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## **Frank Hailer**

School of Biosciences, Sir Martin Evans Building, Cardiff University, UK

## **Why dog breeds aren't considered separate species**

Dog owners might disagree, but as far as evolutionary biologists are concerned, all dogs are just dogs. It may seem odd that *Canis (lupus) familiaris* extends from rabbit-sized Chihuahuas to Great Danes which can be almost the size of a small pony, whereas seemingly much smaller differences place many animals into separate species or sub-species. One has to dig a bit into evolutionary theory for this to make sense.

The dog is [a direct descendant](#) of the grey wolf (*Canis lupus*), with evidence that lots of different wolves fed into the dog gene pool over the years. In the course of dog domestication, their behaviour, morphology and physique has changed, and differences among dog breeds are indeed astonishing. Imagine if future palaeontologists were to find Chihuahua remains in the fossil record: this animal would appear to have little in common with wolves.

But these differences among dog breeds – and between dogs and wolves – aren't enough to warrant recognition as distinct species. Dogs are simply too young, from an evolutionary perspective.

It usually takes hundreds of thousands of years or more for mammals to evolve into distinct new species, requiring the slow accumulation of mutations that cause inheritable changes to its physical characteristics – or “phenotype”. Archaeological data and analysis of DNA from today's dogs and wolves, as well as ancient remains, suggest that domestication started about [16,000-40,000 years ago](#), with most current dog breeds originating in the past 200 years.

## **We've sped up dog evolution – but not enough**

Charles Darwin pointed out that humans have accelerated the process of selection by choosing particular individuals for breeding, based on certain desired characteristics – what we call [artificial selection](#). Natural selection generally requires much more time, because it acts on novel variants introduced into the gene pool through the slow process of chance DNA mutation. Nevertheless, the power of artificial selection in generating extreme phenotypes does not change the fundamental fact that dog breeds have been separated for only a short evolutionary time.

This means that dog breeds differ drastically in their appearance and other characteristics, while most of their genomes are still very much alike. Comparing different breeds, most of their genomes indeed show only little differentiation. In other words, Chihuahuas and Great Danes are overall very similar to one another. The

vast physical differences are largely driven by relatively few loci (regions) in the genome. These loci have a large phenotypic effect, leading to strong differentiation among breeds.

This is particularly interesting for evolutionary biologists, and pinpointing such regions in the genome has for example recovered the genetic basis of [size variation among dog breeds](#). We now also have an understanding of the mutations that control traits such as [coat characteristics](#) and [ear floppiness](#).

## **Dog breeds are artificial and potentially temporary**

So if breeds are that similar to one another in their genomes, how are the vast differences maintained? The obvious answer is the mating pattern we impose on our dogs – we keep breeds separate by preventing interbreeding between them.

The fact humans keep them apart is crucial here. Species are [commonly defined](#) as “groups of interbreeding natural populations that are reproductively isolated from other such groups”. This requires hybrids between distinct species to either be non-viable (such as the proposed “humanzee”), or for their offspring to be infertile like most mules, or the more exotic “ligers”. In both these cases there would be complete reproductive isolation between the two groups, whether they be humans and chimps, lions and tigers, or Labradors and poodles.

Yet two entirely different dogs will produce perfectly fertile offspring, and many modern breeds in fact originated in this way. Of course in some cases other factors might make mating very tricky. A female Chihuahua would have trouble naturally delivering a male Great Dane’s offspring, for instance. But though some breeds would never mate with each other without human intervention, middle-sized breeds could provide the link between extremely large and small dogs.

Street dogs are a vivid illustration of this point – they show how the distinct gene pools of dog breeds can rapidly mix once the restrictions of artificial breeding are removed. Moscow’s [famous feral dogs](#) have existed separate from purebred pets for at least 150 years now. In this time they have largely lost features like the spotty colouration that distinguish one breed from another, or the wagging tails and friendly behaviour towards humans that distinguish dogs from wolves.

So genetic exchange would still be common among dog breeds, were they allowed to reproduce freely. In that sense, dog breeds would not be classified as separate species under most definitions. If those Chihuahuas and Great Danes don’t look like the same species right now, it’s only because humans are constantly maintaining a barrier between them.