Dogs Victoria Fact Sheet
Breeders and Breeding

What is DNA Parentage Testing?

DNA technology is considered the 'gold standard' for detecting the genetic presence of disease and for confirming parentage across many species, including humans.

Most Dogs Victoria breeders will be familiar with DNA testing for breed-specific health issues or undesirable traits – with many breed clubs actively promoting breed health testing prior to the selection of breeding animals to ensure the ongoing global health of their breeds.

Parentage testing (often called parentage 'assurance') is used by many pedigree registers across a wide variety of species – from racehorses to cattle. It not only promotes confidence in the recorded pedigrees but is also a powerful tool in supporting the elimination or reduction of breed-specific health conditions.

Before the development of DNA parentage testing, incorrect parentage often went undetected unless there was some visible proof (i.e. incorrect colour, visibly atypical shape or size) or genetic health testing results were found in progeny that did not follow accepted inheritance patterns.

There are some very high-profile examples within the racing industries where breeders have been charged premium stud fees for a particular sire, only to find out later that they did not get what they paid for !

Where DNA Parentage Testing has been introduced by dog breeding registries around the world, an initial 'error rate' of up to 10% (or more) has been found. That is one in every 10 puppies registered having an incorrect sire or dam!

Given that many breeding and purchase decisions are based on the lineage recorded in the pedigree register, you can see that DNA parentage assurance has an important place in all breeding programs.

So why is the initial error rate so high?

Canine registries that have implemented parentage assurance around the world have found that the majority of errors are not deliberate falsification.

Rather the breeder has been unaware that another male has had access to their female during their fertile period, leading to a litter completely sired by another male, or a multi-sire litter where puppies are born to more than one sire within a single litter.

Of course, there are also cases where a deliberate falsification may have occurred.

Maybe the breeder substituted one sire for another due to known infertility, or to cover up or avoid testing costs for an intentional or accidental mating that may not meet registry requirements.

Examples might include trying to cover up:

- a brother-sister mating
- breeding of a dam that was not of the correct age
- where the breeding would breach litter frequency rules
- a breeding using an unregistered sire or one where the Owner's registration may have lapsed
- using a sire of a different breed or breed variety
- using a sire or dam that had not undergone required health testing etc.

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So how does DNA Parentage Testing Work?

Parentage testing is based on the understanding that the Sire and Dam of an individual each contribute half of the genetic material found in each of their progeny.

> ***Offspring receive one copy of each gene from each parent as the sperm fertilises the egg.***

The genes in each sperm and each egg ('ovum') contain a random assortment of those genes found in the parent animal – with millions of possible combinations across the entire gene sequence.

DNA parentage testing is possible because each offspring can only have genes that are present in their parents.

The 'genotype' of an individual (the complete set of genes that they have) is unique, a bit like a fingerprint.

The chances of two individuals having perfectly identical genotypes is less than one in a million even if they are from the same litter.

> *Note: Although 'Identical Twins' (where two individuals are formed from the splitting of one embryo after fertilization) exist, they have been shown to be exceptionally rare in dogs.*

Your dog's DNA profile uses 'markers' at multiple locations to determine the unique genetic code for your dog. These markers are DNA sequences rather than individual genes.

The DNA profile used for parentage verification does not provide any information relating to breed, health conditions, or other traits such as colour or size.

By comparing the profiles of the offspring to those of the nominated Sire and Dam, it is then possible to determine whether the parent animal could have contributed to the markers present.

Where the genetic markers present in the offspring do match with the genetic markers of the parent in question then they are said to 'qualify' as a parent.

Where the markers present in the offspring match with the markers of the two parents over many different locations the results are considered 99.9% accurate.

Where the genetic markers in the offspring ***do not*** contain the same markers present in either the Sire or Dam, then that individual is 'ruled out' as a parent.

Where are parent is said to be ruled out as a potential sire or dam, the results are considered to be 100% accurate.

Here is a simplified example:

	Marker 1	Marker 2	Marker 3	Marker 4
Puppy	A/C	G/T	C/T	G/G
Dam	C/C	A/G	C/T	G/T
Sire 1	A/C	T/T	**A/A**	A/G
Sire 2	A/G	C/T	C/C	C/G

If we look at the marker in the puppy, we need to be able to account for each of the 'letters' - with one leeter coming from the Dam and one from the Sire.

If we look at Marker 1, you can see that the Dam could only have contributed a 'C' as that is all she has, so the 'A' must have come from the Sire. In this case both sires 'qualify'.

But when we get to Marker 3, you can see that Sire 1 does not have a 'C' or a 'T' to contribute to the Puppy as he only has 'A's'. Therefore, this would exclude him from being the Sire of that puppy.

Want to learn more? Try this short 5-part video series that explains some of the concepts in a very understandable way.