UCSD scientists climb trees in Africa to learn more about family trees of chimpanzees

August 25, 1994

Hold for SCIENCE embargo:

3 P.M. Pacific Time, Thursday, August 25, 1994

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UCSD SCIENTISTS CLIMB TREES IN AFRICA TO LEARN MORE ABOUT FAMILY TREES OF CHIMPANZEES

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To construct family trees of humanity's closest living relatives, a team of biologists and anthropologists from the University of California, San Diego traveled to Africa where they climbed trees and branches in pursuit of genetic clues hidden in chimpanzee hair.

Their search and its results, described in the August 26 issue of the journal Science, represent the first study of genetic variation among wild chimpanzees.

UCSD biologists David S. Woodruff and Phillip A. Morin, and anthropologist Jim Moore, conducted the genetic studies to learn more about the evolutionary history and mating behavior of these endangered apes.

"Genetics tells a lot about the history of animals that we can apply to their conservation," said Phillip Morin, now a postdoctoral researcher with the anthropology department at UC Davis.

"We have to know what it is we are trying to conserve. Genetics tells us about the social structure of natural populations: how many males reproduce, how closely related animals in a group are, or whether females mate with males in their own or neighboring group.

"It also reveals the evolutionary relations between populations and subspecies across Africa."

As reported in Science, the study's important discoveries include:

* in a natural social community, males are more closely related to one another than are females. This supports the notion that kin selection accounts for the evolution of cooperative behavior among male chimpanzees;

* chimpanzees, like humans, are highly variable genetically --more so than previously thought. In fact, West African chimpanzees are so different from others that they may be considered a separate species.

This latter finding has significant implications for both conservation and biomedical research which, in the past, regarded all chimpanzees as the same species.

"This discovery suggests that some biomedical research based on chimps may have to be re-assessed," said Woodruff, a professor of conservation biology at UCSD.

In essence, the study relied on a method of obtaining DNA from hair that makes genetic analysis quicker, cheaper, easier and far less risky than previous methods that required blood or other tissue samples.

"When I heard one could obtain DNA from human hair, a light bulb went off in my head," said Woodruff. "I thought how easy it would be to do the same with endangered species, rather than having to go out and bleed them.

"At the time, I was working on rhinoceros genetics. Bleeding a rhino is a major undertaking."

Morin, who developed the noninvasive genotyping technique in Woodruff's lab, first applied it to chimpanzees in captivity and then in the Kasakela social community in Gombe National Park, Tanzania. The Gombe group were made famous for more than three decades of study by Jane Goodall, one of the article's co-authors. Goodall and her colleagues studied each individual chimpanzee, describing their behavior and relationships in detail and making discoveries that literally changed our ideas of what it means to be "human."

Here, paternity is a major issue since the females of the population tend to be promiscuous.

"Receptive females may mate many times a day with most of the adult males in their group," said Moore, an assistant professor of anthropology at UCSD. "The real fathers were unknowable prior to the development of this method."

Each evening at Gombe, Morin and Moore watched known individual chimps build their tree-top nests of folded branches and leaves. Chimps build new nests every night, and being hairy, tend to leave behind a few hairs. The following dawn, the researchers would return and climb up the tree to look for hair. Some nests were only 8-feet high; others were as high as 60-feet, on branches strong enough to support a chimpanzee, but not a man nearly twice that weight.

"It only took a few weeks to collect hair from every individual," said Moore.

Genetic analysis in the UCSD lab allowed the team to establish "probable paternity" and identify relationships among chimps. The studies showed that males of the colony were more closely related to each other than the females. This is important since the male chimps tend to be more cooperative than their female counterparts, especially in situations of conflict with other communities of chimpanzees--conflict sometimes likened to tribal warfare. According to Moore, the possibility that similar kinship-based conflict may have played an important role in human evolution is a topic of some debate in paleoanthropology.

"From an evolutionary sense, where the goal is to pass genes along, it doesn't make sense for chimpanzee males to fight with relatives carrying similar genes," said Morin. "There's no net benefit to competing, so that behavior is lost. Males cooperate to defend a large territory, thereby gaining access to more females than if they competed with each other."

Moore added that "the males probably are more closely related because they almost always remain in the community of their birth, whereas females usually leave home during adolescence. The result is that communities become defined by many generations of paternal relatives."

The new technique is an adaptation of the polymerase chain reaction (PCR), now used by researchers to make multiple copies of a gene, almost like a genetic "photocopier machine."

Since its invention in 1983 by Nobelist Kary B. Mullis, the technique has been applied to a variety of fields. Not only has it been used to diagnose genetic diseases, but it also has been valuable in forensics by permitting analysis of small bits of blood or tissue left at a crime scene.

Instead of analyzing the entire genetic pattern as is done with DNA fingerprinting, Morin isolated and multiplied specific gene segments. Working with hair from 20 sites across Africa, he focused on bits of DNA in the cell's mitochondria (which are passed along from mother to offspring). The results helped the researchers discover that chimpanzees, now classified into three subspecies according to geographical origin in Africa, might actually be two separate species.

Among other things, the researchers found that two of the subspecies--from East Africa and Central Africa--were quite similar. However, genetic material taken from a third subspecies, from West Africa, was quite different than the other two.

"This is a major discovery that suggests that West African chimpanzees have been isolated from the others for about 1.5 million years," said Woodruff. "The simple interpretation is that this is not a subspecies at all but a different species. However, this conclusion must be confirmed at a nuclear gene or two before anybody elevates this to a full-species status."

Moore noted that these discoveries have important implications for conservation. The West African subspecies historically has been the most heavily exploited for biomedical purposes, he said. During the last 40 years, many thousands have died because of the international demand. Combined with habitat changes and local hunting pressure, it is the most endangered of the three subspecies--probably no more than 10,000 remain in the wild. If it is indeed a separate species, the western chimpanzee may also be the most endangered species of great ape.

It also means, Woodruff said, that current National Institutes of Health research guidelines for treating the approximately 2,000 chimpanzees in the United States as genetically equivalent, "require re-assessment." The authors do not recommend "breaking up mismatched but long-bonded pairs," however.

Also participating in the study--supported by the National Science Foundation and the National Institutes of Health--were Ranajit Chakraborty and Li Jinn, population geneticists from the University of Texas Graduate School of Biomedical Sciences.

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EMBARGOED until 6 p.m., Eastern Time, Thursday, 25 August 1994. COURTESY VIDEO FROM THE JANE GOODALL INSTITUTE

This tape contains about 9 minutes of selections from tapes 231 and 232 of the Jane Goodall Institute video library, shot 20-29 May 1994 in Gombe. The Jane Goodall Institute provided this footage only for the purpose of illustrating news and feature coverage of the research article, "Kin Selection, Social Structure, Gene Flow, and the Evolution of Chimpanzees," by Phillip Morin, et. al, in the 26 August 1994 issue of Science. This is not stock footage.

Broadcast use of this tape must be credited "courtesy of The Jane Goodall Institute" (see reverse).

For more information, media should contact Janet Howard, UCSD University Communications, (619) 534-7572 or Carol Cruzan Morton, UC Davis News Service, (916) 7527704, conorton@ucdavis.edu.

Running

time Scene Description

0:00 [Bar and tone]

0:30 [Slate]

0:43 1 Two chimps mating

1:15 2 Small group grooming, etc.

1:55 3 Young chimps at play

2:19 4 One chimp making a nest in a tree; close-up of another chimp falling asleep

2:46 5 Sunrise, one chimp on ground below tree

3:06 6 Extra-long shot of chimp in tree; medium shot of same chimp eating

4:12 7 One chimp in tree looking out

4:32 8 One chimp running up, through and leaping from tree

5:02 9 One chimp follows grassy trail and sits looking at valley view

5:49 10 One chimp moving down hill through flowers, later eating leaves

7:35 11 Chimps moving though tall grass, over ridge

8:00 12 Group shots of grooming, etc.

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