New research raises doubts about whether modern humans and Neanderthals interbred

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Homo neanderthalensis, adult male. Credit: John Gurche, artist / Chip Clark, photographer

New research raises questions about the theory that modern humans and Neanderthals at some point interbred, known as hybridisation. The findings of a study by researchers at the University of Cambridge suggests that common ancestry, not hybridisation, better explains the average 1-4 per cent DNA that those of European and Asian descent (Eurasians) share with Neanderthals. It was published today, 13 August, in the journal *PNAS*.

In the last two years, a number of studies have suggested that modern humans and Neanderthals had at some point interbred. Genetic evidence shows that on average Eurasians and Neanderthals share between 1-4 per cent of their DNA. In contrast, Africans have almost none of the

Neanderthal genome. The previous studies concluded that these differences could be explained by hybridisation which occurred as modern humans exited Africa and bred with the Neanderthals who already inhabited Europe.

However, a new study funded by the BBSRC and the Leverhulme Trust has provided an alternative explanation for the genetic similarities. The scientists found that common ancestry, without any hybridisation, explains the genetic similarities between Neanderthals and modern humans. In other words, the DNA that Neanderthal and modern humans share can all be attributed to their common origin, without any recent influx of Neanderthal DNA into modern humans.

Dr Andrea Manica, from the University of Cambridge, who led the study said: "Our work shows clearly that the patterns currently seen in the Neanderthal genome are not exceptional, and are in line with our expectations of what we would see without hybridisation. So, if any hybridisation happened - it's difficult to conclusively prove it never happened - then it would have been minimal and much less than what people are claiming now."

Neanderthals and modern humans once shared a common ancestor who is thought to have spanned Africa and Europe about half a million years ago. Just as there are very different populations across Europe today, populations of that common ancestor would not have been completely mixed across continents, but rather closer populations would have been more genetically similar to each other than populations further apart. (There is extensive genetic and archaeological evidence that population in Africa were 'structured'; in other words, different populations in Africa only had limited exchange through migration, allowing them to remain distinct from each other both in terms of genetics and morphology.)

Then, about 350-300 thousand years ago, the European range and the African range became separated. The European range evolved into Neanderthal, the African range eventually turned into modern humans. However, because the populations within each continent were not freely mixing, the DNA of the modern human population in Africa that were ancestrally closer to Europe would have retained more of the ancestral DNA (specifically, genetic variants) that is also shared with Neanderthals.

On this basis, the scientists created a model to determine whether the differences in genetic similarities with Neanderthal among modern human populations, which had been attributed to hybridisation, could be down to the proximity of modern humans in northern Africa (who would have later gone on to populate Europe) to Neanderthals.

By examining the different genetic makeup among modern human populations, the scientists' model was able to infer how much genetic similarity there would have been between distinct populations within a continent. The researchers then simulated a large number of populations representing Africa and Eurasia over the last half a million years, and estimated how much similarity would be expected between a random Neanderthal individual and modern humans in Africa and Eurasia.

The scientists concluded that when modern humans expanded out of Africa 60-70K years ago, they would have brought out that additional genetic similarity with them, making Europeans and Asians more similar to Neanderthals than Africans are on average – undermining the theory that hybridization, and not common ancestry, explained these differences.

Dr Manica added: "Thus, based on common ancestry and geographic differences among populations within each continent, we would predict out of Africa populations to be more similar to Neanderthals than their

African counterparts - exactly the patterns that were observed when the Neanderthal genome was sequenced; but this pattern was attributed to hybridisation. Hopefully, everyone will become more cautious before invoking hybridisation, and start taking into account that ancient populations differed from each other probably as much as modern populations do."

More information: Effect of ancient population structure on the degree of polymorphism shared between modern human populations and ancient hominins, *PNAS*, August 13, 2012.

Provided by University of Cambridge