Ancient ape suggests human, chimp lineage

Hungarian fossils of an ancient ape provide comparative data supporting the view that chimpanzees and humans are more closely related to each other than either one is to gorillas or any other living primate, contends a report in the Sept. 25 SCIENCE.

A majority of studies examining DNA and its molecular products in living primates conclude that humans and chimps form a distinct evolutionary lineage with a common ancestor that lived between 6 and 8 million years ago, although a substantial minority of molecular studies dispute that conclusion. Moreover, studies of modern and fossil primate skeletons suggest that the African apes lie within an evolutionary group separate from hominids, the evolutionary family that includes humans.

The Hungarian fossils provide an unusually good opportunity to gauge whether different groups of hominids and living apes share anatomical features of ancient or more recent origin, asserts anthropologist David R. Begun of the University of Toronto.

Begun and Lazlo Kordos of the Hungarian Geological Institute in Budapest reconstructed fossils uncovered about 20 years ago at a site known as Rudabanya. The specimens include large portions of two skulls, two pieces of upper jaw, four partial lower jaws, isolated teeth, and several fragments of bone from the lower body.

Begun assigns these specimens to the genus *Dryopithecus,* a fossil ape that lived in western and southern Europe between 9 million and 11 million years ago.

Dryopithecus and modern gorillas — but not chimps or fossils belonging to the first hominid genus, *Australopithecus* — share a number of features that apparently arose early in their evolutionary history, Begun says. These traits congregate in the lower part of the face and the teeth, especially the teeth at the front of the mouth, he asserts. *Australopithecus* and chimps share different facial and dental features that evolved from the *Dryopithecus*-gorilla pattern, Begun says.

Most attributes shared by gorillas and *Dryopithecus* also show up on specimens of *Ouranopithecus,* another ancient ape (SN: 6/23/90, p.390), he adds.

The evolutionary separation of *Australopithecus* and chimps from gorillas implies that anatomical traits occurring exclusively in chimps and gorillas, such as knuckle-walking, evolved independently, Begun says. Or, knuckle-walking may be the evolutionary endowment of an ancestor of apes and hominids, which disappeared in the latter group, he theorizes.

"Begun's conclusion doesn't surprise me," remarks anthropologist Steve Ward of Northeastern Ohio University College of Medicine in Rootstown. But the results remain tentative, he adds. "The jury is still out" regarding much of the facial anatomy of *Dryopithecus,* Ward cautions.

Fossil evidence currently cannot pin down the proper anatomical traits for comparison in a study such as Begun's, contends anthropologist Lawrence Martin of the State University of New York at Stony Brook.

Begun disagrees. *Dryopithecus* specimens from Rudabanya, which continue to emerge in ongoing excavations, offer insight into key areas of anatomical variation among apes and hominids, he says.

— B. Bower

First clear images of solar flux tubes

Using a new technique to examine the sun, a Swiss astronomer has obtained high-resolution images that reveal a solar surface covered with small-scale, magnetically active regions related to the more extensive sunspots.

Researchers have long theorized about the form and evolution of these features, called magnetic flux tubes, but have been unable to directly observe them in detail until now, says Christopher U. Keller of the Institute for Astronomy in Zurich. In the Sept. 24 NATURE, Keller announces the first simultaneous observations of the visible-light and magnetic-field signatures of flux tubes.

He obtained the images using a modification of an observing method known as speckle interferometry. The new technique should reveal details of the energy dynamics of the sun, which affect such things as radio communications and electrical power transmission on Earth, explains Carol Jo Crannell, a solar physicist at NASA's Goddard Space Flight Center in Greenbelt, Md.

Flux tubes represent concentrated regions of intense magnetic activity similar to that observed in sunspots (SN: 6/20/92, p.404). However, unlike the massive sunspots, whose diameters often span several thousands of kilometers, flux tubes reach less than a few hundred kilometers across. While these areas may account for more than 90 percent of the magnetic flux outside of sunspots, their small size has prevented researchers from directly observing them in detail, Keller says.

Turbulence in Earth's atmosphere blurs images of the sun, limiting the resolution of observations from ground-based telescopes. Traditionally, astronomers have eliminated some of this blurring in visible-light images by using speckle interferometry, which creates an image composed of many short exposures. By modifying this technique to include magnetic flux data, Keller observed individual flux tubes with diameters as small as 200 kilometers. He found that such small tubes correspond to previously observed bright spots on the solar surface, whereas many tubes larger than 300 kilometers in diameter appear darker than their surroundings. Keller notes that flux tubes seem to evolve rapidly, changing noticeably within 15 minutes.

He made his observations using the 50-centimeter Swedish Vacuum Solar Telescope at La Palma, in the Canary Islands.

Such findings may help astronomers determine the exact relationship between flux tubes and sunspots, says Douglas M. Rabin, an astronomer with the National Solar Observatory in Tucson, Ariz. Rabin says the new study represents "a promising line of investigation," which may finally verify theories that have been debated for decades.

— K. Hoppe

Fingering the right genes in development

Proteins called transcription factors serve as the sergeants of the genetic army. They tell genes when to turn on, when to turn off, and when to stand silently at attention.

Since the early days of molecular genetics, researchers have predicted that each transcription factor controls a separate platoon of related genes. If not, the scientists reasoned, the resulting army would have as many sergeants as soldiers — making for a very unwieldy state of affairs. However, no one could explain how transcription factors — which must match up to chemical similarities in their subordinate genes in order to function — could recognize and direct the activities of more than one gene.

Several recent studies now suggest that at least some types of transcription factors come in a variety of slightly different forms, with affinities for different genes. The newest report, in the Sept. 25 SCIENCE, indicates that a given type of transcription factor can vary during the development of an organism, turning some genes on and others off in successive stages of the organism's life.

A group of researchers led by Fotis C. Kafatos of Harvard University studied the gene that carries the blueprint for making the outermost layer, or shell, of a fruit fly egg. Kafatos — who also holds a position at the University of Crete in Greece — and his colleagues found that female embryos, pupae, and adult flies each possess

a different form of the transcription factor that regulates this gene. Males have yet another form of the same transcription factor, they discovered.

Kafatos' group had previously found that the transcription factor belongs to a class of proteins known as zinc fingers. These proteins, first discovered in 1985, consist of finger-like loops held together by zinc atoms. Each finger in these transcription factors recognizes and binds to a specific region of a gene's DNA.

Kafatos and his colleagues found that the eggshell transcription factor made by fruit fly pupae has one more zinc finger than do forms of the protein made during other stages of the fruit fly life cycle. Moreover, this pupal transcription factor does not bind to the same DNA sequences as the transcription factor produced by embryos or adults, the researchers found.

"The [eggshell transcription factor] protein has a different combination of zinc fingers at different developmental stages," concludes Tien Hsu, a member of the Kafatos group. He suggests that this finger-swapping ability allows such transcription factors to control more than one gene.

Stephen C. Harrison/NATURE

The loops of a zinc-finger transcription factor (top) bind to DNA.

Nick Hastie of the Medical Research Council Human Genetics Unit at the Western General Hospital in Edinburgh, Scotland, suggests that alterations in zinc-finger transcription factors may also underlie several cancers and developmental disorders. Earlier this year, he and colleagues described studies of the gene responsible for Wilms' tumor, an inherited kidney cancer in children.

In the July 10 SCIENCE, Hastie's team reported that the gene directs the production of two slightly different forms of a zinc-finger transcription factor. An earlier paper in the May NATURE GENETICS reported that different forms of this transcription factor can also cause birth defects of the kidneys and gonads.

– C. Ezzell

Greenland ice shows climate flip-flops

If the economy seems unpredictable, take a look at records of Earth's climate. New evidence gathered from deep within Greenland's glacial cap reveals that during the last ice age, temperatures in the North Atlantic region bounced from cold to warm and back again almost a dozen times in 30,000 years.

The recognition of such dramatic wobbles raises questions about the feasibility of predicting how the future climate will evolve, suggest Sigfus J. Johnsen and his colleagues, who performed the study. "If you are working with a system that is not acting in a very stable manner, then it becomes very difficult [to predict]," says Johnsen, a physicist with the University of Copenhagen in Denmark.

The new findings come out of the Greenland Ice Sheet Project (GRIP), an eight-nation European effort to drill straight through the thickest part of Greenland and collect ice cores containing climate clues (SN: 9/14/91, p.168). After four summers of drilling, the team reached bedrock in July at a depth of 3,028.6 meters. This is the longest ice core drilled to date, and it reaches farthest back in time. Preliminary studies suggest that ice from the bottom of the hole may date back 200,000 years.

Glaciers grow incrementally, with each year's snow falling on top of snow from the year before. As the layers accumulate, pressure causes the deeper layers to turn into solid ice, locking in details about climate.

Johnsen's team studied the ice core collected through the summer of 1991. Their samples date back 40,000 years, into the middle of the last ice age. The researchers tracked climate changes by measuring the ratio of oxygen-18 to oxygen-16, which indicates the air temperature at the time the snow fell.

Three previous ice cores drilled in Greenland had suggested that several warm periods, called interstadials, punctuated the most recent ice age, which lasted from about 100,000 years ago to 11,000 years ago. But many scientists questioned those findings because the ice collected in the three cores had flowed a considerable distance from where it originally fell as snow. Some researchers wondered whether this factor could produce the appearance of warmings in the ice record. Moreover, ice cores from Antarctica do not reveal strong evidence of ice-age warmings.

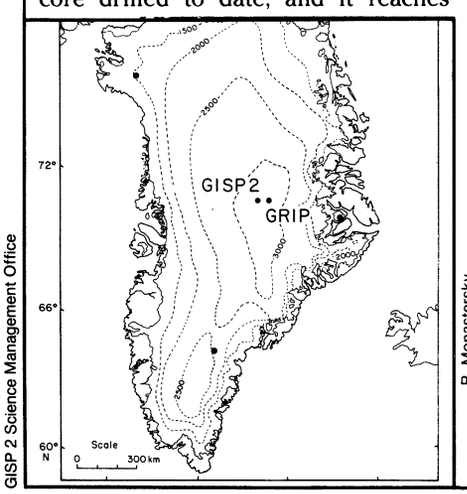
The new results from GRIP, however, provide definitive evidence that the interstadials did occur, Johnsen's group reports in the Sept. 24 NATURE. Questions about ice flow do not plague the GRIP results because this hole is at the summit of the ice cap, where there is little horizontal flow, the researchers say.

The oxygen isotope record shows that the warm interstadials developed quite abruptly, in some cases taking only a few decades to heat up 7°C. Lasting 500 to 2,000 years, the interstadials occurred at irregular intervals. The researchers suggest that the climate may have warmed when ocean currents in the North Atlantic rapidly changed direction or strength.

These results would seem to feed the concerns of some oceanographers, who have warned that a greenhouse warming in the next few decades could cause radical shifts in ocean currents. "If the current system of the ocean starts to change, we could have drastic changes in climate," says Johnsen.

But comparisons between an ice age and the present may be unwarranted because today's oceans may be much more stable than their ice-age counterparts, says David Peel of the British Antarctic Survey in Cambridge, who is working on GRIP. To match current conditions, he says, researchers must look at how the climate behaved roughly 110,000 years ago, during the warm period between two ice ages.

GRIP scientists will compare their findings with those from a U.S. team that is also drilling in central Greenland. The U.S. project did not reach bedrock as planned this summer because the cable supporting the drill wore out. U.S. researchers had to suspend drilling at a depth of 2,250 meters, but they plan to finish next year. *– R. Monastersky*



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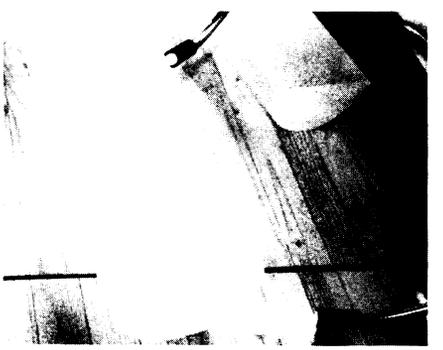

R. Monastersky

Light shines through ice core from GRIP. Map shows European and U.S. (GISP 2) drill sites. Dots show past drill sites.