

# Most dog breeds highly inbred

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Dog breeds are often recognized for distinctive traits—the short legs of a dachshund, wrinkled face of a pug, spotted coat of a Dalmatian. Unfortunately, the genetics that give various breeds their particular attributes are often the result of inbreeding.

In a recent study published in *Canine Medicine and Genetics*, an international team of researchers led by University of California, Davis, veterinary geneticist Danika Bannasch show that the majority of canine breeds are highly inbred, contributing to an increase in disease and [health care costs](#) throughout their lifespan.

"It's amazing how inbreeding seems to matter to health," Bannasch said. "While previous studies have shown that [small dogs](#) live longer than large [dogs](#), no one had previously reported on morbidity, or the presence of disease. This study revealed that if dogs are of smaller size and not inbred, they are much healthier than larger dogs with high inbreeding."

## **Inbreeding affects health**

The average inbreeding based on [genetic analysis](#) across 227 breeds was close to 25%, or the equivalent of sharing the same [genetic material](#) with a full sibling. These are levels considered well above what would be safe for either humans or wild animal populations. In humans, high levels of inbreeding (3-6%) have been associated with increased prevalence of complex diseases as well as other conditions.

"Data from other species, combined with strong breed predispositions to complex diseases like cancer and autoimmune diseases, highlight the relevance of high inbreeding in dogs to their health," said Bannasch, who also serves as the Maxine Adler Endowed Chair in Genetics at the UC Davis School of Veterinary Medicine.

The researchers partnered with Wisdom Health Genetics, a world leader in pet genetics, to obtain the largest sample size possible for analysis. Wisdom Health's database is the largest dog DNA database in the world, helping researchers collect data from 49,378 dogs across 227 breeds—primarily from European sources.

## **Some breeds more inbred**

So, what makes a dog breed more inbred than others? Bannasch explained that it's often a combination of a small founding population followed by strong selection for particular traits in a breed—often based on looks rather than purpose. While she has always had an interest in the population structure of some of these breeds, she became particularly interested in the Danish-Swedish farmdog several years ago. She fell in love with their compact size, disposition and intelligence, and ended up importing one from Sweden.

Bannasch discovered that Danish-Swedish farmdogs have a low level of inbreeding based on their history of a relatively large founding population of 200, and being bred for function, rather than a strong artificial selection for looks. And according to the insurance health data on breeds collected from Agria Insurance Sweden and hosted online by the International Partnership for Dogs, the farmdog is one of the healthiest breeds.

The study also revealed a significant difference in morbidity between brachycephalic (short skull and snout) and non-brachycephalic breeds. While that finding wasn't unexpected, the researchers removed brachycephalic breeds from the final analysis on effects of inbreeding on health.

## **Preserving genetic diversity**

In the end, Bannasch said she isn't sure there is a way out of inbred breeds. People have recognized that creating matches based solely on pedigrees is misleading. The inbreeding calculators don't go back far enough in a dog's genetic line, and that method doesn't improve overall high levels of population inbreeding.

There are other measures that can be taken to preserve the [genetic diversity](#) and health of a breed, she said. They include careful management of breeding populations to avoid additional loss of existing genetic diversity, through breeder education and monitoring of inbreeding levels enabled by direct genotyping technologies.

Outcrosses are being proposed or have already been carried out for some breeds and conditions as a measure to increase genetic diversity, but care must be taken to consider if these will effectively increase overall [breed](#) diversity and therefore reduce inbreeding, Bannasch said. In particular, in the few breeds with low inbreeding levels, every effort should be made to maintain the genetic diversity that is present.

Other UC Davis authors include Thomas Famula, Kevin Batchner, Noa Safra, Sara Thomasy and Robert Rebhun. Contributors from Wisdom Health Genetics include Jonas Donner, Heidi Anderson and Leena Honkanen.

**More information:** Danika Bannasch et al, The effect of inbreeding, body size and morphology on health in dog breeds, *Canine Medicine and Genetics* (2021). [DOI: 10.1186/s40575-021-00111-4](https://doi.org/10.1186/s40575-021-00111-4)

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