Origins | Horse

The horse that can endure Siberian winters

In a few short centuries, the Yakutian horse has gained a large body and long, mammoth-like shaggy hair, allowing it to survive truly harsh conditions

By Jane Palmer
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Local legend has it that when the god of creation flew around the world to distribute riches, he dropped all of his treasures when he arrived in the Yakutian region of Siberia. His hands were simply numb with cold.

The myth is an attempt to explain why Yakutia has such an abundance of precious diamonds, but it is easy to see why the story developed. This republic of Russia gets very cold indeed. Temperatures can dip to -70 °C (-94 °F) and its capitol, Yakutsk, is the coldest city in the northern hemisphere.

There is life in the freezer though, including a population of stocky, shaggy steeds known as Yakutian horses. The Yakuts would undoubtedly have perished if not for these beasts. Locals relied on the horses for transportation, food in the form of horsemeat, and clothing made from horse hides. Horses have played a central role in the region's economy for hundreds of years.

It turns out that these horses adapted to the extreme Siberian climates with astonishing speed.

A Siberian horse (Credit: Gerner Thomsen/Alamy Stock Photo)

Averaging about 150cm, the Yakutian stands a little smaller than most horses. Its winter hair can reach about 10cm in length and it has a thick bushy tail and long mane that, like a shawl, covers both its neck and shoulders.

> *We could really track the whole temporal line*

In short, its appearance is a little like the woolly mammoth version of a horse. It is clearly well suited to the brutal and enduring Siberian winters.

But how long has it taken the Yakutian horses to adapt to this extreme environment? Are they ancient natives to the region, like the now-extinct mammoths? Or did the Yakuts bring them to the area when they fled Mongolia in the 13th or 14th Century to escape Genghis Khan?

To answer such questions, scientists recently turned to genome sampling.

"We wanted to take horses from today, horses from after the 13th century, and from prior to the 13th century," says **Ludovic Orlando** of the University of Copenhagen in Denmark, the lead author of the study. "Because that way, we could really track the whole temporal line and see whether or not those population of horses are actually the same through time."

Genghis Khan once controlled much of Eurasia (Credit: National Geographic Creative/Alamy Stock Photo)

The team sampled the genomes of nine modern day Yakutian horses, one genome from an early 19th Century horse, and another from a horse that lived in the region 5,200 years ago. The scientists then compared the genomes to one another and to existing sequences for dozens of domestic horses, **wild Przewalski's horses that are native to the steppes of central Asia**, and ancient horses.

> *They have adapted to their new environment in just 800 years*

The findings of the study were unequivocal. In the genomes of the modern Yakutian horses **the researchers found a strong signal of a "founder effect"**: a reduction in genetic variation that results when a small population is used to establish a new colony. The precise level of genetic

variation indicates that the small founding population of horses arrived in the Yakutian region about 800 years ago, in the 13th Century.

"We can exclude the possibility that the Yakutian horses descended from the horses that existed in Yakutia in ancient times," Orlando says.

The team's analyses placed the nine modern-day Yakutian horses and the Yakutian horse from the 19th century within the "evolutionary tree" of domesticated horses. They fall closest to the Mongolian, Fjord and Icelandic horses, with the Mongolian horses their most likely ancestors.

But the Yakutian horses differ significantly in appearance to these Mongol horses. They have adapted to their new environment in just 800 years.

Domestic horses in Mongolia (Credit: Frans Lanting Studio/Alamy Stock Photo)

"This is blink-of-an-eye evolution," says **Doug Antczak**, a veterinarian and equine scientist at Cornell University in Ithaca, New York. "What really captures peoples' imaginations from this research is the evidence for rapid adaption to the environment – in this case a cold, harsh, dry environment."

It shows that there are only so many ways a mammal can get adapted to such environments

Focusing on the variation in the Yakutian horse genome, the team identified the key biological functions involved in the adaptive process: those that modified the morphology, hormones and metabolism of the horses. They found variations in the gene pathways involved in hair development, limb length and body size, explaining the Yakutian horses' unique appearance.

Icelandic and Fjord horses are also squat and fat with thick hair coats, whereas horses that live in the desert, such as Arabian horses, have shorter and finer hair coats. "There's an infinite gradation between the horses that have fine hair coats and the Yakutian horses," Antczak says.

The geneticists also found genes associated with the metabolism of sugars including glucose, which can have anti-freezing properties in the blood.

In July 2015, a team of scientists **compared the genomes of ancient woolly mammoths to those of elephants** to determine the features that contributed to the mammoth's appearance and ability to withstand extreme cold. The researchers found similar variations in hair growth, metabolism and stature.

Artist's impression of a woolly mammoth (Credit: Stocktrek Images Inc/Alamy Stock Photo)

"It shows that there are only so many ways a mammal can get adapted to such environments," Orlando says.

But typically, a mammal would take millennia to reach the level of hardiness that Yakutian horses exhibit today.

"It is amazing that in just 800 years, which is only about a hundred generations for horses, you can get from a regular horse, a type of Mongolian horse, to the Yakutian horses we have today," Orlando says. "It tells you how fast evolution can go."

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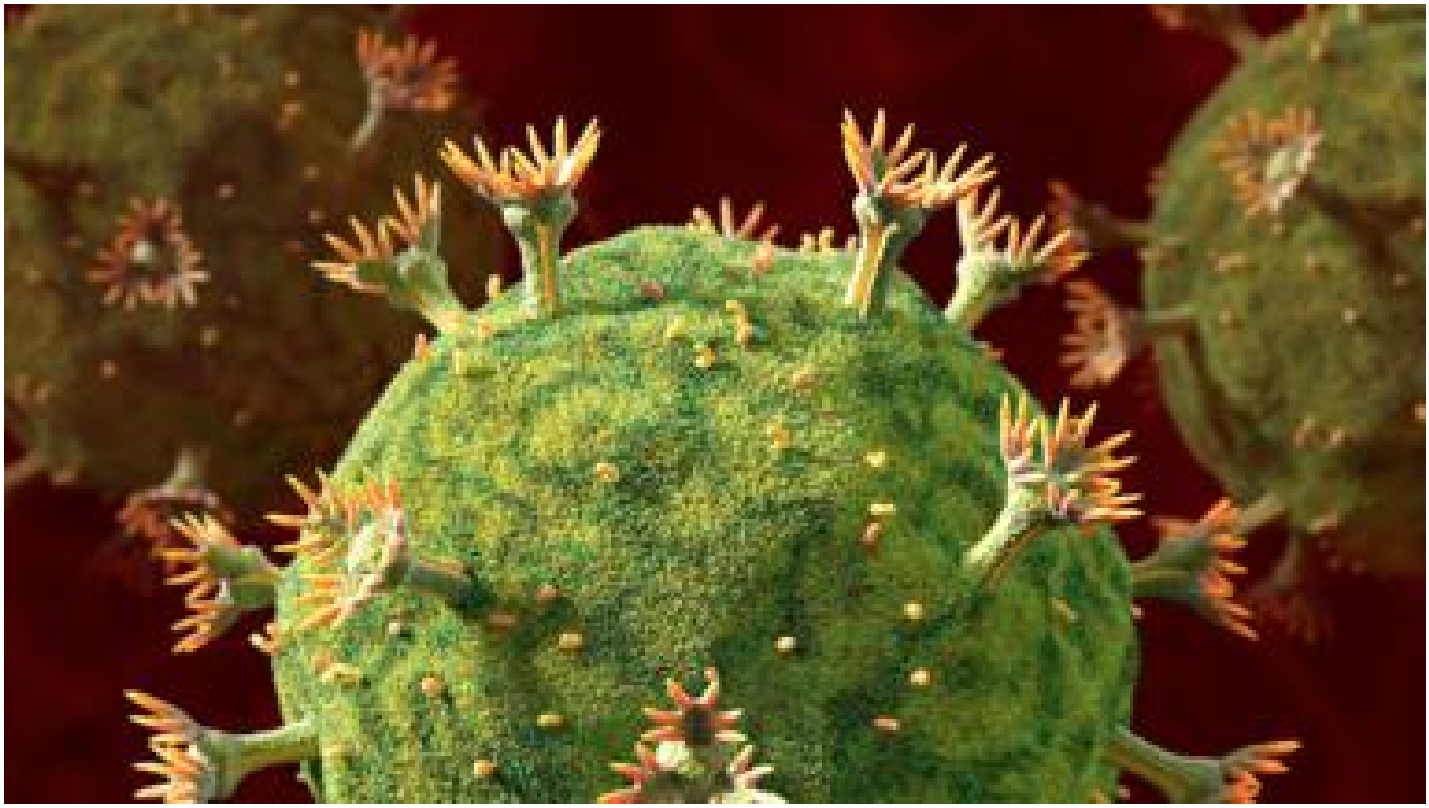

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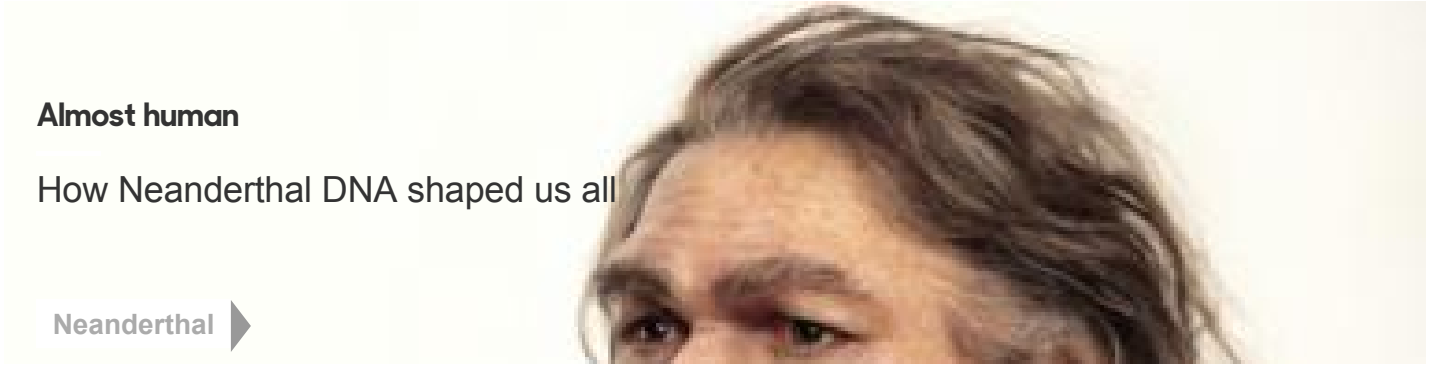

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