

Genetic research reveals Neanderthals could tolerate smoke

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Comparison of Modern Human and Neanderthal skulls from the Cleveland Museum of Natural History. Credit: DrMikeBaxter/Wikipedia

The idea that modern humans displaced Neanderthals because they were better protected against toxic smoke components is now under fire. An earlier study that put forward this suggestion has now been refuted by genetic research by scientists from Leiden and Wageningen. This new research was published in *Molecular Biology and Evolution* on 24

November.

Making and using fire is regarded as one of the most significant innovations in man's evolution. Fire brought with it such benefits as warmth, for example, protection against predators and a broader diet because it made it possible to cook raw, inedible foods. Traces of fire do not preserve well, so it is far from clear when fire-making skills developed and whether Neanderthals have already had these skills for a long time.

Contradictory research

A disadvantage of fire is that it exposes people to the toxic substances in smoke. In 2016, two contradictory genetic studies appeared on whether modern humans or Neanderthals were better able to tolerate the toxic compounds produced by fire. A group of American scientists studied a receptor protein (the aryl hydrocarbon receptor or Ah receptor) that is responsive to toxic smoke components and is different in the two species. They concluded that Neanderthals were up to a thousand times more sensitive to these toxic substances than modern humans.

The other group comprised Leiden researchers including Professor of Archaeology Wil Roebroeks and molecular biologist/toxicologist Jac Aarts. Together with colleagues from Wageningen University & Research, they came to the opposite conclusion, based on studying 19 different genes. They found that Neanderthals had more gene variants that better neutralised the harmful toxic effects of smoke than most modern-day humans, and these protective gene variants are predominantly the older variants in evolutionary terms.

...But not any more

Aarts and his Leiden and Wageningen colleagues have now repeated the earlier study by their North American colleagues. They used a new research design that gave their experiment a better approach to human biology. They used human cells rather than the rat cells that their predecessors had used. Also they investigated the receptor protein very precisely by studying the complete and original genetic information for the two receptor variants compared. They found that there are no grounds for concluding that this receptor protein made Neanderthals more vulnerable to toxins from smoke.

Fire and human biology

Prehistoric use of fire is one of the focal areas in Leiden's archaeology research. Earlier studies in Leiden [have shown](#) that early hominins probably survived for many thousands of years in Europe without access to fire. It were Leiden archaeologists who in 2018 were the first to demonstrate [the use of fire by early hominins](#). Leiden archaeologists also put the worldwide use of [fire in shaping landscapes](#) by hunter-gatherers prominently on the map. This study is currently very topical because of the problematic increase in natural fires in Australia and America.

The new findings by Aarts and his colleagues have wider importance than only to our knowledge of early hominins. This publication emphasises the key importance of studying the function of proteins in their relevant biological context.

More information: Jac M M J G Aarts et al. Evolution of Hominin Detoxification: Neanderthal and Modern Human Ah Receptor Respond Similarly to TCDD, *Molecular Biology and Evolution* (2020). [DOI: 10.1093/molbev/msaa287](https://doi.org/10.1093/molbev/msaa287)

Provided by Leiden University

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