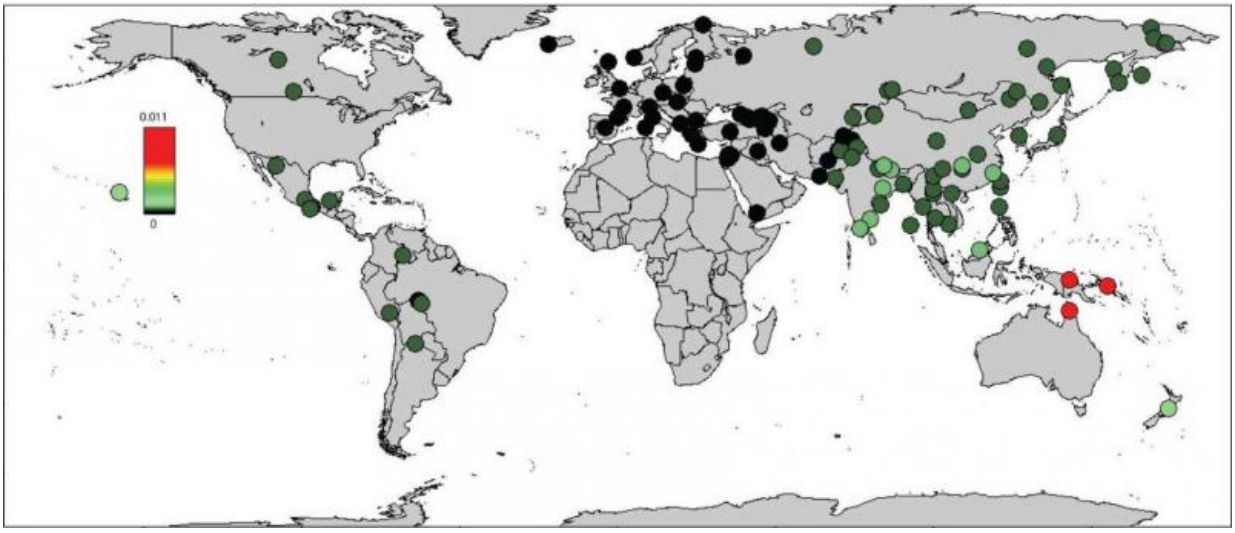
A world map of Neanderthal and Denisovan ancestry in modern humans

March 28 2016



This map shows the proportion of the genome inferred to be Denisovan in ancestry in diverse non-Africans. The color scale is not linear to allow saturation of the high Denisova proportions in Oceania (bright red) and better visualization of the peak of Denisova proportion in South Asia. Credit: Sankararaman et al./Current Biology 2016

Most non-Africans possess at least a little bit Neanderthal DNA. But a new map of archaic ancestry—published March 28 in *Current Biology*—suggests that many bloodlines around the world, particularly of South Asian descent, may actually be a bit more Denisovan, a mysterious population of hominids that lived around the same time as the

Neanderthals. The analysis also proposes that modern humans interbred with Denisovans about 100 generations after their trysts with Neanderthals.

The Harvard Medical School/UCLA research team that created the map also used comparative genomics to make predictions about where Denisovan and Neanderthal genes may be impacting modern human biology. While there is still much to uncover, Denisovan genes can potentially be linked to a more subtle sense of smell in Papua New Guineans and high-altitude adaptions in Tibetans. Meanwhile, Neanderthal genes found in people around the world most likely contribute to tougher skin and hair.

"There are certain classes of genes that modern humans inherited from the archaic humans with whom they interbred, which may have helped the modern humans to adapt to the new environments in which they arrived," says senior author David Reich, a geneticist at Harvard Medical School and the Broad Institute. "On the flip side, there was negative selection to systematically remove ancestry that may have been problematic from modern humans. We can document this removal over the 40,000 years since these admixtures occurred."

Reich and lab members, Swapan Mallick and Nick Patterson, teamed up with previous laboratory member Sriram Sankararaman, now an Assistant Professor of computer science at the University of California, Los Angeles, on the project, which found evidence that both Denisovan and Neanderthal ancestry has been lost from the X chromosome, as well as genes expressed in the male testes. They theorize that this has contributed to reduced fertility in males, which is commonly observed in other hybrids between two highly divergent groups of the same species.

The researchers collected their data by comparing known Neanderthal and Denisovan gene sequences across more than 250 genomes from 120

non-African populations publically available through the Simons Genome Diversity Project (there is little evidence for Neanderthal and Denisovan ancestry in Africans). The analysis was carried out by a machine-learning algorithm that could differentiate between components of both kinds of ancestral DNA, which are more similar to one another than to modern humans.

The results showed that individuals from Oceania possess the highest percentage of archaic ancestry and south Asians possess more Denisovan ancestry than previously believed. This reveals previously unknown interbreeding events, particularly in relation to Denisovans. In contrast, Western Eurasians are the non-Africans least likely to have Neanderthal or Denisovan genes. "The interactions between modern humans and archaic humans are complex and perhaps involved multiple events," Reich says.

The study's main limitation is that it relies on the current library of ancient genomes available. The researchers caution against drawing any conclusions about our extinct human ancestors based on the genetics and possible traits that they left behind. "We can't use this data to make claims about what the Denisovans or Neanderthals looked like, what they ate, or what kind of diseases they were susceptible to," says Sankararaman, first author on the paper. "We are still very far from understanding that."

More information: *Current Biology*, Sankararaman et al.: "The Combined Landscape of Denisovan and Neanderthal Ancestry in Present-Day Humans" dx.doi.org/10.1016/j.cub.2016.03.037

Provided by Cell Press