MHC HAPLOTYPES

The following article is a small part of a seminar given by myself for EACA this year. Having been asked to submit a part of the seminar for publication in 'The Round Up' I felt the subject of HMC Haplotypes is relatively new and yet of great importance to the modern Breeder.

Has anyone reading actually heard of MHC Haplotypes? Well until recently neither had I. However the more I have come to read on this subject the more intrigued I am, MHC Haplotypes are essential to the continuation of life, and not only that but it is essential we keep a high variation of such Haplotypes within the breed. I appreciate that a lot of people will find an explanation of MHC way too complex and I have tried to simplify things, however if I leave you behind don't worry and I apologise to those that are ahead of me, I will use an example to help in a few moments, so please bear with me. The immune system is governed by the **Major Histocompatability Complex (MHC).** This group of genes is referred to as a "complex" because they are all positioned close together on one chromosome. This positioning virtually guarantees that the genes will be inherited as a unit called a haplotype. The haplotype will be passed to offspring without the usual shuffling that occurs as genes are distributed into sperm or eggs. Every individual possesses two MHC haplotypes, one inherited from each parent.

These haplotypes enable the immune system to respond to and fight viruses and bacteria and they exist in all species of mammal. In any wild species and in humans, there are so many variations within these haplotypes that many individuals have unique combinations. MHC genes have a high mutation rate; this is for good reason, because their diversity is VERY important to species survival.

MHC is natures answer to the problem of infectious disease. A mere handful of allele would not allow the necessary flexibility to face down an ever-evolving array of pathogens. In most cases, each haplotype a dog has will differ from the other, thus increasing its odds of having something in its immune arsenal that will work against whatever nasty bug it may encounter. Each individual will have two haplotypes but the overall population of a species will have a great many. So when a new disease comes along the species will survive even though individuals will die out, because some individuals will always have the correct combination of MHC alleles to fight of the attack.

Survivors of epidemics have the "right" combination of MHC alleles to combat that particular infectious disease. The same plague may occur again and again, but as time goes by it becomes less virulent because those with inadequate MHCs will have died and been removed from the breeding population. The high MHC mutation rate guarantees that there will be plenty of ammunition for any new plagues that occur.

Now I shall try and explain this in a less complicated manner. Lets us say each parent has two doctors bags filled with equipment for fighting infection, and when a puppy is born he inherits a Doctors bag from each parent. OK let us open our doctor's bags...

Between the two bags we might get something to help fight 6 viral infections, 7 bacterial infections and an antihistamine to help combat allergies. But if both Doctors bags are pretty much identical, the new puppy will have less medication to choose from, if he becomes ill there is less chance of him finding a cure in his Doctors bags.

Now we get to the important part.

To ensure MHC variety within a species, all **naturally** reproducing species will avoid or significantly limit inbreeding, and this includes line breeding. Studies in mice have shown that females show a preference for mates with dissimilar MHCs, thereby ensuring the offspring sired by those males will have flexible immune systems. Whilst no studies have been done on dogs to date, there are lots of reports of bitches that refuse to mate with closely related dogs.

In an inbred individual, the chance that both parents have passed on identical genes within the MHC increases. This situation diminishes the body's capability to mount an effective immune response. Such dogs are more prone to infections and are more likely to suffer autoimmune disease or allergies.

Going back to our Doctors bags, the closer the breeding behind our puppies' pedigree, the lower the chance of him having variety in his Doctors bags.

Overall the canine population probably contains as much MHC diversity as it ever did, BUT when we begin dividing the species into individual breeds, and then we line and inbreed within these breeds the available MHC allele become limited.

Without diversity within the MHC, the dog is much more vulnerable to disease. If the disease is bad enough, the dog may die. If there were only a few possible MHC haplotypes in a breed or species, the risk of an entire population being wiped out by a virulent plague would be very high.

The regular use of popular sires over several generations can play havoc with MHC diversity. Since any individual can only have two MHC haplotypes, if a significant portion of a breed descends from a relative few individual dogs the population may not be able to respond effectively to the next canine plague that comes along.

Inbreeding has been the norm in domestic dogs for more than a century. As we have said the technique is used quite effectively to "fix" traits deemed desirable. The practice of inbreeding to improve breed traits has inadvertently led to a reduction of MHC diversity within the individual breeds. Unfortunately most Breeders do not appreciate that continued line Breeding is a form of Inbreeding!

Popular sire use is especially pernicious because each such sire can have only two MHC haplotypes--nowhere near the hundreds that exist in the canine genome. Therefore, when a significant portion of a breed descends from one individual, those dogs' resistance to infectious disease or susceptibility to autoimmune disease can be seriously affected. No dog affected with chronic autoimmune disease or serious allergies should be bred. Auto Immune diseases include "Collie nose" which is an autoimmune dermatitis of the face. Another growing problem created by a faulty immune system is generalised Demodectic Mange.

My seminar goes on to explain the amount of inbreeding within the Breed today, and I think the truth of this would alarm most of us, but that is another story!

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