Earth, the smaller the shifts. As a result, Black says, both objects orbiting HD 168443 could be low-mass stars instead of planets or brown dwarfs. "There are plenty of [triple star] systems like this," says Black.

But none of the thousands of triple star systems known has all three members within a few hundred million kilometers of one another, Butler notes. Besides, he says, if the mystery object were a dwarf star, the European Hipparcos satellite would see HD 168443 wobbling slightly because of the orbiting object's gravitational pull. The absence of sideways motion, Butler says, means that the object can't be more massive than 40 Jupiter masses—well within brown dwarf territory.

The new discoveries show how little astronomers know about the formation of planetary systems, Marcy says. Yet the data should help scientists test their models and weed out the unfit. "I regard these discoveries as our gift to the theorists," says Butler. Lin, for one, is a grateful recipient. "I lose sleep over this," he says, "but I'm very happy, because these results will keep me busy."

–GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.

EVOLUTIONARY GENETICS

Horses Domesticated Multiple Times

For several millennia, horses have been lending a hoof to humans. But despite extensive archaeological excavations, researchers have not been able to pin down the exact history of where and when these animals were domesticated. Now, on page 474, evolutionary geneticist Carles Vilà and Hans Ellegren of Uppsala University in Sweden and their colleagues present new genetic evidence on how wild horses came to be beasts of burden. Contrary to conventional wisdom, explains Ellegren, head of the Uppsala lab, "in many places over the world, people must have independently started to domesticate their local horses."

Many horse lovers and researchers have long traced their steeds' ancestry back to the grassland steppes of Eurasia, in the vicinity of the current Ukraine, Kazakhstan, and Mongolia. There, horses hunted as food were eventually tamed, fueling the expansion of their masters and, consequently, the domesticated horse across most of Europe.

Not everyone accepts that scenario, however. Archaeological evidence from that time, some 5000 years ago, is difficult to interpret. Horse bones unearthed at archaeological sites could just as easily reflect a horse-meat diet as a horse-riding or horse-breeding culture. Some researchers have examined fossils and found telltale signs, such as horse teeth worn down by a bit. Yet even with these data, "we've had a big problem with [understanding] horse domestication," says Sandra Olsen, an archaeologist at the Carnegie Museum of Natural History in Pittsburgh, Pennsylvania.

While Vilà was a postdoc in Ellegren's lab in 1998, the two realized they might be able to pinpoint the origins of domestication by tracing the genetic lineages of different breeds of modern horses and comparing those lineages to DNA collected from ancient horse fossils. They first focused on mitochondrial DNA (mtDNA), genetic material inherited only from the mother, because mutations there accumulate fast enough to reveal some insight into the breeding history of these animals in recent millennia.

If horses had been domesticated once from a limited number of ancestors, the mtDNA of all modern domesticated horses should look basically alike. Essentially, the horse family tree would branch off when domesticated horses diverged some 5000 years ago; the small variations among modern horses could be represented as twigs coming off that one branch. By contrast, most DNA from truly wild horses (not the feral horses that roam free today) would belong on other branches.

To probe the puzzle, the Uppsala researchers compiled a database that provides "a good blueprint of the diversity of different horse types," says Ellegren. They had ready access to blood samples from a Swedish registry of 191 pedigree horses, including primitive English and Swedish animals and one breed derived from animals imported to Iceland by the Vikings. Vilà and colleagues then acquired DNA samples from one Przewalski's horse, a small Mongolian equine thought by some to be a sister species to the original wild horses. The team also obtained DNA from the leg bones of horses that have been preserved in the Alaskan permafrost for more than 12,000 years. Another eight samples came from 1000- to 2000-year-old archaeological sites in southern Sweden and Estonia. The study is unique, Ellegren says, "in that we combined an analysis of modern horses and ancient horses."

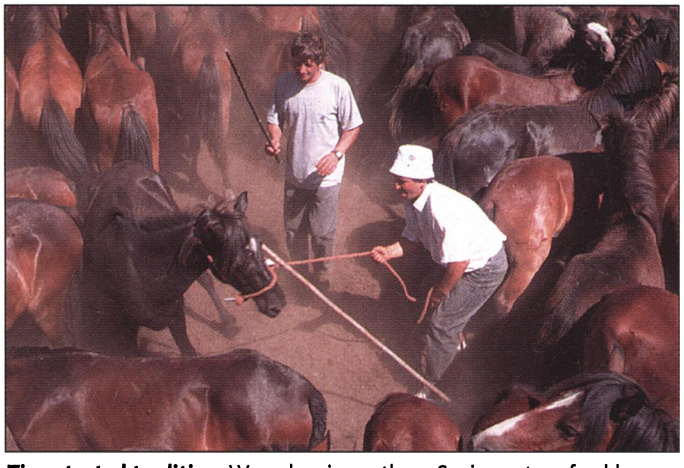
Similar DNA analyses for cattle, sheep, water buffalo, and pig indicate that those modern livestock derived from a small number of animals domesticated in just a few places 8000 to 10,000 years ago. That's because today's animals are much less genetically diverse than their ancient forebears. The mtDNA in today's pigs, for instance, falls into a few distinct groups, suggesting that the offspring of the original livestock were traded and used to establish herds elsewhere.

But the horse mtDNA tells a different story. To the researchers' surprise, the mtDNA samples from the modern horses showed almost as much genetic variation as did samples from the fossil horses—and no distinct branches as there are in domesticated pigs or cattle. The genetic diversity in modern horses implies "that the domestication of the horse was different in time, place, and process from that of other animals," says Daniel Bradley, a geneticist at Trinity College, Dublin, Ireland.

The new work "eliminates the possibility that horses were domesticated in one place and spread from there," says David Anthony, an archaeologist at Hartwick College in Oneonta, New York. Instead, it suggests that today's domestic horse resulted from the interbreeding of many lines of wild horses in multiple places. Even so, Anthony still thinks that horses are likely to have been domesticated first on the steppes, because the archaeological evidence suggests that people there depended heavily on horses for food. Perhaps what spread, he says, was not the horses themselves but the idea and know-how of taming horses.

Marsha Levine is not convinced. An archaeologist at the McDonnell Institute for Archaeological Research in Cambridge, U.K., she takes issue with both the archaeological evidence cited by Anthony and others and the new mtDNA data. She worries that modern horse DNA won't tell the whole domestication story. But, as Olsen points out, solving the riddle of equine domestication has been so difficult that "anything that helps nail it down is a big help."

–ELIZABETH PENNISI



CREDIT: C. VILÀ *ET AL.*

Time-tested tradition. Wranglers in northern Spain capture feral horses, possibly reenacting what their ancestors did 5000 years ago.