

Gene Found that Separates Big Dogs from Small Dogs

Researchers have discovered a genetic variant that creates small dogs or big dogs.

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A team of researchers say they've identified a genetic variant that's a major contributor to small size in dogs. The finding may help efforts to better understand genetic influences on stature in other mammals and even humans.

"The identification and characterization of a key genetic variant that accounts for differences in dog size is particularly exciting because the underlying gene is present in all dogs and other diverse species, including humans," said researcher Eric Green, MD, Ph.D., scientific director of the National Human Genome Research Institute Division of Intramural Research.

In their study, researchers compared the DNA of various small dog breeds, including Chihuahuas, toy Fox Terriers, and Pomeranians, to larger dog breeds, including Irish Wolfhounds, Saint Bernards and Great Danes.

They found that the variation in one gene — IGF-1, which codes for a protein hormone called insulin-like growth factor 1 — is very strongly associated with small stature across all dog breeds studied.

"We have been intrigued by the population structure of dogs, which over the years have been selectively bred, allowing us to more readily analyze the genetic causes of particular traits than is possible in humans," said the study's senior author, Elaine Ostrander, Ph.D., chief of the National Human Genome Research Institute's Cancer Genetics Branch.

"Nearly all of what we learn from studying body structure, behavior and disease susceptibility in dogs helps us understand some aspect of human health and biology," she said.

The team, who in previous research had showed that the IGF-1 gene plays an important role in growth, body size and longevity in mice, used physical observations, X-ray imaging and DNA sequencing, and genotyping analysis to study Portuguese Water Dogs as well as several small and large canine breeds.

The researchers found that differences in dog body size appeared to be associated with minute genetic variations, referred to as single nucleotide polymorphisms, in the IGF-1 gene.

All together, the researchers analyzed DNA from more than 3,000 dogs from 143 breeds to pinpoint a specific gene sequence variant, or haplotype, associated with small size in the genetic code. This genetic variant was found in almost all of the small dogs studied, implicating it as a major influence on stature in dogs.

The researchers also concluded that the small size trait emerged relatively early in the history of domestic dogs. They hypothesize that small size may have facilitated the rapid diversification among domestic dog breeds by making it easier for humans to maintain them in the crowded confines of developing villages and cities, as well as making them more transportable during trade and migration.

The study still aims to identify genes that control other aspects of canine morphology, such as leg length and skull shape.

The findings appear in the April 6 issue of the weekly journal *Science*, published by the American Association for the Advancement of Science.

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