Leakey's new skull changes our pedigree and lengthens our past


Photos: Bob Campbell/National Geographic Society

East Rudolf it seems, like Olduvai, is destined to become an anthropological gold mine for the excavators of man's past. At Rudolf, as at Olduvai, some of the principal workers of the mine are members of the Leakey family. Last week in London, Richard E. Leakey announced the unearthing of a handful of fossil nuggets that, when fitted together, turned out to be "what is almost certainly the oldest complete skull of early man."

Since 1968 when the eastern shore of Lake Rudolf in Northern Kenya was first investigated, Leakey has been working there in an attempt to trace man's ancestry to its roots. Many anthropologists believe that *Australopithecus africanus* (a 3-million-year-old man-like creature) gave rise to *Homo erectus* (man's direct ancestor) only 1 million years ago. Leakey, like his late father, holds that *Homo* and *Australopithecus* had a common ancestral line from which *Homo* broke off about 4 million years ago (SN: 2/26/72, p. 133). *Homo* then lived as a contemporary of *Australopithecus* and eventually developed into *Homo sapiens* while *Australopithecus* died out.

Leakey with man's newest ancestor.

Last year Leakey and his co-workers found three jaw bones, leg bones and more than 400 manmade stone tools. The specimens were attributed to the genus *Homo* and were dated at 2.6 million years.

With this season's finds, Leakey and the expedition's co-leader, Glynn Isaac of the University of California at Berkeley, say "there is now clear evidence that in eastern Africa, a large-brained truly upright and bipedal form of the genus *Homo* existed contemporaneously with *Australopithecus* more than 2.5 million years ago." With this evidence, they say, "it seems certain that *Australopithecus,* as known, can be excluded from our known line of ancestry."

Richard Leakey's wife Meave and Alan Walker of the University of Nairobi pieced the skull together from hundreds of fragments found eroding from the side of a hill. The skull is different from *Homo sapiens,* says Leakey, but it is also different from all other known forms of early man and does not fit into any of the presently held theories of evolution. The brain, for instance, is large. It has a cranial capacity of about 800 cubic centimeters. The average cranial capacity of *Australopithecus* at that time was below 500 cm^3. That of modern man is about 1,500 cm^3. Leakey further described the whole shape of the brain case as remarkably reminiscent of modern man, lacking the heavy and protruding eyebrow ridges and thick bone characteristic of *Homo erectus.*

In addition to the as yet unnamed skull, the expedition turned up parts of the leg bones of two other individuals. These fossils surprisingly show that man's unique bipedal locomotion was developed at least 2.5 million years ago.

"What all this means," says J. Lawrence Angel, curator of physical anthropology at the Smithsonian Institution, "is that before 2.5 million years ago our ancestors had become different enough, through their use of culture [stone tools], from *Australopithecus* so that the two groups could co-exist in the same territory." This is a little difficult for some anthropologists to swallow. Evolutionary theory says it is impossible for two similar groups (having the same environmental and ecological needs) to live sympatrically. One would rapidly displace the other and evolution would go on with the more hardy group. Leakey's evidence suggests that the groups in question co-existed for more than 1 million years. "Some scientists don't like this degree of overlap, but it looks like they are going to have to put up with it now," says Angel.

Other questions can be raised. The intricate rebuilding of the skull, for instance, could be in error. Or, suggests Angel, the thin bones of the skull could be the result of disease. But Angel agrees with Leakey that the find is exciting. Perhaps most important is that it gives more time for the process of human evolution through selection than we thought we had. □

Lack of S waves tell of a liquid lunar core

Last week Gary Latham found what he has been waiting for for three years —seismic signals from a meteorite impact on the far side of the moon that allow him to "see" the moon's deep interior. (Latham, who recently joined the staff of the Earth and Planetary Sciences Division of the University of Texas' Marine Biomedical Institute in Galveston, is the principal investigator for four seismometers now operating at the Apollo 12, 14, 15 and 16 sites.)

This latest impact, says Latham, "is the most direct source of evidence for a molten segment in the core that we have yet had." (The impact actually occurred July 17, but because of delays at the Manned Spacecraft Center, Latham just analyzed the tapes last week.) Impacts cause two kinds of seismic waves—shear (S waves) and compressional (P waves). Shear waves cannot pass through liquid; P waves can. Latham says he sees P waves but definitely no S waves at stations 12, 14 and 16. The inference is that they were blocked by a liquid core. "We may see them at Apollo 15, but that would be expected since it is closest to the impact. The waves would not travel through the interior to get there."

Seismic evidence has been hinting at a core for some time now. Before the farside impact, the largest impact had been what Latham called the "whopper" (SN: 5/20/72, p. 328). From that event, Latham saw "hints" of core. Other hints come from moonquakes that occur about 800 kilometers to 1,000 kilometers in the interior. □

Time-reversed shadows from future passed

Time reversal is one of the basic symmetries of particle physics. If a movie could be made of a particle process, such as a photon producing a positron and an electron, and shown reversed, a physicist would see an electron and a positron coming together to form a photon, a perfectly plausible occurrence. From what he saw, he would have no way of knowing that the film had been reversed.

Time-reversal symmetry does not apply in other branches of physics. Take a film of Humpty Dumpty falling off the wall. If it is reversed so that the fragments come together to form Humpty Dumpty, and he flies up the wall, the smallest child will yell that he is being bamboozled. In most of the things we experience, the arrow of time, as it is called, is pointed firmly in the direction we call future.

It is possible to imagine, however, a universe in which the arrow of time is pointed opposite to ours. P. C. W. Davies of the Institute of Theoretical Astronomy in Cambridge, England, suggests in the Nov. 6 NATURE PHYSICAL SCIENCES that we do so in the context of a bouncing universe theory. In a bouncing universe theory the universe is always oscillating between one compact fireball and another. It leaves one fireball, expands to a certain size, collapses to another fireball *ad infinitum*. This gets rid of a serious problem of the ordinary big-bang theory, the zero point of space-time at the beginning. While theologians will accept a zero point (1,500 years ago in the *City of God* St. Augustine of Hippo made it explicit), physicists dislike it because they cannot deal with it.

Within a bouncing universe theory different cycles may come out with different physical laws. Davies suggests that alternate cycles have the arrow of time reversed. In the cycle subsequent to ours the arrow would be the reverse of ours. Inhabitants of the subsequent cycle would not know this; they would still see Humpty Dumpty falling off, not flying up, the wall. (The idea may drive some cosmologists up the wall, but that's another story.) A person outside both universes would be able to see the difference. What it means is that our future and theirs are both converging toward the same fireball. If they, by our lights, are subsequent to us, we, by their lights, are subsequent to them.

Davies suggests that there can be evidence of such a thing in the microwave background radiation that pervades our universe, the three-degree blackbody. Orthodox big-bang people regard this background as a leftover from the big bang, a relic of the past. Davies makes it come from the future. It is, he says, what is left of the background of starlight in the subsequent cycle that has been/will be compressed through the fireball stage and shifted from visible light to radio. He cites similarities between the energy density of the microwave background and the starlight that exists in our universe in support of the suggestion. □

Gobble, gobble, gobble, my mother's not a turkey

Every year about this time thousands of turkeys are trotted out, axed and turned into sacrificial lambs for the traditional Thanksgiving Day eating orgy. Most Thanksgiving gobblers are raised on turkey farms, but there are still many areas where wild turkeys live in natural woodland habitats and are hunted as game. One of the reasons wild turkeys are so plentiful is that they are carefully watched over in their natural habitat by the U. S. Department of Agriculture's Forestry Service.

One habitat research program at the Forestry Sciences Laboratory in Morgantown, W. Va., is aimed at determining what forest conditions will support wild turkey populations most efficiently. To find out, wildlife biologist Bill Healy studies the daily routines of real game birds under actual woodland conditions.

Under the best of conditions, however, bird watching is a rather time-consuming and inefficient method of data collection. Two birds in the bush, it seems, are not as readily observable as one turkey in in the hand. To get around this problem, Healy decided to become a mother to 66 turkeys.

While three batches of wild turkey eggs were being incubated, Healy mastered many of the wild turkeys' special sounds and gestures. Then he lived with each of the three broods, in turn, for the first four to five days after hatching. In this way he could offer

U.S. Forestry Service

Healy knows how to talk turkey.

each of the young birds the movement, sound and contact that would normally be provided by a natural mother. He simulated motherly contact, for instance, by warming the young turkeys in the pockets of his sweatshirt.

As a result of this early, personal care, the birds were imprinted to the scientist. This means they learned to follow his movements, respond to his calls and act tamely toward him without losing their wild nature. The birds that were not mothered by Healy within four days of birth could neither be handled nor worked with.

After one week of imprinting, the birds were so attached to Healy and the rest of the flock that they could be taken on walks in the woods without fear of their running off. Different aspects of flock behavior were monitored on daily excursions. Information on food eaten and eating rates was gathered in various woodland conditions.

Healy has learned much about his turkey family after only one season with them. The first 24 hours of life, he says, are the most important to a young turkey's progress with imprinting and learning. They learn fear and avoidance reactions within 12 hours of birth. They learn aggressive-submissive behavior and the sexual strut before two weeks of age. Turkeys give contentment calls when they are warm and well fed and distress calls when they are lost or injured. They begin to give the well-known gobble by the time they are two months old.

The young birds, Healy found, subsist on a diet of insects during the first two months of life. After that they extend their diet to include various forms of vegetation. This and other information gathered will be used to evaluate and improve turkey habitats and will be added to and verified next year when Healy again adopts and raises a brood of wild turkeys. □