came up with Australopithecus anamensis, which lived about four million years ago and appeared to be an afarensis precursor. Another discovery by Dr. Leakey challenged the prevailing view that the family tree had a more or less single trunk rising from ape roots to a pinnacle occupied by Homo sapiens. Yet here was evidence that the new species Kenyanthropus platyops co-existed with Lucy's afarensis kin.

The family tree now looks more like a bush with many branches. "Just because there's only one human species around now doesn't mean it was always that way," Dr. Grine said.

Few hominid fossils have turned up from the three-million- to two-million-year period, during which hominids began making stone tools. The first Homo species enter the fossil record sometime before two million years ago, and the transition to much larger brains began with Homo erectus, about 1.7 million years ago.

Other recent discoveries have pushed deeper in time, closer to the hominid origins predicted by molecular biologists.

Dr. White was involved in excavations in Ethiopia of many specimens that lived 4.4 million years ago and were more primitive and apelike than Lucy. The species was named Ardipithecus ramidus. Later, a related species from 5.2 million to 5.8 million years ago was classified Ardipithecus kadabba.

At that time, six years ago, C. Owen Lovejoy of Kent State University said, "We are indeed coming very close to that point in the fossil record where we simply will not be able to distinguish ancestral hominid from ancestral" chimpanzees, because, he said, "They were so anatomically similar."

Two even earlier specimens are even harder to interpret. One found in Kenya by a French team has been dated to six million years and named Orrorin tugenensis. The teeth and bone pieces are few, though the discoverers think a thigh fragment suggests that the individual was a biped — a walker on two legs.

Another French group then uncovered 6.7-million-year-old fossils in Chad. Named Sahelanthropus

tchadensis, the sole specimen includes only a few teeth, a jawbone and a crushed cranium. Scientists said the head appeared to have perched atop a biped.

“These are clearly the earliest hominids we have,” said Eric Delson, a human-origins scientist at the American Museum of Natural History. “But we still know rather little about any of these specimens. The farther back we go toward the divergence point, the more similar specimens will look on both sides of the split.”

Other challenges arise from human evolution in more recent epochs. Just who were the “little people” found a few years ago in a cave on the island of Flores in Indonesia? The Australian and Indonesian discoverers concluded that one partial skeleton and other bones belonged to a now-extinct separate human species, Homo floresiensis, which lived as recently as 18,000 years ago.

The apparent diminutive stature and braincase of the species prompted howls of dispute. Critics contended that this was not a distinct species, but just another dwarf-size Homo sapiens, possibly with a brain disorder. Several prominent scientists, however, support the new-species designation.

The tempest over the Indonesian find is nothing new in a field known for controversy. Some scholars counsel patience, recalling that it was years after the discovery of the first Neanderthal skull, in 1856, before it was accepted as an ancient branch of the human family. Critics had at first dismissed the find as only the skull of a degenerate modern human or a Cossack who died in the Napoleonic wars.

Perhaps the analogy is not as encouraging as intended. Scientists to this day are arguing about Neanderthals, their exact relationship to us and the cause of their extinction 30,000 years ago, not long after the arrival in Europe of the sole surviving hominid that is so curious about its origins.