

# GENETIC TESTING FOR PLN-ASSOCIATED VARIANT GENES



## UNDERSTANDING BREEDING COMBINATIONS: A BREEDERS' TOOL



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The purpose of this tool is to assist breeders in understanding what will be the results of particular breeding combinations. *This tool does **not** contain any recommendations about breeding nor explanations about the meaning of the results or the research behind the test.*

The final page is for those interested in understanding more about the difference between probabilities for individual puppies vs. the litter as a whole.

For those wanting to learn more about the test, the research, or the impact of a particular DNA status, please visit the SCWTCA DNA Testing page at <http://www.scwtca.org/health/dnatest.htm> for additional resources.



# Understanding Breeding Combinations

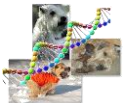
Select your dog's status below to start.

- [My dog is a homozygous negative](#)
- [My dog is a heterozygote](#)
- [My dog is a homozygous positive](#)

**A note about terminology** – since introduction of the test, breeders have adopted different ways of describing results. While we will use the language above in this tool, below is a chart mapping out some of the different terms you may hear.

	Definition	Other Common Terms	
<b>Homozygous Negative</b>	A dog without any of the variant alleles	<ul style="list-style-type: none"><li>• 0</li><li>• 0,0</li><li>• 1-1*</li></ul>	<ul style="list-style-type: none"><li>• “Normal”.</li><li>• “Clear”</li><li>• 0 or no copies</li></ul>
<b>Heterozygote</b>	A dog with one copy of the variant alleles	<ul style="list-style-type: none"><li>• 1</li><li>• 0,1</li><li>• 1-2*</li></ul>	<ul style="list-style-type: none"><li>• “Carrier”</li><li>• 1 copy</li></ul>
<b>Homozygous Positive</b>	A dog with two copies of the variant alleles	<ul style="list-style-type: none"><li>• 2</li><li>• 1,1</li></ul>	<ul style="list-style-type: none"><li>• 2-2*</li><li>• 2 or both copies</li></ul>

*\*These abbreviations are used by Drs. Littman & Henthorn, who state geneticists use “0” for an unknown, “1” for a normal and “2” for a variant allele.*





# My dog is a Homozygous Negative

Find the DNA status of the mate and read across to understand the results of breeding your Homozygous Negative to him/her:

The potential mate is a....	Each puppy....	Litter Composition
Homozygous Negative	Will be a Homozygous Negative	All puppies will be Homozygous Negative
Heterozygote	Has a <ul style="list-style-type: none"><li>• 50% chance of being Heterozygote and</li><li>• 50% chance of being Homozygous Negative</li></ul>	<ul style="list-style-type: none"><li>• <i>The litter could be ANY combination of Heterozygous and/or Homozygous Negative puppies. All puppies could be Heterozygote, all puppies could be Homozygous Negative, or the litter could be any combination of the two.</i></li><li>• However, <b>no</b> puppies can be Homozygous Positive</li></ul>
Homozygous Positive	Will be a Heterozygote	All puppies will be Heterozygotes





# My dog is a Heterozygote

Find the DNA status of the mate and read across to understand the results of breeding your Heterozygote to him/her:

The potential mate is a....	Each puppy has a....	Litter Composition
Homozygous Negative	<ul style="list-style-type: none"><li>• 50% chance of being Heterozygote</li><li>• 50% chance of being Homozygous Negative</li></ul>	<ul style="list-style-type: none"><li>• <i>The litter could be ANY combination</i> of Heterozygous and/or Homozygous Negative puppies. All puppies could be Heterozygote, all puppies could be Homozygous Negative, or the litter could be any combination of the two.</li><li>• However, <b>no</b> puppies can be Homozygous Positive</li></ul>
Heterozygote	<ul style="list-style-type: none"><li>• 25% chance of being Homozygous Negative</li><li>• 50% chance of being Heterozygote</li><li>• 25% chance of being Homozygous Positive</li></ul>	<p><i>The litter could be ANY combination</i> of Homozygous Normal, Heterozygous and/or Homozygous Positive puppies. All puppies could be Heterozygote, all puppies could be Homozygous Positive, all puppies could be Homozygous Negative or the litter could be any combination of the three.</p>
Homozygous Positive	<ul style="list-style-type: none"><li>• 50% chance of being Heterozygote</li><li>• 50% chance of being Homozygous Positive</li></ul>	<ul style="list-style-type: none"><li>• <i>The litter could be ANY combination</i> of Heterozygous and/or Homozygous Positive puppies. All puppies could be Heterozygote, all puppies could be Homozygous Positive, or the litter could be any combination of the two.</li><li>• However, <b>no</b> puppies can be Homozygous Negative</li></ul>





# My dog is a Homozygous Positive

Find the DNA status of the mate and read across to understand the results of breeding your Homozygous Positive to him/her:

The potential mate is a....	Each puppy....	Litter Composition
Homozygous Negative	Will be a Heterozygote	All puppies will be Heterozygotes
Heterozygote	Has a <ul style="list-style-type: none"><li>• 50% chance of being Heterozygote</li><li>• 50% chance of being Homozygous Positive</li></ul>	<ul style="list-style-type: none"><li>• <i>The litter could be ANY combination</i> of Heterozygous and/or Homozygous Positive puppies. All puppies could be Heterozygote, all puppies could be Homozygous Positive, or the litter could be any combination of the two.</li><li>• However, <b>no</b> puppies can be Homozygous Negative</li></ul>
Homozygous Positive	Will be a Homozygous Positive	All puppies will be Homozygous Positives





# A word about probabilities

Sorting out the difference between a puppy's chance to have a specific DNA status and what will be in your litter can be confusing. Here's an easy demonstration you can do:

1. Take out a coin...it's got two sides, heads and tails. You know that if you flip that coin, there's a 50% chance it'll be heads and a 50% chance it'll be tails.
  2. Now, flip it 6 times. You probably didn't get 3 heads and 3 tails...you may have gotten 2 and 4 or 5 and 1 or all one or the other. *(Mathematically speaking, you had a 31.25% chance of getting 3 and 3)\**
- The reason for this result is that each coin toss is **an independent event**...the result of the second toss has nothing to do with the result of the first.
    - **Each puppy's** DNA is based on getting one gene from mom and one from dad...and that is **independent** of what happens to every other puppy in the litter. That means each puppy is like flipping the coin in step 1 above,
    - However, **a litter** is like flipping the coin 6 times in step 2. That is why we show two separate columns: one for each puppy's possible result and one for the litter as a whole.

\*An explanation of the calculations can be found here: <http://www.dummies.com/how-to/content/how-to-determine-probable-outcomes-with-coins-and-.html>

