

The pets in our households are all descendants of wild animals, many of which still run free today. But dogs, cats, and rodents are all domesticated to varying degrees, with a wide range of consequences for their behavior and genetics.

To understand the nitty gritty of this, let's get some **terminology** out of the way first. When we discuss **domestication**, we're referring to the process of adapting wild plants and animals for human use. This definition is frustratingly vague, so we won't open the entire can of worms: in this column, we'll focus on pets, so animals intended for human companionship (leaving out plants and animals intended for food or labor).

On one end of the spectrum, we have **wild** animals – that is, animals that live their entire lives outside the human bubble. They don't rely on us, and human encounters tend to be detrimental to one party or another. At the other extreme, we are left with **domesticated** pets, which have, over many generations, grown and changed alongside their human companions, who have selectively bred and chosen the animals who best fit their needs. If only the most human-tolerant members of the population are allowed to mate, certain genetic traits like reduced fear and increased friendliness will become more prevalent in future generations. The classic example of this is dogs being bred from wolves, which we'll dive into shortly.

But between wild and domestic, there are at least two shades of gray. First, animals can be **tamed**, but not domesticated (though some use the terms interchangeably). In these cases, a single wild animal can be adapted to live alongside humans, take their food, and generally benefit from their presence – but the change is entirely behavioral and can occur within a single animal's lifespan. Genetic changes do not occur, and the rest of the animal's species

remains wild. What's more, not all domesticated animals are tame: consider chickens or Spanish fighting bulls.

Next, we have the inverse of taming, in which a domesticated species is released to the wild and adjusts to fending for itself, results in a **feral** animal. In both of these cases, behaviors change ahead of genetics – but tamed and feral animals can be precursors of genetic changes in either direction.

But what do these genetic changes actually entail? The domestication of dogs, bred from their wolf ancestors, is the process that has undergone the most scrutiny. Without going too deeply into the history and philosophy of domestication, it's thought that dogs were originally domesticated (at least once, if not multiple times) **between 10,000 and 33,000 years ago** in Asia. Their original purpose was likely to aid in the hunt, but along the way, companionship became a driving factor. And unsurprisingly, when we compare the genomes of modern domesticated dogs to those of wild wolves, there are quite a few differences that have manifested over the years.

As you might expect, many of the differences account for changes in **behavior**, including alterations in genes controlling brain development and function that increase animals' tolerance of and even friendliness towards humans. But other changes are less intuitive. For instance, unlike their carnivorous wolf ancestors, dogs eat diets more similar to those of their omnivorous human companions. Consequently, dogs' genomes have changed over the years to produce more proteins involved in **starch and fat metabolism**.

These shifts in behavior and diet are two of many characteristics we find in domesticated animals. By no means are these **patterns** hard and fast rules, and many exceptions exist. But speaking generally

and liberally, domesticated animals are more likely to: be smaller or larger than their wild counterparts; undergo multiple periods of fertility within the span of one year (a trait referred to as being polyestrous), unlike wild animals, which often mate seasonally; and have spots or patches in their fur, curly hair, floppy ears, smaller heads, and shorter tails. Many of these last physical characteristics are reminiscent of juvenile versions of domesticated animals' ancestors; in other words, dogs are the Peter Pans of the wolf world – pups that never grew up.

In fact, after making many of these observations, a few scientists decided to put the genetics of domestication to the test in late 1950s Soviet Russia with a group of silver foxes. The researchers selectively bred only the friendliest or most aggressive foxes of each generation. Forty years later, the scientists found themselves with **domesticated foxes** that eagerly approached humans, wagging their short and curly tails, pricking their floppy ears, and allowing their soft, speckled fur to be petted. Their wilder counterparts, on the other hand, remained combative, untamed, and anatomically like their ancestors. The researchers showed domestication was breedable and that it came as a **package deal** with predictable changes anatomy and physiology.

With this kind of directed breeding, domestication can produce companions that are almost unrecognizable as descendants of their wild ancestors. But my cats will be the first to tell you that not all the pets we spend our time with have been domesticated to the same extent. After all, bringing wild animals into the home is no simple feat. And while cats have also been a part of human society for a long time – about 10,000 years – they're often noted as more aloof, more independent, and less needy of attention than dogs. It may be because they've been around for a little less time, but the truer and far more compelling reason is that cats may have **domesticated themselves**. Many generations ago, the first barn cats found their

own way into civilization because they cleverly deduced that grain storehouses were good places to corner mice (which, to go a layer deeper, have also seemingly **self-domesticated**; the same cannot be said for the grain).

And when we look at the genes of house cats and their wildcat ancestors, the differences are accordingly **sparse** and **minor**. While we purposefully selected out subpopulations of friendly wolves until we successfully bred man's best friend, cats more or less wandered into our lives and decided to stay put. In other words, cats didn't experience the same pressure to change to fit human needs.

All that said, domesticated or not, cats are of course wonderful companions to many – myself included. One of my cats plays fetch; another sleeps curled up next to me every night without fail. On the other hand, there's no question about how well my cats have trained me to be at their beck and call. Their internal clocks recognize when we normally eat dinner, when we typically play, and even the strange, amorphous time of evening when the humans scoop their poops. And if I try anything shady – sleeping in on a Saturday, for instance, instead of promptly doling breakfast out at 6 a.m. – my attempts are quickly squelched by their frantic meows and scrabbling paws. My cats are tame – but it's probably more accurate to say they've tamed me.

Most pets have life spans shorter than those of their human companions. But I'd be surprised if their presence isn't also exerting some kind of selective pressure on us. After all, we're not exactly wild ourselves.