

Basics of Cattle Immunity

When establishing a vaccination program it is important to understand how animals naturally protect themselves from infection and how vaccination and other management practices enhance that protection.

There are three major ways the body defends itself against infectious organisms.

1. The first method is physical barriers, such as skin, normal microorganisms, and self-cleaning procedures such as coughing, sneezing, vomiting and diarrhea. Organisms that penetrate the body are often eliminated by these procedures. Animals must be adequately hydrated and nourished for these barriers to work effectively.
2. The second method of body defense is native or innate immunity. The native immune system controls invading organisms with chemicals and/or by ingesting them. The native immune system lacks memory, so each infection is treated in the same manner. The immune system needs adequate nutrition (including energy, protein and minerals) to function at a maximum level. Stress reduces the efficiency of the native immune system.
3. The third method is the acquired immune system, which responds to vaccines. This system can recognize and destroy specific invaders. With acquired immunity, the body remembers specific invaders and can respond more intensely if stimulated by those invaders

later. While physical barriers and the native immune system respond rapidly, the acquired immune system takes days to weeks to become effective. When the acquired immune system is compromised, as in human AIDS patients and cattle with bovine viral diarrhea (BVD), other diseases can rapidly overcome the animal's defenses.

Acquired immunity may involve the production of a specific antibody (humoral immunity); or, it may involve the rapid recognition and destruction of specific foreign cells (cell-mediated immunity). The humoral immune response is relatively easy to measure and it is the most common way immune responses to vaccine and/or disease are detected. Cell-mediated response is much more difficult to quantify. The body reacts to specific diseases with either an antibody or a cell-mediated response. Organisms that attack the outsides of cells usually respond to antibodies. Organisms that invade the cell, such as all viruses and some bacteria (including brucellosis), often are better controlled with a cell-mediated immune response.

Vaccines made from modified live products are usually more efficient at protecting against diseases such as brucellosis or BVD that infect the insides of cells. Modified live vaccines replicate in the animal and usually do not require boosters. However, these vaccines are easily degraded and made ineffective by exposure to chemicals or extremes of light or temperature.

Vaccines made from killed products are usually more efficient at destroying organisms that attack the outsides of cell, such as those that cause blackleg or tetanus. Killed

Tom Hairgrove and
Steve Hammack*

**Program Coordinator for
Livestock and Food Animal
Systems and Professor Emeritus
and former Extension Beef
Cattle Specialist, The Texas
A&M System.*

products do not replicate, so boosters are usually needed for good protection. Killed products can give undesirable results if shaken excessively or frozen.

All vaccines should be handled according to manufacturers' recommendations.

A vaccination program is simply a tool in a total health program. Animals must have adequate nutrition for their immune systems to work properly. Animals also should be protected from environmental and social stressors and parasites, which may decrease an animal's natural response to disease and the effectiveness of vaccines.

Administering too many vaccines, or vaccines that are not compatible, also can lower the immune response. Some vaccines should not be administered to pregnant animals because they may cause reproductive loss. Vaccines may not be effective when given to calves with high levels of maternal antibodies. All of these factors are reasons why you should consult with your veterinarian when designing vaccination programs.

Vaccines are not always effective under field conditions, so producers should have reasonable expectations of vaccine programs. A vaccine program to prevent unborn calves from becoming persistently infected with BVD might be quite different from one to control BVD in a group of stocker calves.

Always consult with your veterinarian, who is familiar with disease patterns in your area and can recommend the most effective vaccination program.

References

- Tizzard, I.R. 2009. *Veterinary Immunology: an Introduction*, 8th ed. Saunders Elsevier.
- Abul, A.K. and A.H. Lichtman. 2009. *Basic Immunology: Functions and Disorders of the Immune System*, 3rd ed. Sanders Elsevier.
- Roth, J.R. 2009. *Basic Immunology and Principles of Vaccination*. Institute for International Cooperation in Animal Biologics.

Produced by AgriLife Communications, The Texas A&M University System
Extension publications can be found on the Web at: <http://AgriLifebookstore.org>.
Visit Texas AgriLife Extension Service at <http://AgriLifeExtension.tamu.edu>.

Educational programs of the Texas AgriLife Extension Service are open to all people without regard to socioeconomic level, race, color, sex, disability, religion, age, or national origin.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Edward G. Smith, Director, Texas AgriLife Extension Service, The Texas A&M University System.
New
