Serum Neutralization Titers

By John C. Wenzel, Extension Veterinarian

We will start this month with a few basic definitions needed to understand the topic of this newsletter.

Antigen- a toxin, protein or other foreign substance that causes the body to initiate an immune response, usually resulting in the production of antibodies against the foreign substance.

Antibody- a protein produced by the body’s immune system in response to recognition of a foreign substance, which will assist in the neutralization of the effects of that substance.

The immune response is a very complex system. For the purposes of this newsletter, we will discuss the immune response in a very general sense. For an antibody to be circulating in the bloodstream, the immune system had to have prior exposure to the antigen that resulted in the production of that antibody. When the body is exposed to an antigen, many processes are engaged to produce antibodies against that antigen. How and where in the body that a particular antigen is presented to the immune system can influence the antibody production. These principals are the basis for the types, routes and frequency of administration of vaccines. We have learned to manipulate the immune response and prepare an animal’s body for the possibility of re-exposure to a particular antigen.

There are many tools available to evaluate the immune system. One of these tools is serum neutralization titers or SN titers. A serum neutralization titer is a measure of circulating antibodies and the level at which it no longer neutralizes a known amount of antigen added to the test sample. While we realize that SN titers are a very rough measure of the immune response, SN titers can provide guidelines to help us in the evaluation of the immune system. The results of an SN titer requires additional information to be interpreted, such as what is the vaccination history, the age and health status, and the presence or absence of clinical signs of the tested animal. SN titers are generally very specific against a particular disease, but this can be complicated by diseases that have different strains or types that have similar cores, but have different aspects that cause different effects on the body. To submit a sample for SN testing, a blood sample is drawn and placed into a tube that will allow the blood to clot. The sample is spun in a centrifuge to separate the serum from the cells. This serum is used for the testing. A measured amount of serum is placed into a test well, and then each subsequent test well is a one half dilution of the previous well. This means the first dilution is a 1:2 dilution. The next well will be a 1:4 dilution, then 1:8, 1:16, 1:32, 1:64 and so on. Then a known amount of antigen for a particular disease is added to each test well. The last well at which this known amount of antigen is neutralized is the SN titer. For example, if the antigen is
neutralized at the 1: 32 dilution, but not at the 1: 64 dilution, then this sample has an SN titer of 1: 32. We know there was enough circulating antibody present in this sample at a 1:32 dilution to neutralize the known amount of antigen that it was challenged with. The higher the number or dilution, the greater the amount of circulating antibody. While this does not mean greater immunity to the particular disease, it is suggestive that the higher the titer, the better prepared the animal may be to re-exposure to the disease tested for. Also, generally speaking, the immune response to the natural disease cannot be differentiated from the immune response created by vaccination. If an SN titer is negative or zero, then we do not know if exposure to the tested disease has never occurred, or took place so long ago that circulating antibodies have decayed and disappeared. If no SN titer is detected, it is suggestive that this particular animal may be susceptible to the tested disease. If an animal has a titer of 1: 4, we can make some general statements, such as we know this animal has not been recently exposed or vaccinated for the tested disease. We know this animal has produced antibodies so exposure took place at some time. If an animal has a titer of 1: 1024, this suggests more recent exposure or vaccination. In some cases, the titer will be greater than the testing capabilities. At a point, or “end point” the test will not be carried out any farther. For example, with BVD testing, the end point used by the Colorado State University Diagnostic Laboratory is 16,384. So a titer greater than this will be reported as >16,384. With some diseases, the titers generated by natural exposure to disease are much greater than what is generated by vaccination. Also, the type of vaccine, such as killed versus modified live vaccines will influence the amount of circulating antibody present. Generally, modified live vaccines create higher SN titers.

Understanding these basic principles will assist in the interpretation of SN titers. So when sample results are obtained, you must ask about vaccine history and frequency. Then the SN titer is used as a general guideline. It is best used to look at a group of animals, rather than an individual. Questions such as “have these cattle been vaccinated or exposed to a particular disease?” or “is my vaccination program giving me the duration I am seeking?” can be evaluated using SN titers. It may be prudent to run a few samples on incoming cattle or new additions to look at background immune status. This may assist on deciding on whether or not to vaccinate new additions. While SN titers are not the “end all- be all”, they are a tool that when used and interpreted correctly can be a very valuable diagnostic test to provide information to aid many management decisions.

For further information on the Bull Test Sale, please see attachment.
Check us out on Facebook!


NMSU Dept of Extension Animal Sciences and Natural Resources

New Mexico State University is an equal opportunity/affirmative action employer and educator. NMSU and the U.S. Department of Agriculture cooperating.