

# Immunology 101

## SOME BASIC CONCEPTS OF IMMUNOLOGY HELP EXPLAIN HOW VACCINES WORK

By Rene Gandolfi, DVM

*This is the second in an ongoing series of articles on vaccination.*

The immune system has evolved to help animals deal with attacks by various microorganisms such as bacteria, viruses, and parasites. In simple terms, the defense is provided by two different systems. One, called cellular immunity, depends on the action of a group of cells that "recognize" the invader and then either kill or neutralize it. A family of lymphocytes called T cells is responsible for coordinating the attack.

A second system, humoral immunity, uses a class of protein molecules called immunoglobulins. Produced by B lymphocytes, these proteins are Y-shaped. At the end of the each of the two arms is a chemical binding site. At these binding sites, immunoglobulins are able to attach to the surface of the bacteria, viruses, or parasites. Each site is designed to bind with a very specific location (called an antigen, located on the

surface of the microbe), much like a key fits only one particular lock.

Once an immunoglobulin molecule attaches, it can then serve as a "molecular signpost" to alert other cells in the immune system that there is something here that needs to be destroyed or removed.

Because each molecule (antibody) has two attachment sites, immunoglobulins can also crosslink two different viruses, etc. The binding of a bunch of them can lead to the aggregation of a large antigen-antibody complex that, because of its size, is more easily filtered out of the system by other parts of the immune system.

Whether the exposure is from natural infection or by vaccination, the immune system is trained to react.

With humoral immunity, the first exposure to an antigen will cause the development of particular B cells. Once mature, each B cell will only

produce one (and only one) kind of immunoglobulin molecule shape. The B cell becomes a dedicated factory, manufacturing multiple identical copies of the immunoglobulin it was trained to produce. On a second exposure to the same antigen, some of these cells will multiply resulting in many more cellular factories and a much higher level of antibody production (titer).

Antibodies circulate in the blood. During pregnancy, antibodies circulating in the mother's system can cross the placenta. Called passive immunity, this transfer of antibodies protects the newborn until the youngster's own immune system matures enough to become capable of fighting off infections. Thus maturation usually takes between 6 and 16 weeks depending on the particular infection. As we will see in later discussions, this same passive immunity can interfere with the effectiveness of vaccines that are administered to young animals.

### Canine Distemper Outbreaks

On June 9, animal control officers in Chicago confirmed canine distemper has been detected in the city. In July, distemper also struck a ferret shelter in Westchester County, New York.

To ensure your pets' safety, you must keep them up-to-date on their vaccinations.



*Congratulations  
to Onyx,  
owned by Laura Williams,  
named  
Companion of the Year 2002!*

Photo by Photos With Flair, Jennifer Deming-Lambert, Grand Rapids, Michigan