Light My Fire: Cooking As Key To Modern Human Evolution

ScienceDaily (Aug. 10, 1999) — **MINNEAPOLIS / ST. PAUL--Fire provided the "spark" for modern human evolution, but not because it allowed our ancestors to eat meat. Rather, it was the ability to cook tuberous roots akin to carrots, potatoes and beets that caused hominids to turn a major evolutionary corner about 1.9 million years ago, according to anthropologists Richard Wrangham of Harvard University, Gregory Laden of the University of Minnesota and Harvard colleagues David Pilbeam, Jamie Jones and NancyLou Conklin-Brittain. The researchers will publish their hypothesis in an upcoming issue of Current Anthropology.**

The researchers link the advent of tuber cooking to changes in body size and tooth size that separated Homo erectus from earlier hominids such as australopithecines, of which "Lucy" is the most famous specimen. They said that tuber cooking could also have brought about basic changes in hominid social structure. The key word is cooking, not tubers.

"The process of human evolution had much to do with food and how it was prepared," said Laden. Australopithecines like Lucy had huge teeth suitable for chewing all day long, and males were much bigger than females. But 1.9 million years ago, things changed. Teeth got smaller, and both sexes increased in size. Females increased in size more than males, and so the size gap between the sexes shrank. Homo erectus had arrived, and cooking of tubers made the difference.

"We strongly suspect hominids began using fire about 1.9 million years ago, when Homo erectus appeared," said Laden. "The evidence for fire this early is a bit tenuous, but once word got out about our idea, we were contacted by colleagues working in East Africa who are about to publish very strong evidence for human-controlled fire at a very early date. In any event, fire wouldn't have worked as a 'spark' to evolution if roots hadn't already been in the diet."

According to Laden and his colleagues, both Lucy and Homo erectus ate tubers, but Lucy ate them raw. Thus, she and her australopithecine relatives had huge teeth and strong jaws. But with the advent of fire, hominids were able to cook tubers, which softened them, making chewing easier, and increased the amount of available nutrients. Teeth no longer had to be huge and suitable for constant chewing. Further, cooking allowed hominids to expand their diets. Many tubers are poisonous unless cooked, so cooking opened up new food sources. The use of tubers may have helped australopithecines expand their range from rainforest to savanna, where tubers were numerous. But cooking foods went beyond this, said Laden, and had profound effects on early human size and social behavior.

"On an evolutionary scale, male primates are limited in reproduction by access to females," said Laden, "but females are limited by access to resources." When cooking increased the supply of calories, females were

able to grow to a larger size. At the same time, a decrease in the male-female size difference signalled a change in mating systems.

"Highly polygynous mating systems, such as the harem system of gorillas or the promiscuous mating of chimps, are typically associated with males being much larger than females," said Laden. "When male and female mammals are close in size, pair bonding is the rule. So this change about 1.9 million years ago is probably best explained as a change in mating practices."

This social change is probably more important than, and was caused by, the expansion of the diet, Laden said. Cooking required changes in how food was prepared. Like living chimps, australopithecines would have eaten food on the spot whenever it was found. But cooking meant bringing food to a common site for processing, where other members of the group--including larger and more dominant individuals--could see it.

"We propose that cooking opens the door for theft, so among cooking hominids, there would have been cause to cooperate in new ways," said Laden. Females would have been vulnerable to theft by much larger males. This would have resulted in evolutionary pressure for females to form bonds with males, basing their choice on male willingness to cooperate in defending food stores rather than on male size. Laden and his colleagues believe this might have led to an important evolutionary novelty of humans: female sexual attractiveness.

Unlike humans, other female primates are sexually attractive only around the time of ovulation, as indicated by obvious physical and behavioral changes, Laden said. But women are generally attractive to males, and this is part of the process by which long-term bonds can form between individuals. This would have lessened the benefit many male mammals gain from direct competition for females in heat.

"We don't know if males or females invented cooking, or who did the cooking, but the kind of 'scramble' competition we see in primates would have made a cooking-based strategy impossible, while pair bonding and formation of a sort of family around a hearth would be a stable, evolutionarily sensible strategy," he said.

All these changes resulted in humans becoming a species that ate a wider variety of foods than their ancestors, formed more stable pair bonds and cooperated in cooking and defending food stores.

Laden and his colleagues believe, he said, that tooth size probably did not decrease as a result of meat eating, as some have suggested, because evidence from stone tools and butchered animal bones indicates that meat

eating appeared significantly earlier than tooth reduction. Also, significant changes in body and tooth size didn't result from the advent of cooking alone. Instead, it was the addition of roots to the cooking pot that did the trick.