SCIENCE & NATURE

Neanderthal Man

Svante Paabo has probed the DNA of Egyptian mummies and extinct animals. Now he hopes to learn more about what makes us tick by decoding the DNA of our evolutionary cousins.

By Steve Olson
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As a boy in Sweden, Svante Paabo read everything he could about ancient civilizations. After powerful North Sea storms uprooted trees, he begged his parents to take him to archaeological sites to look for potsherds and other artifacts. When he was 13, his mother, a food chemist in Stockholm, yielded to her son's most frequent request: to visit Egypt. "It was absolutely fascinating," he recalls. "We went to the pyramids, to Karnak and the Valley of the Kings. The soil was full of artifacts."

Paabo, 51, is still looking for artifacts, but in a very different place. He's a leader of the worldwide quest to explore the past by analyzing human DNA. He has helped show that human groups—southern Africans, Western Europeans, Native Americans—are closely related, despite superficial distinctions. He has been uncovering key genetic changes that helped transform our shambling, hirsute ancestors into the brainy bipeds we are today. This past summer, Paabo announced that he and his co-workers were going to take the next—and biggest—step, in their effort to resurrect the genome of the Neanderthal, our distant evolutionary cousin, who went extinct 30,000 years ago. The first scientist to analyze segments of DNA from Neanderthal bones, Paabo now wants to re-create the entire DNA sequence of a Neanderthal and compare it with our own, looking for the reasons that one evolutionary experiment failed and the other succeeded. "He really is a visionary," says Mary-Claire King, a geneticist at the University of Washington.

Paabo is director of the genetics department at the gleaming new Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany. But you'd never guess his heady position from his taste in clothes, which leans toward shorts and Hawaiian shirts. In his simply decorated office, he kicks off his clogs, folds his long legs under his angular body to perch on a sofa, and grins. "It is a wonderful time to be working in this field," he says.

Ever since the 1940s, when DNA was identified as the molecule that carries genetic information between generations, scientists have predicted that the study of genetics would yield great things, from drought-resistant crops to cures for genetic diseases. Recently, geneticists have realized that there is another way of looking at DNA—as a link to history. All of us inherited our DNA from our biological parents, who inherited it from their biological parents, and so on. Like an ancient manuscript that is copied and recopied with each generation, DNA bears tales from beyond memory. It also carries a unique time stamp: DNA is copied imperfectly, and these minor changes are passed from one generation to the next. Scientists can date these changes by comparing DNA among humans or between humans and other species. In this way, DNA connects us not only with our ancestors but also with the animals from which we evolved.

Paabo enrolled at the University of Uppsala, in 1975, to study Egyptology. But rather than excavate exotic archaeological sites, as he expected, he spent most of his time conjugating ancient Egyptian verbs. "It was not at all what I wanted to do." Soon he found himself in medical school, a route his biochemist father had also taken. Then he entered a PhD program in molecular immunology. Still, he couldn't shake his fascination with Egypt. "I knew about these thousands of mummies that were around in museums," he recalls, "so I started to experiment with extracting DNA." With the help of his old Egyptology professors, Paabo obtained skin and bone samples from 23 mummies. Working nights and weekends (Paabo was worried that his immunology professor would not approve of the project), he succeeded in extracting and analyzing a short segment of DNA from the 2,400-year-old mummy of an infant boy. In early 1985, he sent his results to Nature, one of the world's leading

professional at-bat.

Paabo also sent a copy of the manuscript to Allan Wilson, a molecular biologist at the University of California at Berkeley. Wilson had made headlines when he and his colleagues extracted a fragment of DNA from the remains of a quagga, a zebra-like creature that went extinct in 1883. After Wilson read Paabo's paper, he asked if he could go to Paabo's lab for a sabbatical. "I hadn't even finished my PhD!" Paabo says. Paabo wrote back with a counteroffer: Could he work in Wilson's lab?

Wilson, who died of leukemia in 1991 at the age of 56, "was one of the best people I've ever seen at generating ideas," says Mark Stoneking, who worked with Wilson in the 1980s and is now one of Paabo's colleagues at the institute. Stoneking helped Wilson establish the existence of "mitochondrial Eve"—a woman who lived in Africa about 200,000 years ago. The Berkeley scientists traced our ancestry to her by analyzing the DNA in mitochondria, parts of a cell that produce energy and operate somewhat independently of the rest of the cell. We inherit mitochondria through our mothers, grandmothers, great-grandmothers, and so on. By analyzing the mitochondrial DNA of people throughout the world, Wilson and his colleagues determined that the maternal lineages of everyone alive today converge on a single ancient woman.

Paabo, meanwhile, was developing new ways of extracting DNA from preserved specimens of extinct organisms, including moas (a giant flightless bird) and marsupial wolves. Others in Wilson's lab were trying to find DNA in fossilized plants and animals. In the acknowledgments of his 1990 novel *Jurassic Park*, author Michael Crichton gives part of the credit for his inspiration to Berkeley's Extinct DNA Study Group.

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