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Basic Vaccinology Pt.1 of 2

Vaccines have proven to be a major scientific advancement for people and animals for over a century. Vaccination is the most efficient, practical and cost-effective means of controlling infectious diseases via prophylaxis. The enormity of the benefit from vaccines is hard to comprehend and is one of the biggest reasons (if not the biggest) we as a society currently enjoy our relative good state-o- health. Vaccination has been responsible for the eradication of small pox across the globe; the elimination of hog cholera and brucellosis from North America; and the control of diseases such as foot and mouth disease, pseudorabies, rabies, anthrax and rinderpest would not have been possible without the use of effective vaccines.

The general principle behind the use of vaccines is to introduce a modified and safe version of a given pathogen into an animal host which induces an immune response that will be protective to the animal in the future if and when it encounters a natural exposure to this pathogen. There are two basic methods by which an animal may be made immune to an infectious disease. One method is passive immunity which produces immediate but temporary resistance by transferring antibodies from a resistant animal to a susceptible animal. Examples of this type of immunity include colostrum from the dam to the newborn and the use of tetanus and *Clostridium perfringens* C & D antitoxins. The second method of immunization is called active immunization which involves administering antigens (foreign substance-vaccine) to an animal so that it responds by developing its own protective immune response. Re-immunization or exposure to infection will result in a secondary immune response. The disadvantage of active immunization is that protection is not conferred immediately. The advantage of active immunization is that once it is established, it is long-lasting and capable of restimulation.

Passive immunization requires that antibodies be produced in a donor animal by active immunization and that these antibodies are then given to susceptible animals in order to confer immediate but short-lasting protection. Serum containing these antibodies, (sometimes called serum antibodies, antiserums or antitoxins) may be produced against a wide variety of pathogens. The most important role of antiserums is in the protection against toxigenic organisms such as *Clostridium tetani* or *Clostridium perfringens*. Antiserums made in this way are commonly produced in young horses by a series of immunizing injections. The toxins of these clostridia are proteins that can be denatured and made non-toxic by treatment with formaldehyde. This type of vaccine is known as a toxoid.

Donor horses are first given toxoids, but once antibodies are produced, subsequent injections of purified toxin are used and the donor horses produce high levels of antibodies. The horses are bled when their antibody levels are sufficiently high and the serum antibody fraction is separated from the blood, then processed and dispensed for use in susceptible animals. Serum antibodies can be introduced into a recipient animal by injection subcutaneously and or intramuscularly (depending on the product) and in some cases intravenously. Again, the main advantage to passive immunity (serum antibodies) is instant immunity to particular disease(s). The disadvantage is immunity only lasts 10 –14 days in the recipient, so repeat doses may be needed. Serum antibodies serve an important role as part of the adjunctive treatment of animals that are currently suffering from a given disease for which the antiserum has antibodies against. An example would be treating a horse suffering from tetanus with tetanus antitoxin.

Active immunization has several advantages compared to passive immunization. These include the prolonged period of protection and the recall of boosting of this protective response by repeated injections of vaccine or by exposure to infection. Ideally, the perfect vaccine should illicit a high protective immune response with the absence of adverse side effects. This is where the challenge for vaccine manufacturers comes in because these two prerequisites tend to be incompatible in a lot of cases.