

Major Histocompatibility Complex and Autoimmune Disease in Dogs

By Steve Goodman

The Major Histocompatibility Complex (MHC) can best be described as the “factory floor” of the immune system. The MHC is an area of the human, and canine genome, which has been identified to code for the creation of proteins that the immune system uses to distinguish between foreign and non-foreign bodies. All cells within the body are “tagged”, if you will, with “self” proteins produced by the MHC. Basically the way that both the human and canine immune system functions is that the T-cells of the immune system interact with the protein coat of any material they encounter in the body – it is the MHC that gives the body’s own cells the “secret password” that tells the T-cells this is a friend, not a foe to be destroyed.

These “friend or foe” protein markers are also called antigens. In humans, they are known as human leukocyte antigens (HLA) and in canines, Dog Leukocyte Antigens (DLA).

When the T-cell encounters a material and determines that the antigen does not belong there – it will take steps to attack and kill the cells that are surrounded by the foreign protein. This is how the immune system kills bacteria and other microorganisms, which get into your dog’s body.

When a virus gets into the body, it hijacks the reproductive system of the cells it invades, forcing it to make duplicates of itself, and in effect changes the protein signature of the cell. This is how the immune system can identify cells, which have been infected by viruses, and attack them to try to stop the spread of the infection.

In humans it is the MHC that leads to rejection problems in organ transplant surgeries, and why transfusion of the “wrong” blood type can be fatal. Recently, protocols for both kidney and liver transplants in dogs have been developed. As such procedures gain more wide spread acceptability among practitioners- deeper understanding of the functionality of the MHC in tissue rejection will need to be explored and anti-rejection treatments expanded, as they have in humans. However, just as it is in humans, the most significant aspect of the Major Histocompatibility Complex to your dog’s health is the role the MHC plays in so-called autoimmune diseases.

What is an Autoimmune Disease?

An autoimmune disease is basically a condition where something “goes haywire” with those codes produced by the MHC, and the body starts treating “friends” as “foes” – and basically turns on itself.

“Autoimmunity” literally means “immunity against self”. The symptoms of autoimmune disease are caused by the body mounting an immune response to antigens that would normally be recognized as “self.” Most autoimmune diseases in dogs, as well as in humans, have a genetic basis. It is believed that there is genetic variance in the MHC that causes the individual or dog to be more susceptible to an autoimmune reaction, and that various environmental factors from viruses, bacteria, and allergens, to toxins can set off that susceptibility. Veterinarians identify four major factors relevant to causes of autoimmune disease in dogs,

- Genetic predisposition

- Hormonal influence
- Viral Infections
- Stress

In dogs that may be predisposed to autoimmune reactions, common vaccines for canine disease such as distemper and parvo have been known to trigger the response. Certain regularly used canine drugs have also been associated with aggravating immune response blood disorders, such as the newer combination of monthly heartworm preventives. Keep in mind too, that any drug has the potential to cause immuno-related side effects in such susceptible individuals.

Because it is known that autoimmune diseases are linked to genetic predispositions in the MHC—this is yet another reason why potential dog owners of purebred dogs should only deal with respected and reputable breeders who are aware of, and employ breeding practices designed to limit genetic disorders.

The thyroid gland plays a key role in the immune system, and thyroid disease is one of the most common autoimmune diseases in dogs. Since proper thyroid function is critical to a healthy immune system, if the dog is susceptible to thyroid disease, by inference it is also likely susceptible to other autoimmune disorders. This is why genetic screening for thyroid disease can be used in healthy animals to determine their fitness for breeding.

The animal's blood is tested for the presence of antithyroid autoantibodies. Any dog that has such antibodies circulating in the bloodstream, could potentially develop thyroid disease, and/or be vulnerable to other autoimmune diseases because his or her immune system is compromised. Responsible dog breeders use thyroid prescreening as a very important tool for selecting good breeding stock.

Common Canine Autoimmune Diseases

As stated, Lymphocytic thyroiditis, is the most common MHC related autoimmune disease in dogs, and as such actually serves as a marker for susceptibility to a myriad of other autoimmune diseases. Some of these are:

- Autoimmune hemolytic anemia (AIHA),
- Immune-mediated thrombocytopenia (IMTP or ITP)
- Autoimmune thyroiditis (hypothyroidism)
- Hypoadrenocorticism (Addison's disease)
- Systemic lupus erythematosus (SLE):
- Rheumatoid Arthritis (RA)
- Myasthenia gravis

Other MHC Functions

It would be remiss in an article about the MHC and canines not to mention this interesting sidebar. Recent studies have shown that the MHC may form the scientific basis for the continuing anecdotal reports of dogs with the ability to “sniff out” cancer in humans. The olfactory ability of dogs is well documented. Dogs can identify chemicals diluted to parts per trillion in solutions. There have long been reports of dogs alerting owners to the presence of

melanomas by constantly sniffing at a skin lesion. There have been several clinical studies published in respected medical journals that have tested and confirmed the ability of dogs to detect melanomas, bladder, breast, and lung cancers. Now, a recent study published in the journal *Medical Hypotheses*, indicates that anomalies in the MHC of the humans presenting with those cancers may be the mechanism for these dogs' remarkable diagnostic abilities.

It is known that human body odor is determined by the human leukocyte antigens (HLA) that are produced by the Major Histocompatibility Complex. The study concluded that "the volatile organic compounds produced by tumors, and detected by dogs, are products of MHC genes. These HLA molecules in humans have "soluble and detectable isoforms that are present in body fluids such as blood, urine and sweat, and there is a strong association between changes in HLA and cancers."