

No, a genetic study didn't pinpoint the ancestral homeland of all humans

Enlarge / 200,000 years ago, parts of the Kalahari Desert in southern Africa looked a lot like the Okavango Delta in Botswana.

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A study published in the prestigious scientific journal *Nature* earlier this week supposedly determined that a particular region of southern Africa gave rise to modern humans 200,000 years ago. But, shockingly, it turns out that a single genomic study can't instantly resolve one of the biggest questions in human evolution.

The *Nature* paper's claim has drawn criticism from people in the field, in part because it contradicts a heap of other evidence—and it doesn't offer any explanation. And the actual emergence of our species is much older, much messier, and much more interesting.

Is this the homeland of modern humans?

Geneticist Eva Chan of the Garvan Institute of Medical Research in Australia and her colleagues say that mitochondrial DNA can be used to trace the origins of modern

humanity to an area spanning the borders of Botswana, Namibia, and Zimbabwe. This place is a dry landscape dotted with salt pans that hint at a former wetland paradise. Because mitochondrial DNA is passed directly from mother to child, the study claims that this is where the maternal ancestors of modern humans—6,500 generations removed—once lived.

DNA mutates over time, and those changes build up at a predictable rate, so geneticists can compare genomes and calculate when they last shared a common ancestor. That's true for mitochondrial DNA (mtDNA for short) just as it is for the much larger genome carried by our chromosomes.

The oldest mitochondrial lineage that we know of is called L0, and some of its oldest branches are now found mostly in people who live in southern Africa. Chan and her colleagues used mtDNA genomes from about 1,200 people with the L0 lineage and used the results to build a "family tree." This tree calculated when each branch of the L0 lineage split off—in other words, every time a group of women moved away from the rest of their maternal relatives.

According to Chan and her colleagues, the oldest branches of L0 formed between 165,000 and 240,000 years ago. Their findings also assert that two major branches split off around 130,000 years ago and 110,000 years ago, respectively (there are lots of smaller branches involved, but we can focus on the big ones).

But the researchers wanted to know where (not just when) early humans moved around. So they mapped where each branch of the mtDNA "family tree" (which scientists call haplogroups) showed up in people living today.

The oldest branches, it turned out, were found mostly in indigenous Khoisan people living south of the modern Zambezi River, in what's now called the Kalahari region. Two hundred thousand years ago, paleoclimate records suggest that the area

was a lush wetland mostly surrounded by less-inviting arid brushland. We now call this region Makgadikgadi. People whose mtDNA belonged to the haplogroups that branched out 130,000 years ago mostly came from northeast of that region, and people with mtDNA from the 110,000-year-old haplogroups mostly came from southwest of the Zambezi basin, along the western coast of South Africa.

Chan and her colleagues suggest that changing climates opened corridors of rainfall and vegetation that enabled people to start migrating out of the Zambezi “homeland” around 130,000 years ago.

There are some bones of contention

That’s a clear, simple story, and simple explanations always hold a certain appeal. But this story ignores mountains of fossil, archaeological, and genetic evidence that *Homo sapiens* has been around much longer than 200,000 years and didn’t actually originate in a single region of southern Africa. (Oops.)

“Although it’s been touted as interdisciplinary, [the paper] ignores the swathe of fossil and archaeological evidence that supports an older origin for our species,” paleoanthropologist Eleanor Scerri, of the Max Planck Institute for the Science of Human History, told Ars.

The earliest fossil from a member of our species may be about 300,000 years old, and it comes from a site called Jebel Irhoud in Morocco. That lines up well with genetic evidence, which suggests that our species as we know it first evolved between 260,000 and 350,000 years ago in Africa. Until fairly recently, it was thought that we didn’t appear on the scene until 220,000 years ago, and the oldest fossil dated to just 195,000 years ago in eastern Africa. But the more evidence we get, the more we construct a picture of our species emerging sooner, and going farther faster, than we gave ourselves

credit for.

Fossils from Misliya Cave in Israel show that *Homo sapiens* had spread as far as the Levant by 177,000 years ago, and human fossils from Israel's Skhul Cave and Qafzeh date to around 120,000 years ago. That initial foothold seemed to falter, since the humans living at some of those Levantine areas appear to have been replaced by Neanderthals. Our spread throughout the world seems to have begun in a series of fits and starts, probably driven by changing climates.

Again, ours is a complicated story, and that's part of what makes it interesting. Recently, a fossil finger bone found eroding out of the dry sediments of the Saudi Arabian desert turned out to be from a human who lived there around 87,000 years ago.

By the time Chan and her colleagues claim that modern humans were just venturing northeast from our wetland sanctuary, the fossil record says we were already trying to make a living in caves in the Levant.

The story is always more complicated

To be fair, the humans who lived at Jebel Irhoud 300,000 years ago probably didn't look exactly like modern people anywhere. Different groups of early humans, scattered around the continent of Africa, had different combinations of "modern human" features. But, in all likelihood, nobody had the full set of physical traits that we think of as defining modern humans until between 100,000 and 40,000 years ago.

Based on genetic and fossil evidence, it seems most likely that that combination of traits took shape gradually, as diverse groups of early humans scattered around Africa interacted with each other over a few hundred thousand years.

“Is there even any point in attempting to identify a specific locale of origin given that this is unlikely to tell the whole story?” asked archaeologist Patrick Roberts of the Max Planck Institute for the Science of Human History.

University of Wisconsin paleoanthropologist John Hawks suggested that the study might still contribute a piece of the larger story of human origins. “This new evidence from mtDNA is useful, and maybe it tells part of the story. It may give us some of the best reason so far to think that southern Africa played a key role in the earliest evolution of humans,” he told Ars. “But it’s too soon to say whether that is the original homeland of humans or whether there was a broader involvement of much of the continent.”

DNA studies aren’t always the perfect tool

Part of the problem is the study’s emphasis on mtDNA, which can only tell part of the story. In particular, mtDNA only tells you about half of your ancestry for each generation, and it changes rapidly enough that things become difficult to resolve if you go back far enough in time. mtDNA can still be useful for answering really broad questions; in the 1980s, for example, geneticists determined that African mtDNA lineages were substantially older than Eurasian mtDNA lineages, which helped settle the debate about whether humans had originated in Africa or all over the Old World. And it’s useful for tracking aspects of population movements over a few centuries or a few thousand years.

Over hundreds of thousands of years, however, mtDNA is not the best tool for trying to pinpoint really fine details of population dynamics. “The ancestors of [these] mitochondrial lineages were not the only people living in Africa at this time, and they may not necessarily have even transmitted the rest of their nuclear DNA,” Scerri told Ars. “The analogy I

used was that reconstructing these ancestries from mtDNA is like trying to reconstruct a dead language from a couple of words, whereas using the genome or nuclear DNA is like listening to a language being spoken for a day, for example.”

And DNA from living people can’t necessarily tell you much about the past, in any case. One thing that population genetics has made clear in recent years is that people have always moved around—and we know that because of studies that involved both ancient and modern genomes.

“Most researchers in the field use nuclear DNA, which contains a huge amount of information, and particularly ancient nuclear DNA recovered from old bones, because people today don’t tell us much about the ancient past (people move, populations mix, etc.),” archaeologist Huw Groucutt, of the Max Planck Institute for the Science of Human History, told Ars. “The data from this kind of research does not suggest that humans evolved in one small part of Africa!”

Of course, Chan and her colleagues couldn’t have done that, because the environment in most of Africa isn’t great for preserving DNA. So the oldest DNA sequenced from the continent so far is around 15,000 years old. That’s why human origins studies need to combine genetics with fossil and archaeological evidence.

“No single source of evidence is going to answer the questions about human evolution,” Scerri told Ars. “We need to have a combined approach, because all data is partial.”

There are no evolutionary relics

Chan and her colleagues contend that many of the Khoisan groups in their study actually haven’t moved around much in the last 200,000 years. “It’s almost physically impossible for people to have come across the Zambezi, run all the way back, and landed up in southern Africa not leaving any signatures

behind anywhere,” said Garvan Institute geneticist Vanessa Hayes, a co-author of the homeland study.

(There are good examples of exactly that happening, at least relatively recently in human history.)

Even if Chan and her colleagues are correct, however, there are some major problems with the idea that any group of modern people represents the roots of the human family tree. People may infer that the “roots” might be less evolved, or more primitive, than the later branches—that’s both inaccurate and may be harmful to the people involved. Every group of people alive today has been subject to the same 300,000 years of evolutionary pressure, and no group of people alive today looks or behaves exactly like people looked and behaved 300,000 years ago.

“To call any population today a basal branch is like saying they’re a bunch of primitives,” Scerri told Ars. “They’re not evolutionary relics who have neither changed nor moved geographically for either tens or hundreds of thousands of years.” Framing them that way could do real harm, especially given that racism is still a powerful force and indigenous hunter-gatherers’ legal rights to their land and way of life—not to mention their privacy and self-determination—are by no means guaranteed.

It shouldn’t be surprising that a study based mostly on a single type of data can’t fill in all the gaps in the story of human origins. These are large, complicated questions, and while we have more of a narrative than we had 20 years ago, no single method, let alone a single study, is ever going to tie it all up with a neat bow. We’re a complicated species, and we always have been, so we should be skeptical of answers that sound too simple.

But we should also keep asking the questions. “I think it’s something that fascinates all humans,” Hayes said. “If we want

to really understand our future, we need to understand our past and who we are and where we all come from.”

Nature, 2019. DOI: 10.1038/s41586-019-1714-1 (About DOIs).

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