Opinion Piece: Perpetuating Bloodline Diversity for Future Generations
Written by Kimberly Dunn
September 2023
Note: This opinion is based on the analysis of the reverse pedigrees of the 2017-2022 contributing breedstock in North America. Reverse pedigrees were formulated by including sire/dam ancestors in G2 and G3 and sire ancestors in G4.

When comparing heritage breeding to modern breeding, heritage breeding often requires more emphasis on the preservation of genetic health, bloodline diversity and breed type in the midst of low numbers and very small breeding/bloodline pools. Line breeding and in-breeding will be evident in brood stock pedigrees simply because there are fewer combinations to choose from and create. In some rare breed situations, like the Fell Pony, simply calculating an inbreeding coefficient for a proposed mating is not enough. We need to keep informed on bloodline trends and choices at the collective level. For example: Let's say you breed Stallion X to Mare Y and they share only 1 ancestor in the 3rd generation. An inbreeding coefficient calculation would be low leading you to think it's a good match. But what if we come to find that one ancestor is found in 60% of the bloodline/breeding pool and 30% is tight line bred with that one ancestor. We may then have what looks like a good breeding for the one foal coming from the mating but not necessarily beneficial for the collective future.

The North American breeding pool of Fell ponies for the years 2017-2022 consists of 110 contributing mares and 41 stallions. When looking at these numbers in light of my example of breeding stallion X to Mare Y, the hypothetical 60% presence of an ancestor relates to 90 out of 151 total ponies. If that 60% includes just even a few stallions, the ancestor is perpetuated at a faster rate as stallions can have multiple progeny in a year. When analyzing the top 9 producing North American stallions in this 6 yr. pool, we not only see related lines with these stallions, we see their lines exponentially perpetuated with their progeny. For example with stallions, out of the 41 contributors, the top 9 producers collectively have 16 progeny also contributing.

When looking at the bloodlines of the North American breeding pool in light of the global producing bloodline pool which is both small and lacking in diversity, acquisition and breeding choices should spring from this knowledge. Anyone who takes time to look into the bloodlines of the Fell pony breeding pool will easily see that line breeding, from tight line all the way to inbreeding, is common practice. The most common general motivation for line breeding is to perpetuate desired traits. A pattern of healthy line breeding makes sure to pick complementary lines for outcrossing before breeding back to the perpetuated line.

The not so easy task of finding good outcross lines gets even more challenging if our fellow breeders are line breeding the same pathways to foundation lines as everyone else. Homozygosity of traits achieved by line breeding is a double edged sword in that it can cause high rates of undesirable traits as well as genetic mutations leading to disorders or diseases. Here is a hypothetical example: Take the foundation stallion, Rylstone Black Knight having a high percentage of influence in the 2022 bloodline pool with multiple progeny and grand-progeny significantly passing on his lines. Should a stallion like Black Knight turn up testing heterozygous for pssm1, we could end up with a significant number of progeny and grand-progeny inheriting the related genetics. If Black Knight's lines are heavily perpetuated through line breeding

and in-breeding, we then speed up a path towards the homozygosity of pssm1.

Here is another way to look at this concern. The Dales Pony Society has a policy that licensed stallions must be FIS clear. With the Dales Pony breed having an even smaller breeding pool, one might think that eliminating a carrier stallion from the gene pool would be a mistake when there is such desperation for bloodline diversity. However, it is evident that the opposite couldn't be more true when one looks forward into the future probability of having a high rate of carriers in the collective breeding pool. If your breeding pool reaches a high rate of carriers, you then are limited in options for safely producing bloodline diversity. Fortunately, FIS is recessive and strategies can be utilized to ensure it does not overly plague a breed. But what if a genetic disease that is dominant finds its way into the breeding pool?

Many personal hours have gone into analyzing the North American broodstock bloodline pool and organized them into reverse pedigree format. This format allows one to look at what is happening with bloodline perpetuation at the collective level. I have also begun the same analysis for the UK breeding pool which is still very relatable to ours here in North America. This analysis gives me the ability to help breeders make better informed decisions when planning matings and making new acquisitions for their programs. Please contact me for more details and information on consultations.