

Type I CDDY-IVDD

This is a newer genetic test that looks for the CFA12 FGF4 insertion and has a lot of people worried. Type I IVDD, affected dogs can have a disc event where it ruptures or herniates towards the spinal cord. ... Chondrodystrophy (CDDY) refers to the relative proportion between a dog's legs and body, wherein the legs are shorter and the body longer like seen in a dachshund (one of the genes that gives us smaller dogs). 85-90% of all smaller dogs have 1 or 2 copies of this gene. Type I IVDD is marked by early-onset degeneration of IVDs (beginning before the age of 1 year) in which the tissues of the IVDs undergo significant degradation, calcification, and replacement by other tissue types (a process called chondroid metaplasia). Type II IVDD is a chronic type of IVDD associated with age-related degenerative changes which occur in every dog (though not every dog will develop clinical signs of type II IVDD) and is especially common in large breed dogs. (we often call this 'arthritis' in an older dog)



IVDD Breeding Recommendations

<https://www.pawprintgenetics.com/blog/2020/02/10/genetics-shortened-limbs-and-association-canine-intervertebral-disc-disease-ivdd/>

Taken from Pawprint Genetics website (link above)

Both insertions (on CFA12 and CFA18) are associated with shortened limbs in a dominant fashion, meaning that a dog only needs to require a single copy of either insertion to inherit shortened legs and dogs inheriting insertion variants on both chromosomes 12 and 18 will have the most extreme shortening. However, it should be noted that the CFA12 insertion mutation results in limb shortening in a semidominant (additive) fashion in which the overall limb length decreases as the number of copies of this mutation increases. IVDD type I risk associated with the CFA12 FGF4 insertion is also inherited in a dominant fashion however, **it displays incomplete penetrance, meaning that some dogs which inherit the CFA12 FGF4 insertion will never develop clinical signs of IVDD type I.** (In our 15 years of experience breeding we have never had a dog come down with IVDD although 90% have this mutation).

Appropriate breeding decisions regarding dogs which have inherited the CFA12 FGF4 insertion need to address both the potential loss of genetic diversity in a population which would occur if dogs with this mutation were prohibited from breeding as well as the loss of the short-legged appearance that is a defining physical characteristic for some breeds. In breeds which are known to inherit both mutations associated with short-legged appearance, breeders may be able to use results of genetic testing to selectively breed for the CDPA (CFA18 FGF4 insertion) mutation while breeding away from the CDDY and IVDD risk (CFA12 FGF4 insertion) mutation in order to reduce IVDD risk and retain a short-legged appearance. However, the frequency of each mutation varies between breeds and in some cases, may not be conducive to such a breeding strategy. For example, breeds with extreme limb shortening (e.g. basset hound, dachshund, corgi) typically develop their appearance due to inheritance of both the CFA12 and CFA18 FGF4 insertions. Therefore, elimination of either mutation from breeds with extreme limb shortening, may result in offspring which exceed breed standard leg length. Similarly, breeding strategies to eliminate IVDD in breeds expected to have moderately short legs may result in offspring with legs which are too long to meet breed standards if born without either the CFA12 or CFA18 FGF4 insertions.

Our Take Away after researching CFA12 FGF4 insertion

This gene is one of those that gave us smaller dogs to begin with. We personally feel strongly that this mutation is inconsequential. To be quite honest with you, we have NEVER experienced, heard of or seen any IVDD cases with either our cross breeds or purebreds in the nearly 15 years we've been breeding. It is extremely important to note that 85-90% of ALL toy & mini poodles have either 1 or 2 copies of the gene known as CDDY-IVDD and it's even more common in King Charles Cavaliers. It is part of the Cavalier breed to have short legs and longer backs. Eliminating this gene may change the appearance and breed standard altogether.

Here is a link to Animal Genetics' explanation of CDDY & CDPA
https://www.animalgenetics.us/Canine/Genetic_Disease/IVDD.asp

Embark

When Embark first started testing for CFA12 FGF4 insertion the letter we received made it sound like most of our dogs (85-90%) were doomed to get this disease and have all kinds of complications because of it. We're very very pleased to see that Embark has recently updated their description on the CDDY-IVDD minimizing the implications of 1 or 2 copies of this gene (see below).

"Skeletal (Skeletal)

- Gene: FGF4 - chr12
- Inheritance type: dominant

Chondrodystrophy (CDDY) refers to the "long and low" body shape characteristic of many dog breeds including Dachshunds and Corgis. Recently, a mutation was discovered that not only predicted the chondrodystrophic body shape, but increases the risk of Type I intervertebral disc disease (IVDD or "slipped disc."). A dog with one or two copies of this mutation has an increased risk of developing IVDD compared to a dog with zero copies. Its effect on body shape is slightly different--a dog with one copy of the retrogene is likely to have longer legs than a dog with two copies, but shorter legs than a dog with zero copies. We measure this result using a **linkage test**.

WHAT IS A LINKAGE TEST?

DNA sequences that are close together on a chromosome tend to be inherited together. Because of this, we can use genetic variation surrounding a specific variant (i.e. "linked" to it) to infer the presence or absence of a variant that is associated with a health condition or trait.

Linkage tests are not as predictive of your dog's true genotype as direct assays, which we use on most other genetic conditions we test for.

Actions to take if your dog is affected (taken from our Embark Result reports)

Follow veterinary advice for diet, weight management, and daily exercise. Overweight dogs and those with insufficient exercise are thought to be at higher risk of developing clinical disease.

Ramps up to furniture, avoiding flights of stairs, and using a harness on walks will also help minimize some of the risk of an IVDD event by reducing stress on the back.

In breeds where this variant is extremely common, this genetic health result should not be a deciding factor when evaluating a dog for breeding or adoption purposes.

It's important to remember that most all diseases have more than 1 gene that determines if it will actually occur. Some have MANY! This is a new genetic variant that, in our opinion, still needs to be researched. Hopefully some other genetic mutations will be discovered that play a bigger role in whether or not a dog will come down with IVDD.

Please note that this mutation is extremely common in many small and chondrodystrophic dog breeds. In these breeds, this mutation may not be the strongest predictor of IVDD risk compared to other genetic or environmental factors; further, no genetic mutation is a guarantee of clinical disease. There is active research going in to the frequency of this mutation within particular breeds and how it impacts IVDD risk. It is likely that other genetic factors that can contribute to IVDD risk, as well as environmental factors. In addition, many chondrodystrophic dogs do NOT have this mutation--another even more common FGF4 retrogene on canine chromosome 18 also drives a chondroplastic body type, but is not associated with IVDD (described in Parker et al 2007).

Citations Brown et al 2017 Batcher et al 2019 "