Breeding Basics - Reading a Pedigree

One of the things that set purebred pedigree dogs apart is the recording and documentation of the family tree within the breed for many generations.

If you look at the pedigree papers that came with your female, you will see a three generation family tree listing parents, grandparents and great grandparents in a standard layout and format.

Of course, the family tree extends many generations further back, and there are plenty of breeders who spend hours tracing and recording the ancestors of the dogs within their kennel or breed.

Why study pedigrees?

Studying pedigrees can provide you with a lot of information. There may be health information, colour or coat type information, and the various ancestors listed may have earned 'titles' that will give you an idea of their quality or working ability.

Learning to 'read' and understand pedigrees is a skill that all breeders need to develop. Analysis of the pedigree can help determine the origins of a disease or emerging health issue, can help a breeder narrow down families or lines that might interact well with their own, and can assist with understanding the merits of various animals within their own animal's family.

Having said that, the pedigree only indicates what the animal 'might' be – remember that the best and worst pups in a litter will have exactly the same pedigree, but due to different combinations of genes and gene expression, they may look and behave completely differently. There are also environmental factors such as diet, nutrition levels, training and handling that can influence the underlying genetic potential.

Although all of the animals in an individual's pedigree will have a degree of influence, the first 2 to 3 generations are likely to have the most influence and are therefore most important.

For example, an individual in the 6th generation may only contribute less than 2% of the individual's overall genetic material. Even if they appear multiple times in that 5th or 6th generation, they still may only contribute 2 to 3% of the overall genetic make up of the animal in question. This is due to the somewhat random nature of genetic assortment and the dilution of genes with each generation.

Just because the dog has the all time, top winning herding dog in its pedigree (maybe even several times) does not mean it will sire pups that can herd. If the dog has already sired two or three litters, and not a single puppy has shown any herding instinct, that tells you more than the pedigree does.

What is pedigree analysis?

Pedigree analysis simply means looking at the pedigree to gain information about an individual, their family, or to examine possible breeding combinations.

Important!

Although many breeders place a lot of importance on pedigree when it comes to selecting breeding animals, you need to look at the actual dog in front of you and not just rely on what they are 'on paper'.

There are many dogs with fabulous pedigrees that are not great examples of their breed. There are also plenty of dogs with fabulous pedigrees that are not successful as breeding animals.

Pedigree analysis involves examining the documented family tree and using the information about each individual to determine what that pedigree might contain genetically. This may help you to trace desirable traits within your breed or follow the progression of an undesirable trait or a particular disease.

Pedigree analysis can also be used to assess the level of genetic diversity within an individual and identify any common ancestors that may appear in the pedigree of any proposed mating.

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There are quite a number of ways to do pedigree analysis – everything from computer based pedigree programs to simple spreadsheets to hand written diagrams. Like any 'database', they are only as good as the information entered into them!

Because a pedigree is simply a list of ancestors - like your own family tree, you are most likely going to be familiar with (and more likely to have met) ancestors from the first 2 to 3 generations, and you will have plenty of information about them. When you go further back in the pedigree, the individuals may be very old or may have long since passed away, and you are less likely to have met them. You will have to rely on photos or the memories of breeders who have been in the breed for a long time.

For many traits, the information you can gather will be reliable – coat colour, DNA or health testing results that have been submitted to a reliable register, titles earned etc. However, when it comes to researching other traits, you may find that gathering information is a little harder. There will be information on the internet, breed club records, breed books and publications, and in the memories of long time breeders that you may be able to access. It is up to you to ask the questions and collect the information you need.

Important!

You need to remember that people's memories of an animal may be clouded by opinion and affected by their relationship to the animal and its owners. Make sure you do your research well, and where possible, get as many opinions as possible.

Keeping breeds healthy

As we have already discussed, all of the breeds we see today result from people breeding animals with similar traits or aptitudes together with the aims of breeding a litter of pups that also had these traits or behaved in a certain way. Usually, quite a small number of individuals from the local population were used over quite a few generations to 'lock in' the traits that the breeder was looking for.

As a result of constantly selecting for things such as size, herding or hunting ability, coat colour or coat texture there was an increase in the homozygosity for specific traits/ genes. This had the advantage of producing a reliable style of animal but also risked the increase of recessive traits that may not have been healthy.

Back in those days, breeders would simply cull unhealthy individuals, and animals that were not fit for purpose were removed from the breeding program – the breed either became established or died out. In many cases, an entire breed would be developed at a single kennel or in an isolated area, so the breeding of close relatives was relatively common.

If a problem developed or a breeder needed to introduce a particular trait, it was not uncommon to go 'outside' the kennel and breed to any individual with the desirable trait. There were no 'rules' in place that restricted the use of other 'breeds' or individuals; the focus was on function and personal preference.

Note:

If you look at the history of your breed, you will probably find some information about the development of the breed and its key breeders. Most breeds were developed in a region or area where there was a set of attributes required for success at a particular task – for example, physical attributes that assisted with negotiating the terrain. For other breeds, their history revolves around a large kennel where the breeder had a particular preference for colour, size or a behavioural trait that was important to them.

When the 'Pedigree Registers' were developed, and breed standards were written, there was a move to 'closed' gene pools. This meant that it was no longer permissible to breed animals who were not registered as the same breed if you wanted to have the resulting progeny recorded on the pedigree register.

This presented breeders with a new challenge – how to keep their breed healthy (both physically and genetically) over time, within the limitations of breeding only within the existing population of animals.

Dogs Victoria Fact Sheet
Breeders and Breeding

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Clever breeders were well aware of the effects of breeding animals that were too closely related, even if they did not understand the actual genetics behind it. Because they had large kennels and bred large numbers of litters, they were able to see which combinations produced the best animals and which combinations produced disease, poor fertility, lower birth rates, or other undesirable traits.

These days, with the advances in genetic technology, there are a host of tools that can be used to reduce the risks of breeding animals that may not be compatible and the ability to access genetic diversity through the use of reproductive technology. However, it is still up to the breeder to ensure they consider genetic diversity when selecting breeding animals.

Inbreeding, Line Breeding and Outcrossing – what do they mean?

'Inbreeding' - is the breeding of closely related individuals. It is usually defined in modern times as 'first generation matings' - the breeding of brother to sister, father to daughter or mother to son, or those who have many common ancestors in the first 1 to 2 generations.

Inbreeding increases the risk of the progeny being homozygous for many traits as there is far less genetic variability possible. Increased homozygosity can lead to the expression of adverse recessive traits such as disease and can lead to a general depression of health and fertility.

'Line Breeding' - is technically a form of inbreeding. There is a lot of debate and speculation about what is considered line breeding and what is inbreeding, and it depends on who you are talking to. Line breeding is generally defined as breeding animals who have common ancestors within the first 3 to 4 generations.

Line breeding aims to 'lock in' all of the parents' desirable traits (by increasing the level of homozygosity) whilst avoiding the depressive effects seen when the individuals are more closely related.

'Outcrossing' – An 'outcross' is a mating of two 'unrelated' individuals. This is loosely defined as not having any common ancestors for at least six generations. Within many breeds, an outcross may still include common ancestors further back in the pedigree and therefore may technically be a diluted form of line breeding – it's all about the definitions.
Outcrossing is generally done to introduce a desirable trait or introduce hybrid vigour; however, it does not guarantee healthier or higher quality animals. The genetic assortment seen in 'unrelated' animals can introduce new diseases into a population or result in the homozygosity for unwanted traits that were not visible in the two unrelated individuals or populations.

The breeder's role in genetic diversity

Inbreeding and purebred dogs is a very topical issue – with many animal welfare groups calling for the opening of closed gene pools to address severe breed specific health issues. There is also the promotion of 'cross bred' animals as being healthier or even 'free of disease', which of course, is not true.

As a breeder, it is up to you to make considered decisions when choosing your breeding animals. The level of inbreeding and associated health issues in your breed will direct some of your choices, as will the size of the potential gene pool.

There are rules prohibiting certain combinations, and there are tools to help you assess the level of inbreeding, both within the breed and within an individual or combination.

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The more advanced pedigree software programs allow breeders to calculate several numeric or statistical values relating to genetic diversity. The most commonly used one is 'Wright's Coefficient of Inbreeding', which is calculated using ten or more generations. The inbreeding coefficient is a numerical representation of the relatedness of the mother and father of the litter.

It is important to remember that the inbreeding coefficient is simply indicative of risk – it is not an indicator of health or disease status. It is simply another tool breeders can use when considering the parents of their litter.

The UK Kennel Club has an excellent article on this topic that you can read: https://www.thekennelclub.org.uk/health-and-dog-care/health/getting-started-with-health-testing-and-screening/inbreeding-calculators/

There is also an excellent article on 'Pedigree Analysis and How Breeding Decisions Affect Genes' by Dr Jerold Bell that explains the concept of genetic diversity from a breeder's perspective.

Dogs Victoria Regulation 20.1.14 states:

First generation breeding (eg father / daughter; brother / sister; mother / son) matings are not permitted.