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Pedigree Analysis - Deciphered

Written by and used with the permission of Tina Porter

In our quest to produce happy, healthy puppies, most breeders run genetic reports, or pedigree analysis on a potential breeding looking for both pitfalls and strengths. These reports give us a lot of data- but what exactly are these numbers, what information do they give us, and how should we use them?

Let's take a look at part of a sample pedigree report for the purely hypothetical mating between Lakeway's Take a Chance on Me (Joss) and Lakeway's It's Yours Truly-Sierra (Tru). The top line **#TEST :: Tru/Joss :: 091707** is the data for the **hypothetical** puppy.

PedX Test Report :: sorted by % of Blood (similar to RC report)

Name	COI	COR	Count	Min Gen	Max Gen	% of Blood	Cov AX
#TEST :: Tru/Joss :: 091707	9.70%	100%	1	0	0	0%	109.70%
Lakeways Its Yours Truly Sierra	0.03%	57.01%	1	1	1	50%	59.72%
Lakeway's Take a Chance on Me	13.61%	59.57%	1	1	1	50%	66.50%
Lakeways It's Simply Simon-Zion	14.97%	42.08%	1	2	2	25%	47.26%
Lakeway's Bailey Lady of Zion	16.69%	38.59%	1	2	2	25%	43.67%
Twincedars Desparado - OTX	0%	23.92%	1	2	2	25%	25.05%
Indy Woods of Sierra	11.51%	42.73%	1	2	2	25%	47.25%
Shiloh's Wolfin Sasquach	3.77%	34.05%	8	4	7	24.22%	36.33%
Crane's Our-Tribute-To Contessa	11.23%	32.31%	2	3	4	18.75%	35.69%
Jnk Smoke'N Black Bear Of Zion	10.83%	33.18%	2	3	4	18.75%	36.58%
Shiloh's Easy Rider	3.91%	21.80%	12	5	8	15.63%	23.27%
Morris Good Morning Mona	0%	24.48%	9	5	8	13.67%	25.64%
Snow's A Tribute To Pax-Zion	7.90%	28.33%	1	3	3	12.50%	30.82%
Sierra's Close Encounter	16.25%	28.08%	1	3	3	12.50%	31.72%
Twin Cedar's Northern Dancer	0%	12.02%	1	3	3	12.50%	12.59%
Twincedars Adorable Adelaide	0%	11.95%	1	3	3	12.50%	12.51%
Zion's Winnie-The-Pooh	6.99%	30.80%	1	3	3	12.50%	33.37%
Shenandoah's The Phantom V Zion	14.97%	37.13%	1	3	3	12.50%	41.70%
Super Sweet Sabrina Selah	26.34%	13.21%	12	5	9	12.30%	15.55%
Shiloh's Kara Lobo Of Emmview	2.15%	15.69%	18	6	11	10.94%	16.60%
Shiloh-GuardianStill Smokin'	21.44%	21.94%	14	6	9	10.55%	25.33%
Campaigner's Gunsmoke	3.13%	16.76%	60	7	14	10.55%	17.83%

COI = Inbreeding Coefficient or IC

- A number created by calculating how many times (and in what generation) shared ancestors appear in a pedigree of a specific dog.

- The higher the number, the more ancestors a pup's Mom and Dad have in common. COI's are 0 for dogs with no common ancestors.
- The number also tells you the probability that both alleles for any given gene come from the same ancestor. (This is called having a homozygous genotype.)
- The higher the number, the greater the chance of locking in a trait – either good or bad.
- The higher the number, the more you risk the effects of inbreeding depression.
- Any trait your dog is homozygous for, it will pass that allele on to its pups.

- Keep in mind -

- This number doesn't tell you which ancestor is contributing the alleles that are being doubled on. Is it the one on the dam's side that produced EPI, or the fabulous great-great- grandsire who lived to be 16?
- COI doesn't tell you which particular alleles you might be doubling up on. Is it a "good" allele for a trait, which you want the dog to have? Or is it a "bad" allele that causes disease and structural faults?
- Due to events during sperm and egg cells production, the COI is only a "guesstimate". The reality is it could be higher or lower than this number, depending upon which specific alleles are inherited by each dog in the pedigree from the common ancestor.

COR = Relationship Coefficient or RC

- An approximate percent of the genes passed down from a specific ancestor to the dog whose pedigree you are studying.
- The higher the COR value, the more genes the ancestor and hypothetical pup will have in common, and the greater the chance they will share a trait.
- COR values are influenced by the dog's COI number, presence of other relatives in the pedigree, and pedigree position.

- Keep in mind -

- Again, this is only an approximate percentage of the genes. When mom "passes" her genes to the puppy the COR expects that 50% are coming from her mom and 50% from her dad. But this may not be the case. Of the genes mom passes to the pup, anywhere between 0 and 100% of them may come from her mom, not just 50%. This is why siblings don't all look alike (and are genetically different) - they are getting different combinations of genes from their parents.

Count

- The number of times this individual shows in the pedigree. Higher the count, the higher the possibility of locking in traits from this ancestor.

- Keep in mind -

- While this number can be quite large (example: Campaigner's Gunsmoke) and his genes are found in the dogs we are breeding, it is more important to look at his COR and Cov AX numbers to determine his true genetic influence. This dog first appears in the 7th generation, and his genes have been filtered through his offspring to our current breeding pair. It is the genes being held by the dogs in the first 4 generations and their immediate relatives that are more likely to be of worry.

Min Gen

- The first generation that the dog appears in the pedigree. The lower the generation number the more recent the dog- the 1st generation are the parents, 2nd grandparents etc.

Max Gen

- The last generation that the dog appears in the pedigree.

% of Blood

- Another method of showing the possible genetic contribution of each ancestor.
- Based on the calculation that each dog passes 50% of its genes on to the next generation. So for the planned puppy - the parents each contribute 50%, in the grandparents 25%, the great grandparents 12.5%, and the great-great grandparents 6.25%, etc.
- Dogs that appear more than once in the pedigree will have % of blood number that doesn't follow this pattern. Their contribution from each appearance in the pedigree is combined into one number.

- Keep in mind -

- This is different from RC in that the calculation for RC uses the IC for the dogs. % of Blood is based only on the dog's position in the pedigree.
- Problems with this data are the same as the ones for RC

Cov AX –Genetic Covariance

- It determines the extent to which the planned pup will resemble that specific ancestor.
- COR, COI and % of Blood are used to calculate genetic covariance. The more homozygous the dogs genes (COI), the more of that dogs genes get passed on to its offspring (COR), and the closer that dog appears in the pedigree (Min Gen), the more of its genes the pup will carry (% of Blood), therefore, it is more likely its offspring are going to look like that dog.

- Keep in mind-

It is only as accurate as the numbers used to create it - so the "Keep in minds" are also true for this one. If the stud looks like his great grandpa on the sire's side, that great-grandpa may be a greater influence than what the numbers suggest.

Each of these numbers can give you useful information when planning a litter. While it would be nice to think that there is a magical formula or combination of COI/COR/CovAX numbers that would create the perfect litter of pups, it simply is not true. An IC of less than 10% will not guarantee you a healthy litter, just like an IC of over 30% doesn't mean all the pups will be sickly. Instead, these numbers are best used to help us to identify important individuals (those who will make a large genetic contribution to our pups). Then it is up to us as breeders to research those individuals, find the plusses and minuses associated with them, and then make the best decision possible.

COI – The most useful COI number is the one for the planned puppy. Having a low COI lessens the risk of doubling on a nasty hidden recessive allele, suffering from inbreeding depression; and helps keep our gene pool healthy. The COI's for the rest of the dogs in the pedigree are interesting, but only useful in that they are used to calculate COR and CovAX.

COR, % of Blood, Count and CovAX are all excellent for pointing out dogs in the pedigree that we should know more about. The higher these numbers are, the more genes they will give to the puppy, the more they will determine what your pups will look like, therefore the more important they are to investigate. This is why it's important to also look at the ancestors (and their littermates), especially the 2nd and 3rd generation, so you can see some of the traits they have and get an idea of some of the genes they carry. What are some of the health issues associated with this dog? This dog's siblings? This dog's offspring? This dog's ancestors? Pedigree report numbers don't tell you what they look like, what they act like, or how healthy they were.

Let's look at the hypothetical mating. The COI is under 10%, which is great! No inbreeding problems here. Now the COR values. The big numbers here belong to the dogs in the first 3 generations, as they should. But a closer look shows a large contribution from Shiloh's Wolf in Sasquatch (4th generation) too. So these are all dogs to investigate further.

% of Blood shows that the dogs in the first 3 generations and Sasq are all large contributors.

Cov AX tells us the pups will most likely resemble Joss (Lakeway's Take a Chance on Me). It also shows that the Tessa/Bear line will play a large role in these pups make-up, as the dogs these pups are most likely to resemble: Joss (66%) Tru (59%), Simon (47%) Indy (47%) and Phantom (41%) all have Tessa/Bear behind them. Sasq (37%) is also a big influence, as well as Bailey (43%). Interestingly, the outcross Jake (Twincedar's Desperado) contributes the same % of Blood as Bailey (Lakeway's Lady Bailey of Zion), but he has a much lower Cov AX score. This means the pups are almost twice as likely to look like her as they are him, even though they are both grandparents to the litter.

After looking at this report, things I might ask myself now are:

What are some of the health risks associated with Tessa/Bear lines? Do any of the dogs in the first 3 generations suffer from one of these risks? Have they produced it? What are the strengths of these dogs? What are some of the good and bad things (health, conformation, and temperament wise) that the top genetic contributors could be passing forward? What are some of Joss's weaknesses, and does Tru have the same fault(s)? Knowing that all breedings have pros and cons, do the pros outweigh the cons?

To sum everything up -

Pedigree analysis reports are valuable tools that can help give us a sense of which dogs will be the largest genetic contributors to a litter. Once those individuals are identified, they can be researched further to get a sense of what genes they do carry. However, they are not the only tools a breeder should rely upon. These numbers alone do not give enough information about the dogs to be the sole basis for planning a litter. One must always take

into account the actual dogs that are being considered for breeding. In addition to their individual health, temperament and structure, one must also attempt to learn as much information as possible about their siblings and parents.

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