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Basic Vaccinology Pt.2 of 2

Traditionally, there have been two types of vaccines through the years: live or modified live vaccines and killed vaccines. Modified live vaccines infect host cells and undergo replication. These infected cells then process endogenous (inside the cell) antigen. In this way the vaccine antigen triggers an immune response. One of the hazards with this approach is the live vaccine organisms may themselves cause disease or persistent infection (residual virulence). For this reason the virulence of live vaccines must be reduced so that they will create a protective immune response without creating disease.

The process of reducing virulence is called attenuation. Attenuation of live vaccines can be achieved in a number of different ways. One way is adapting organisms to growth in unusual conditions so that they lose their adaptation to their usual host. Genetic manipulation of the organism is another attenuation technique. Prolonged growth in tissue culture in cells that the virus is not adapted to is a common attenuation technique for viral modified live vaccines. Advantages to using live vaccines include fewer inoculating doses required, adjuvants are unnecessary, less chance of hypersensitivity, and induction of interferon.

Killed or inactivated vaccines are the other common type of vaccine. If organisms are to be killed for use in vaccine, it is important that they remain as antigenically similar to the living organism as possible. One common way of inactivating is the use of formaldehyde.

Alkylating agents such as ethylene oxide, ethyleneimine, acetyleneimine, and beta-propiolactone are also used in veterinary medicine as inactivating agents. The advantages of using killed vaccines are 1.) They are stable in storage 2.) They will not cause disease through residual virulence 3.) They are unlikely to contain contaminating organisms. The disadvantages to using killed vaccines include the tendency to induce a lesser immune response than live vaccines and therefore adjuvants are commonly added to killed vaccines to increase the immune response. Common adjuvants are aluminum phosphate, aluminum hydroxide, Freund's incomplete and complete adjuvant, saponin and many others.

Other disadvantages to killed vaccines are the local reactions that the adjuvants can cause and the need for multiple dosing which increases the risk of hypersensitivity reactions. The most common route of administering vaccines is through injection subcutaneously or intramuscularly. Some modified live vaccines can be given intranasally to more closely simulate the natural route of infection and stimulate a quicker, local immune response (interferon). Research using oral vaccines is ongoing and has actually worked with some success in raccoons with an oral rabies vaccine in an edible vehicle. When a farm or ranch encounters an organism that is unique or a variant that for which there is no commercial vaccine for, an autogenous vaccine may be useful. Autogenous vaccines are made from a sample of organisms taken from infected animals on a given farm and is made specifically for use at that particular location.

Although killed and modified live vaccines have been very successful over the years, modern vaccine technology is an exciting and continuously growing field. Modern genetic techniques can produce new, improved and safe vaccines. The USDA classifies these new vaccines into three categories: Category 1.) Antigens generated by genetic engineering Category 2.) Genetically attenuated organisms Category 3.) Live recombinant organisms.

The decision to use vaccines for the control of any disease must be based on considerations that the risks of vaccination do not exceed the risk of contracting the disease itself. In most cases, vaccination is the way to go. As mentioned in the beginning of this article, vaccines have provided a great service to people and animals for decades. They have helped to eradicate or control many diseases that previously caused epidemics.

Vaccines help the rancher to provide a safe end-product on the grocery store shelves while increasing profitability for the rancher by eliminating diseases. Vaccines have been so successful in fighting disease through the years that the general public has taken the benefits from vaccinating for granted. The slight risks of adverse reactions following vaccination should always be viewed in light of the great numbers of animals that have been protected



from vaccination. Stop and think what the world would be like without vaccines.

Ref.: Tizard, Veterinary Immunology, 6th edition.