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DNA Linked to Covid-19 Was Inherited From Neanderthals, Study Finds

The stretch of six genes seems to increase the risk of severe illness from the coronavirus.



By Carl Zimmer

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A stretch of DNA linked to Covid-19 was passed down from Neanderthals 60,000 years ago, according to a new study.

Scientists don't yet know why this particular segment increases the risk of severe illness from the coronavirus. But the new findings, which were posted online on Friday and have not yet been published in a scientific journal, show how some clues to modern health stem from ancient history.

"This interbreeding effect that happened 60,000 years ago is still having an impact today," said Joshua Akey, a geneticist at Princeton University who was not involved in the new study.

This piece of the genome, which spans six genes on Chromosome 3, has had a puzzling journey through human history, the study found. The variant is now common in Bangladesh, where 63 percent of people carry at least one copy. Across all of South Asia, almost one-third of people have inherited the segment.

Elsewhere, however, the segment is far less common. Only 8 percent of Europeans carry it, and just 4 percent have it in East Asia. It is almost completely absent in Africa.

It's not clear what evolutionary pattern produced this distribution over the past 60,000 years. "That's the \$10,000 question," said Hugo Zeberg, a geneticist at the Karolinska Institute in Sweden who was one of the authors of the new study.

One possibility is that the Neanderthal version is harmful and has been getting rarer over all. It's also possible that the segment improved people's health in South Asia, perhaps providing a strong immune response to viruses in the region.

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“One should stress that at this point this is pure speculation,” said Dr. Zeberg’s co-author, Svante Paabo, the director of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany.

Researchers are only beginning to understand why Covid-19 is more dangerous for some people than others. Older people are more likely to become severely ill than younger ones. Men are at more risk than women.

Social inequality matters, too. In the United States, Black people are far more likely than white people to become severely ill from the coronavirus, for example, most likely due in part to the country’s history of systemic racism. It has left Black people with a high rate of chronic diseases such as diabetes, as well as living conditions and jobs that may increase exposure to the virus.

Genes play a role as well. Last month, researchers compared people in Italy and Spain who became very sick with Covid-19 to those who had only mild infections. They found two places in the genome associated with a greater risk. One is on Chromosome 9 and includes ABO, a gene that determines blood type. The other is the Neanderthal segment on Chromosome 3.

But these genetic findings are being rapidly updated as more people infected with the coronavirus are studied. Just last week, an international group of scientists called the Covid-19 Host Genetics Initiative released a new set of data downplaying the risk of blood type. “The jury is still out on ABO,” said Mark Daly, a geneticist at Harvard Medical School who is a member of the initiative.

The new data showed an even stronger link between the disease and the Chromosome 3 segment. People who carry two copies of the variant are three times more likely to suffer from severe illness than people who do not.

After the new batch of data came out on Monday, Dr. Zeberg decided to find out if the Chromosome 3 segment was passed down from Neanderthals.

About 60,000 years ago, some ancestors of modern humans expanded out of Africa and swept across Europe, Asia and Australia. These people encountered Neanderthals and interbred. Once Neanderthal DNA entered our gene pool, it spread down through the generations, long after Neanderthals became extinct.

Most Neanderthal genes turned out to be harmful to modern humans. They may have been a burden on people’s health or made it harder to have children. As a result, Neanderthal genes became rarer, and many disappeared from our gene pool.

But some genes appear to have provided an evolutionary edge and have become quite common. In May, Dr. Zeberg, Dr. Paabo and Dr. Janet Kelso, also of the Max Planck Institute, discovered that one-third of European women have a Neanderthal hormone receptor. It is associated with increased fertility and fewer miscarriages.

Dr. Zeberg knew that other Neanderthal genes that are common today even help us fight viruses. When modern humans expanded into Asia and Europe, they may have encountered new viruses against which Neanderthals had already evolved defenses. We have held onto those genes ever since.

Dr. Zeberg looked at Chromosome 3 in an online database of Neanderthal genomes. He found that the version that raises people's risk of severe Covid-19 is the same version found in a Neanderthal who lived in Croatia 50,000 years ago. "I texted Svante immediately," Dr. Zeberg said in an interview, referring to Dr. Paabo.

Dr. Paabo was on vacation in a cottage in the remote Swedish countryside. Dr. Zeberg showed up the next day, and they worked day and night until they posted the study online on Friday.

"It's the most crazy vacation I've ever had in this cottage," Dr. Paabo said.

Tony Capra, a geneticist at Vanderbilt University who was not involved in the study, thought it was plausible that the Neanderthal chunk of DNA originally provided a benefit — perhaps even against other viruses. "But that was 40,000 years ago, and here we are now," he said.

It's possible that an immune response that worked against ancient viruses has ended up overreacting against the new coronavirus. People who develop severe cases of Covid-19 typically do so because their immune systems launch uncontrolled attacks that end up scarring their lungs and causing inflammation.

Dr. Paabo said the DNA segment may account in part for why people of Bangladeshi descent are dying at a high rate of Covid-19 in the United Kingdom.

It's an open question whether this Neanderthal segment continues to keep a strong link to Covid-19 as Dr. Zeberg and other researchers study more patients. And it may take discoveries of the segment in ancient fossils of modern humans to understand why it became so common in some places but not others.

But Dr. Zeberg said that the 60,000-year journey of this chunk of DNA in our species might help explain why it's so dangerous today.

"Its evolutionary history may give us some clues," Dr. Zeberg said.

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