Journey of Man: A Genetic Odyssey

By Spencer Wells

By analyzing DNA from people in all regions of the world, geneticist Spencer Wells has concluded that all humans alive today are descended from a single man who lived in Africa around 60,000 years ago. Modern humans, he contends, didn't start their spread across the globe until after that time. Most archaeologists would say the exodus began 100,000 years ago-a 40,000-year discrepancy. Wells' take on the origins of modern humans and how they came to populate the rest of the planet is bound to be controversial. His work adds to an already crowded field of opposing hypotheses proposed by those who seek answers in "stones and bones"- archaeologists and paleoanthropologists - and those who seek them in our blood-population geneticists and molecular biologists.

Over the last decade, major debate on whether early humans evolved in Africa or elsewhere, when they began outward migration, where they went, and whether they interbred with or replaced archaic species has moved out of scientific journals and into the public consciousness. Wells addresses these issues in a new book, *The Journey of Man: A Genetic Odyssey*, and a National Geographic documentary of the same title. In a straightforward story, he explains how he traced the exodus of modern humans from Africa by analyzing genetic changes in DNA from the y-chromosome. "As often happens in science," he said, "technology has opened up a field to new ways of answering old questions-often providing startling answers."

Of course, not everyone agrees with him.

Search for Origins

The use of population genetics and molecular biology in human origins research has been extremely important in helping to resolve a long-running debate on where modern humans first evolved. According to the multi-regional model, an archaic form of humans left Africa between one and two million years ago, and modern humans evolved from them independently and simultaneously in pockets of Africa, Europe, and Asia. Wells's work and that of others confirms the more widely accepted Out of Africa model, which says that all modern humans evolved in Africa and then left in several waves of migration, ultimately replacing any earlier species.

"Genetic evidence tells us that Homo sapiens are of recent origin and arose in Africa," said S. Blair Hedges, a molecular biologist at Pennsylvania State University. "African populations have the most ancient alleles [gene pairs that code for specific traits] and the greatest genetic diversity, which means they're the oldest," Hedges explained. "Our species probably had arisen by 150,000 years ago, with a population of perhaps 10,000 individuals."

Chris Stringer, director of the Human Origins Program at the Natural History Museum in London, said: "The multi-regional model of Homo sapiens evolving globally over a long time scale is certainly dead." Whether archaic humans and modern humans interbred is another point of debate. "Given the uncertainties, it isn't yet possible to establish whether we are entirely recent African in origin-certainly my preference-or whether there was a little bit of hybridization/assimilation" between modern and archaic species," said Stringer.

Wells says there is no genetic evidence that supports the idea of intermixing, and several DNA studies actually argue strongly against it.

Journey of Man

Today, there is general agreement that Homo erectus, the precursor to modern humans, evolved in Africa and gradually expanded to Eurasia beginning about 1.7 million years ago. By around 100,000 years ago, several species of hominids populated the Earth, including H. sapiens in Africa, H. erectus in Southeast Asia and China, and Neandertals in Europe. By around 30,000 years ago, the only surviving hominid species was H. sapiens. But when did we leave Africa and where did we go? Here's where opinions diverge widely.

Wells says his evidence based on DNA in the Y-chromosome indicates that the exodus began between 60,000 and 50,000 years ago. In his view, the early travelers followed the southern coastline of Asia, crossed about 250 kilometers [155 miles] of sea, and colonized Australia by around 50,000 years ago. The Aborigines of Australia, Wells says, are the descendants of the first wave of migration out of Africa. Many archaeologists disagree, saying the fossil record shows that a first wave of migration occurred around 100,000 years ago.

"Archaeological evidence suggests that there were modern humans in at least two places in the Levant region of the Middle East 90,000 years ago," said Alison Brooks, a paleoanthropologist at George Washington University in Washington, D.C. "They disappear from the Levant about 10,000 years later, but could have survived further south in Asia-we just have no evidence."

"There's also evidence," she added, "of Homo sapiens in Australia 60,000 years ago, and they'd have to go through India and Southeast Asia to get there."
Wells agrees that there may have been early human forays into the Middle East, but argues that the Levant of 100,000 to 150,000 years ago was essentially an extension of northeastern Africa and was probably part of the original range of early Homo sapiens. These early settlers were replaced by Neandertals in the region about 80,000 years ago.

"There's a roughly 30,000-year gap in the archaeological record of Homo sapiens outside of Africa," said Wells. "The real expansion occurred in the Upper Paleolithic (around 40,000 years ago) into the uncharted territory of Asia proper." Brooks agrees there's a gap, but puts it closer to 20,000 years. Richard Klein, an anthropologist at Stanford University, has one explanation for the gap and the subsequent waves of colonization beginning around 45,000 years ago. Klein thinks Homo sapiens may have been anatomically modern 150,000 years ago, but did not become behaviorally modern until about 50,000 years ago, when a genetic mutation related to cognition made us smarter. He theorizes that this change in thinking ability enabled modern humans to craft sophisticated tools, build permanent lodgings, hunt more effectively, and possibly develop language. It also led to greater travel.

Other possible triggers for the burst of migration 45,000 years ago include an increase in population, which spurred competition and innovation; a change in diet, with consumption of more meat and fish; the acquisition of language; and climate change.

Populating the Globe

Wells says a second wave of hominids left Africa around 45,000 years ago, reproduced rapidly, and settled in the Middle East; smaller groups went off to India and China. Isolated by mountains and the sea for many generations, and exposed to a colder climate and less sunlight than in Africa, the Asian populations became paler over time. Around 40,000 years ago, as the grip of the Ice Age loosened and temperatures briefly became warmer, humans moved into Central Asia. Amid the bountiful grassy steppes, they multiplied quickly.

"If Africa was the cradle of mankind, then Central Asia was its nursery," said Wells. Around 35,000 years ago, small groups left Central Asia for Europe. Cold temperatures kept them there. Cut off from other groups, these migrants became paler and shorter than their African ancestors. From there, around 20,000 years ago, another small group of Central Asians moved farther north, into Siberia and the Arctic Circle. To minimize physical exposure to the extreme cold they developed, over many generations, stout trunks, stubby fingers, and short arms and legs. Finally, around 15,000 years ago, as another Ice Age began to wane, one small clan of Arctic dwellers followed the reindeer herd over the Bering Strait land bridge into North America.

According to the genetic data, says Wells, this initial group may have included as few as two or three men-perhaps 10 to 20 people in all. Also isolated, they too acquired distinct physical characteristics. Many archaeologists, however, believe that Australia, the Middle East, India, and China were inhabited much earlier. "The dates don't compare well to the order or the geography of the migration patterns revealed by the fossil record," said Brooks. "Y-chromosome data give consistently younger dates than other types of genetic data, such as mitochondrial DNA."

Hedges said that "the dates of expansion and colonization discussed by Wells may be correct, but they almost appear to be too recent. Most geneticists are getting data that agree with most archaeological and fossil data." He noted, however, that all of the different methods used for dating can generate errors.
"If you step back a bit and look at the bigger picture, there is a lot more agreement in this field today than there was a decade ago," Hedges said.

Common Ancestors

Wells's work is based on studies of DNA in the y-chromosome. The y-chromosome is a good candidate for population studies such as this because it doesn't recombine as other parts of the genome do (each parent contributes half of a child's DNA, which join together to form a new genetic combination). Thus, the y-chromosome is passed on as a chunk of DNA from father to son, basically unchanged through generations except for random mutations. These random mutations, which can happen naturally and be harmless, are called markers. Once a marker has been identified, geneticists can go back in time and trace it to the point at which it first occurred, which would be the most recent common ancestor. As in any scientific work, there are caveats.

The point at which a single common ancestor is found "can vary based on which gene you're looking at, the mutation rate, and population size, and on factors such as whether a bottleneck in the population occurred," said Sarah Tishkoff, a geneticist at the University of Maryland. "Natural selection also plays a significant role." There is another chunk of DNA that

also passes through generations relatively unchanged; it is found in a part of the cell called the mitochondria and is transferred from mother to daughter.

While the most recent male common ancestor identified through the y-chromosome lived 60,000 years ago, the most recent female common ancestor traced through mitochondrial DNA lived around 150,000 years ago. Whether an individual can be identified as our single common ancestor is open to debate.
"There's almost certainly not an Adam or Eve," said Tishkoff. "Each of our genes have their own history, which could be passed on from different ancestors. It's more likely that a lineage can be traced back to a population of 50, 100, or even several thousand people."

Others agree.

"The fact that one man apparently gave rise to the y-chromosome genes of all moderns does not mean he was our only male ancestor," said Stringer. "What it means is that his male progeny were more prolific breeders or luckier, and their Y genes survived while those of his contemporaries didn't. But those contemporaries could have passed on many other genes to present-day peoples."

That's "absolutely correct," said Wells, adding: "The real significance of the date of our common Y-chromosome ancestor, is that it effectively gives us an upper limit on when our species began to leave Africa." One point of wide agreement among those who study human origins is that more and more insight will come from closer collaboration between disciplines. "Greater discussion and collaboration between geneticists and paleoanthropologists would be good for both," said Stringer. "It's worth bearing in mind," he said, "that studies of recent DNA are studies of the genes of the survivors. Such studies can't tell us anything about non-survivors, such as the Neandertals and Solo Man in Java. We still require fossils, archaeology, and, where possible, ancient DNA for the whole picture of human evolution."

Wells's work described in Journey of Man draws on genetics, Palaeoanthropology, palaeoclimatology, archaeology, psychology, and linguistics. "I really see the field as a collaborative, synthetic effort to make sense of our past," he said. "The notion that any single area of investigation, operating in isolation, could have all the answers is ludicrous."

http://news.nationalgeographic.com/news/2002/12/1212_021213_journeyofman.html

Of lasting genes and lost cities of Tamil Nadu Papri Sri Raman
(Indo-Asian News Service)
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http://www.hindustantimes.com/

India's East Coast, especially along Tamil Nadu, is increasingly drawing the attention of archaeologists and anthropologists from across the world for its evolutionary and historical secrets. The focus has sharpened after genetic scientist Spencer Wells found strains of genes in some communities of Tamil Nadu that were present in the early man of Africa.

In the "Journey of Man" aired by the National Geographic channel, Wells says the first wave of migration of early man from Africa took place 60,000 years ago along the continent's east coast to India. Genetic mapping of local populations provided the evidence. RM Pitchappan, a professor of Madurai Kamaraj University in Tamil Nadu, helped Wells collect the gene evidence from Tamil Nadu's Piramlai Kallar people, inhabiting the Madurai and Usilampatti areas 500 km south of Chennai. Their genes have the amino acid bands found in the gene map of the original man from Africa.

Says Pitchappan: "The ancestors of the Kallar community may have come into India from the Middle East." Wells believes there were three waves of migration that early man undertook. According to him and his Indian collaborator, early man went from Africa to the Middle East, on to Kutch on India's west coast, all the around to the peninsula's east coast and then on to Australia. Pitchappan, who heads the immunology department at Madurai Kamaraj University, has found that the gene markers M130 seen in man 50,000 years ago and M20 seen in man of 35,000 years ago are present in the Kallars and several other local people of Tamil Nadu. Some of the markers are common to the Kallars and the Yadava populations of the Saurashtra coast in Gujarat. And the M172 markers found in some Tamil Nadu populations are also found in the people of Pakistan's Balochistan province and M17 in some populations of Central Asians.

"These gene pools are unique and very accurately map the path a population has taken, leaving behind original communities to grow into independent groups but with a common ancestor," explains Pitchappan. It is not only the study of Wells and Pitchappan that has focused scholars' attention on India. A British marine archaeologist, Graham Hancock, has been examining a submerged city on the East Coast.

Hancock says a civilisation thriving there may predate the Sumerian civilisation of Mesopotamia in present-day Iraq and definitely existed before the Harappan civilisation in India and Pakistan. Hancock has been excavating the site off the coast of Poompuhar, near Nagapattinam, 400 km south of Chennai. At a meeting of the Mythic Society in Bangalore in early December, Hancock said underwater explorations in 2001 provided evidence that corroborated Tamil mythological stories of ancient floods. He said tidal waves of 400 feet or more could have swallowed this flourishing port city any time between 17,000 and 7,000 years ago, the date of the last Ice Age. The Gulf of Cambay was also submerged, taking with it evidence of early man's migration.

The populations Wells and Pitchappan mapped settled on India's East Coast 50,000 to 35,000 years ago and developed into modern man. According to Hancock, "the Poompuhar underwater site could well provide evidence that it was the cradle of modern civilisation." Hancock's theory is strengthened by findings of India's National Institute of Oceanography (NIO), which has explored the site since the 1980s. Man-made structures like well rims, horseshoe-shaped building sites are some of the lost city's secrets. At low tide, some brick structures from the Sangam era are still visible in places like Vanagiri. The region, archaeologists say, has been built over and over again through the ages and some of its past is now being revealed.

Glenn Milne, a British geologist from Durham University, has confirmed Hancock's theory. The American Learning Channel and Britain-based Channel 4 have funded Hancock to

make films of the site, in collaboration with the NIO. The areas of archaeological interest are Tranquebar and modern Poompuhar.

The Archaeological Survey of India (ASI) is now beginning excavations in another site, about four kilometres from Pondicherry, in a place called Arikamedu. This was an ancient port town on the banks of the river Ariyankuppam.

Archaeologists Mortimer Wheeler and JM Casal first found artefacts in this area in the 1930s and 1940s, says historian M. Mathew, former head of Pondicherry University's department of history. Vimala Bagley, a US-based historian, has also done research in the early 1990s on the Pondicherry coast's maritime links with Greco-Roman empires. The ASI is in the process of acquiring 10 acres of land where the site, now privately owned, lies. The Pondicherry government too is planning to develop the area as a major tourist attraction that can be accessed by boat.

http://www.raceandhistory.com/cgi-bin/forum/webbbs_config.pl/noframes/read/1242