

# Why Obama's Dog Has Curly Hair? Study Finds 3 Dog Coat Genes

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University of Utah biologist K. Gordon Lark holds his dog, Mopsa, a Portuguese water dog with wavy hair. President Obama's dog Bo is a Portuguese water dog with curly hair. Lark was part of a team, led by National Institutes of Health geneticists, that showed variations in three genes account for seven major kinds of dog coats. Lark and colleague Kevin Chase helped find the gene responsible for curly hair or wavy hair. Photo Credit: Sean Graff

(PhysOrg.com) -- University of Utah researchers used data from Portuguese water dogs - the breed of President Barack Obama's dog Bo - to help find a gene that gives some dogs curly hair and others long, wavy hair.

It was part of a National Institutes of Health (NIH) study - published

online Thursday, Aug. 27 by the journal *Science* - showing that variations in only three genes account for the seven major types of coat seen in purebred dogs. The findings also point the way toward understanding complex human diseases caused by multiple genes.

“We were part of a team that found three genes that control 90 percent of the seven coat types that characterize different breeds of purebred dogs,” says K. Gordon Lark, one of 20 co-authors of the study and a distinguished professor emeritus of biology at the University of Utah.

“We helped identify the gene that controls curly or wavy coats,” adds study co-author Kevin Chase, a University of Utah research specialist in biology.

The study’s first author is Edouard Cadieu, and its senior author is Elaine Ostrander, both of the National Human Genome Research Institute in Bethesda, Md. Other authors came from that institute, which is part of NIH, and from the University of California’s Davis and Los Angeles campuses, Cornell University in Ithaca, N.Y., and Affymetrix Corp., in Santa Clara, Calif.

The study showed that combinations of various forms of only three genes - named RSPO2, FGF5 and KRT71 - account for seven major coat types in purebred dogs.

By analyzing more than 1,000 dogs from 80 domestic breeds, the researchers found that RSPO2 is the gene associated with whether or not a dog has a moustache and large eyebrows (known together as “furnishings”); FGF5 is linked to whether a dog’s fur is long or short; and KRT71 determines if the hair is curly or wavy.

## **Mutant Genes and the Well-dressed Dog**

All purebred dogs have the three genes, but the presence or absence of mutant, variant forms of those genes - rather than the ancestral forms inherited from wolves - determines coat types:

-- Short-haired dogs like basset hounds have none of the variant genes, just the ancestral form of each gene.

-- Wire-haired dogs such as Australian terriers have the variant form of only the RSPO2 gene.

-- Dogs with wiry and curly hair - Airedale terriers, for example - have variants of both RSPO2 and KRT71 genes.

-- Long-haired dogs like golden retrievers have a variant form of the FGF5 gene.

-- Long-haired dogs with furnishings, such as the bearded collie, have variant forms of FGF5 and RSPO2.

-- Curly haired dogs such as Irish water spaniels have the variant forms of the FGF5 and KRT71 genes.

-- Curly haired dogs with furnishings - such as the bichon frise breed and some Portuguese water dogs, including President Obama's dog Bo - have the variant form of all three genes.

Portuguese water dogs come in both curly haired and wavy haired varieties, depending on what form of the KRT71 gene they have. Chase says wavy haired Portuguese water dogs fit in the new study's long-hair-with-furnishings category.

Chase says breeders characterized First Dog Bo as curly with furnishings, while Lark's Portuguese water dog, Mopsa, has wavy hair,

even though she appears pretty curly. Chase notes that the KRT71 gene really controls the extent of curl, not curl versus no curl

What about the fur characteristics of mutts? Because mutts are not part of a closed breeding population like each breed of purebred dog, it's difficult to separate the genetic contributors to their traits, Chase says.

"We don't know enough about the genetics of mutts," Lark adds.

## **From Portuguese Water Dogs to Human Disease**

Chase and Lark assisted the NIH research by sharing data on Portuguese water dogs, which they have studied for years.

"Our contribution to this paper is data collected on the Portuguese water dog that indicated that keratin genes controlled the amount of curliness," Lark says. "Our data plus other data from the Ostrander group narrowed this down to KRT71."

KRT71 carries the code that produces keratin 71, a structural protein in hair.

Even though he and Chase studied the genetics of curliness stemming from KRT71, Lark says the other two genes involved in determining dog coat types are more interesting in the sense that they produce proteins that regulate a variety of processes in living organisms, not just the kind of coat a dog has. That makes them relevant to diseases of dogs and humans.

"Dogs share many diseases and other traits with humans," Lark says. "That's why they were used for many decades so extensively for pharmaceutical and medical-physiological-biochemical testing. Not surprisingly they share much of their genome [genetic blueprint] with

humans also.”

Lark says a dog bred for a desired trait may end up, years later, more vulnerable to cancer, immune disorders or other diseases of aging, and thus have a shorter life span.

“Ultimately the most important part of this paper - mostly the work of Ostrander’s group - is that we will be able to get glimpses of how major regulatory genes interact with other genes to change the functioning of an animal in a way that does not kill it, but that may eventually compromise its longevity or its functioning as it ages,” Lark says.

Earlier studies involving Ostrander and Lark revealed genetic variations that make small dogs small and account for longevity in dogs.

## **A Pup for a President and a Geneticist**

Lark, once a soybean geneticist, has run a long-term dog genetics research effort known as the Georgie Project, after Georgie, a stray Portuguese water dog he adopted in 1986. Georgie died in 1996, and when Lark sought a replacement, a breeder sent him Mopsa - now 13 years old - and nagged him to study the breed’s genetics.

Lark and Chase learned that the breed was ideal for genetics research because all Portuguese water dogs descended from a small group of “founders” and could help the search for genes responsible for complex traits - including human diseases caused by multiple interacting genes.

Portuguese water [dogs](#) gained publicity earlier this year when President Obama fulfilled his promise to get a dog for his daughters by obtaining Bo, a Portuguese water dog, reportedly as a gift from U.S. Sen. Edward Kennedy, D-Mass.

“As a supporter of Obama, I feel glad that he has a good dog,” Lark says.  
“He has good taste and a good dog.”

The portion of the new study conducted at the University of Utah was funded by NIH’s National Institute of General Medical Sciences, the Judith L. Chiara Charitable Fund and the Nestle Purina PetCare Co.

Provided by University of Utah ([news](#) : [web](#))

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