

Neanderthals may have been morning people, says new study

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A new research paper finds that genetic material from Neanderthal ancestors may have contributed to the propensity of some people today to be "early risers," the sort of people who are more comfortable getting

up and going to bed earlier.

The findings are [published](#) in the journal *Genome Biology and Evolution*.

All anatomically modern humans trace their origin to Africa around 300,000 years ago, where environmental factors shaped many of their biological features. Approximately 70,000 years ago, the ancestors of modern Eurasian humans began to migrate out to Eurasia, where they encountered diverse new environments, including higher latitudes with greater seasonal variation in daylight and temperature.

But other hominins, such as the Neanderthals and Denisovans, had lived in Eurasia for more than 400,000 years. These archaic hominins diverged from modern humans around 700,000 years ago, and as a result, our ancestors and archaic hominins evolved under different environmental conditions. This resulted in the accumulation of lineage-specific genetic variation and phenotypes. When humans came to Eurasia, they interbred with the archaic hominins on the continent, and this created the potential for humans to gain genetic variants already adapted to these new environments.

Previous work has demonstrated that much of the archaic hominin ancestry in modern humans was not beneficial and removed by [natural selection](#), but some of the archaic hominin variants remaining in [human populations](#) show evidence of adaptation. For example, archaic genetic variants have been associated with differences in hemoglobin levels at [higher altitude](#) in Tibetans, immune resistance to new pathogens, levels of skin pigmentation, and fat composition.

Changes in the pattern and level of light exposure have biological and behavioral consequences that can lead to evolutionary adaptations. Scientists have previously explored the evolution of circadian adaptation in insects, plants, and fishes extensively, but it is not well studied in

humans.

The Eurasian environments where Neanderthals and Denisovans lived for several hundred thousand years are located at higher latitudes with more variable daylight times than the landscape where modern humans evolved before leaving Africa. Thus, the researchers explored whether there was [genetic evidence](#) for differences in the circadian clocks of Neanderthals and modern humans.

The researchers defined a set of 246 circadian genes through a combination of literature search and expert knowledge. They found hundreds of genetic variants specific to each lineage with the potential to influence genes involved in the circadian clock. Using artificial intelligence methods, they highlighted 28 circadian genes containing variants with potential to alter splicing in archaic humans and 16 circadian genes likely divergently regulated between present-day humans and archaic hominins.

This indicated that there were likely functional differences between in the circadian clocks in archaic hominins and modern humans. Since the ancestors of Eurasian modern humans and Neanderthals interbred, it was thus possible that some humans could have obtained circadian variants from Neanderthals.

To test this, the researchers explored whether introgressed genetic variants—variants that moved from Neanderthals into modern humans—have associations with the preferences of the body for wakefulness and sleep in large cohort of several hundred thousand people from the UK Biobank.

They found many introgressed variants with effects on sleep preference, and most strikingly, they found that these variants consistently increase "morningness," the propensity to wake up early. This suggests a

directional effect on the trait and is consistent with adaptations to high latitude observed in other animals.

Increased morningness in humans is associated with a shortened period of the circadian clock. This is likely beneficial at higher latitudes, because it has been shown to enable faster alignment of sleep/wake with external timing cues. Shortened circadian periods are required for synchronization to the extended summer light periods of high latitudes in [fruit flies](#), and selection for shorter circadian periods has resulted in latitudinal clines of decreasing period with increasing [latitude](#) in natural fruit fly populations.

Therefore, the bias toward morningness in introgressed variants may indicate selection toward shortened circadian period in the populations living at high latitudes. The propensity to be a morning person could have been evolutionarily beneficial for our ancestors living in higher latitudes in Europe and thus would have been a Neanderthal genetic characteristic worth preserving.

"By combining ancient DNA, large-scale [genetic studies](#) in modern humans, and artificial intelligence, we discovered substantial genetic differences in the circadian systems of Neanderthals and modern humans," said the paper's lead author, John A. Capra. "Then by analyzing the bits of Neanderthal DNA that remain in modern human genomes we discovered a striking trend: many of them have effects on the control of [circadian genes](#) in [modern humans](#) and these effects are predominantly in a consistent direction of increasing propensity to be a morning person.

"This change is consistent with the effects of living at [higher latitudes](#) on the circadian clocks of animals and likely enables more rapid alignment of the circadian clock with changing seasonal light patterns. Our next steps include applying these analyses to more diverse modern human

populations, exploring the effects of the Neanderthal variants we identified on the [circadian clock](#) in model systems, and applying similar analyses to other potentially adaptive traits."

More information: Keila Velazquez-Arcelay et al, Archaic Introgression Shaped Human Circadian Traits, *Genome Biology and Evolution* (2023). [DOI: 10.1093/gbe/evad203](https://doi.org/10.1093/gbe/evad203)

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