

## DNA Shows that Spotted Horses in Cave Art Weren't Just a Figment,



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Left to right: Chauvet cave, Lascaux cave, modern horse with leopard spots

Roughly 25,000 years ago in what is now southwestern France, human beings walked deep into a cave and left their enduring marks. Using materials like sticks, charcoal and iron oxides, they painted images of animals on the cave walls and ceilings — lions and mammoths and spotted horses, walking and grazing and congregating in herds. Comparing DNA from the present and the Stone Age convinced scientists that those spotted depictions were based on existing animals. Today, the art at the **Pech-Merle cave**, and in hundreds of others across Europe, is a striking testimony to human creativity well before modern times. But what were these cave paintings, exactly? Were prehistoric artists simply sketching what they saw each day on the landscape? Or were the images more symbolic, diverging from reality or representing rare or even mystical creatures? Such questions have divided archaeologists for years.

Now, a group of researchers has used distinctly modern techniques to help decipher the mystery, at least in the case of Pech-Merle's famous spotted horses. By comparing the DNA of modern horses and those that lived during the Stone Age, scientists have determined that these drawings are a realistic depiction of an animal that coexisted with the artists. The research, published in the journal **Proceedings of the National Academy of Sciences**, grew out of an effort to discern the coat colors of ancient horses to help figure out when the animals were domesticated, a pivotal moment in the development of human societies. In general, domesticated species exist in a far greater variety of colors than wild ones, so understanding color variation in fossil animals can help pinpoint the timing. Previous research on DNA from the bones and teeth of horses that lived 7,000 to 20,000 years ago showed that those animals were either black or bay (a brown coat with a black mane and tail). That work was **published in the journal Science** in 2009. Since then, geneticists have deciphered the underlying code for the spotted pattern, known as leopard, in modern horses. So the scientists went back to their samples, looking for the leopard sequence in horses that lived in Europe 11,000 to 15,000 years ago. "There is a striking correspondence between the coat-color patterns of horses painted in Paleolithic caves of France with what geneticists found in the genotypes of color genes," said **Hopi E. Hoekstra**, an evolutionary biologist at **Harvard** who studies pigmentation. Dr. Hoekstra was not involved in the study but called it "very convincing."

An author of the study, **Michael Hofreiter**, an evolutionary biologist at the University of York in England, said: "Why they took the effort making these beautiful paintings will always remain a miracle to us. "It's an enigma, but it's also nice to see that if we go back 25,000 years, people didn't have much technology and life was probably hard, but nevertheless they already endeavored in producing art. It tells us a lot about ourselves as a species." Extracting DNA from such old material is a complex process, and the potential for contamination is huge. Early studies of Neanderthal DNA were marred by contamination from humans, and led to skepticism about the field's future. Since then, researchers have adopted strict procedures to ensure they are not contaminating ancient samples with modern-day DNA. The procedures include analyzing ancient and contemporary material in physically separate facilities and replicating results multiple times. "This is a whole different level of clean," said **Jessica L. Metcalf**, a postdoctoral researcher at the University of Colorado who also works with the Australian Center for Ancient DNA in Adelaide, where the labs that work on ancient and modern DNA are more than half a mile apart. "We have sealed rooms with HEPA filter air flow, UV lights that sterilize when you come in," she said. "We spend over half our time cleaning. We use a lot of bleach. You're in this ridiculous-looking clean suit with a face shield on." In fact, Dr. Hofreiter said, **researchers who work with ancient horse genes should not even go horseback riding.** "Traces of DNA," she said, "they just stick to people."