HUMAN ORIGINS

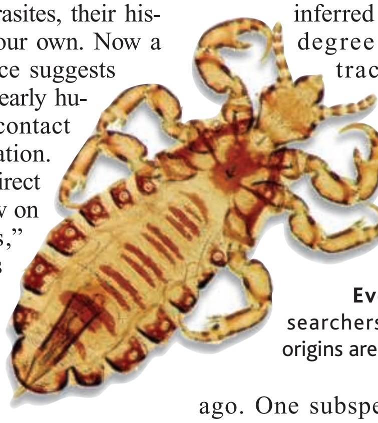
Louse DNA Suggests Close Contact Between Early Humans

Lice may be the bane of teachers trying to stop the parasites from leaping from head to head, but their persistent association with people is proving a boon to researchers probing modern human origins. Because lice are species-specific parasites, their history is thought to parallel our own. Now a genetic analysis of head lice suggests that two distinct species of early humans had close physical contact after a long period of isolation. "The work [gives] us an indirect but informative new window on modern human origins," says paleontologist Chris Stringer of the Natural History Museum in London.

Stringer and others have argued that our species, *Homo sapiens*, migrated out of Africa and quickly replaced other human species, such as *H. erectus* in Asia, without interbreeding. A competing theory, multiregional evolution, contends that modern humans appeared when *Homo sapiens* from different geographical regions mated with each other as well as with archaic *Homo* populations, blurring regional and species boundaries. A middle-ground proposal suggests that as modern humans from Africa spread across the globe, they interbred with archaic humans, but that only African genes persisted. After analyzing lice data, Dale Clayton, an evolutionary biologist at the University of Utah, Salt Lake City, says that the history of these pests best fits the third hypothesis.

For the work, Clayton and postdoc David Reed, now an evolutionary biologist at the University of Florida, Gainesville, compared mitochondrial DNA from lice, primarily *Pediculus humanus*, to existing data on human evolution. They analyzed six louse species, including two from humans, three from other primates, and one from a rodent. They used the sequences of two mitochondrial genes plus morphological traits to draw the louse family tree, which they then compared to the *Homo* tree.

Because lice never leave their human hosts, the lice data are "a completely independent line of evidence" that helps confirm human prehistory, says Clayton. For example, according to the parasite's DNA, lice specific to humans and lice specific to chimpanzees appeared 5.6 million years ago, confirming previous work suggesting that the ancestors of chimps and humans diverged at about this time, Reed, Clayton, and their colleagues report in the 5 October online *Public Library of Science*. The lice also suffered a dramatic population decline and then recovery about 100,000 years ago, a bottleneck that parallels the story inferred from human genes. "The degree to which [the louse] tracks human history [is] amazing," says Reed.



Evolutionary partner. Researchers itching to track human origins are turning to lice for answers.

CREDIT: VINCENT S. SMITH/UNIVERSITY OF GLASGOW

The data also revealed that two genetically distinct lineages of *P. humanus* appeared about 1.18 million years ago. One subspecies is now distributed worldwide and infects either the head or the body, whereas the other only inhabits the New World and only lives on scalps. Clayton argues that the two lice subspecies must have diverged at about the same time that two human lines—perhaps Asian *H. erectus* and the African ancestors of *H. sapiens*—became established. The fact that the lice grew so far apart genetically suggests that they had little or no contact with each other —which implies that their human hosts were also separated. Consequently, "long-term gene flow such as is envisaged in the multiregional model is ruled out from these data," says Stringer.

But the data do suggest that there must have been some contact among different kinds of early humans. Today, there is only one species of human—but two subgroups of lice. So the lice thought to have been living on *H. erectus* must have jumped to *H. sapiens* at some point before *H. erectus* went extinct, perhaps as late as 30,000 years ago. The researchers think the shift occurred through skin-to-skin contact, as might occur during fighting or sex.

Some researchers are convinced by this scenario. "The pattern they found is as clear as a bell," says anthropologist Henry Harpending of the University of Utah, who was not involved with the work. But Milford Wolpoff of the University of Michigan, Ann Arbor, author of the multiregional hypothesis, calls the new study a "fringe explanation." He notes that the divergence of the louse subspecies does not necessarily imply a million-year separation, because populations can diverge without isolation. He adds that the story "doesn't work at all with our studies," which he says indicate frequent contact between different archaic humans.

Clayton and Reed hope to pin down the question of contact among human species by studying the genetic history of lice transmitted almost exclusively through sexual intercourse. "If we get pubic lice, which are a different genus, and get the same results, then we would know that there is something very interesting going on," says Clayton.

–ELIZABETH PENNISI

RESEARCH COMMUNITY

Janelia Farm to Recruit First Class

Neuronal circuitry and imaging technologies will be the focus of the new Janelia Farm Research Campus of the Howard Hughes Medical Institute (HHMI). This week HHMI begins recruiting staff in these fields for its $500 million, 280-scientist institute in Ashburn, Virginia, scheduled to open in late 2006.

Janelia Farm director Gerald Rubin says he wants to recreate the close-knit feeling of legendary labs such as the Laboratory of Molecular Biology in Cambridge, U.K., where well-funded investigators free of grant-seeking pressures work in small groups (*Science*, 9 May 2003, p. 879). There will be at least one difference: Janelia will emphasize technology. Last week, a hardhat-clad Rubin showed off the vast concrete bays and corridors of Janelia's main building at a bucolic site along the Potomac River, about 64 kilometers from Washington, D.C. It could accommodate the largest nuclear magnetic resonance machine or microscope, but at this point, he says, "we have no idea what we're going to put in it."

To decide on Janelia's research focus, HHMI held five workshops earlier this year and asked scientific leaders to think about problems tough enough to require 100 people working for 10 years. The advisers ruled out areas such as membrane proteins, figuring that they could be studied at existing labs. But the "challenging" and "highly interdisciplinary" problem of how a fruit fly assesses motion and distance to land softly on a wall made the cut, Rubin says. So did building new optical and other microscopes for imaging subcellular structures and living systems.

One workshop participant, molecular biologist Eva Nogales of HHMI, the University of California, Berkeley, and Lawrence Berkeley National Laboratory, hopes Janelia's teams will devise new detectors ▸

Published by AAAS