

The Production & Types of Vaccines

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The main principle involved in the production of vaccines is to place [virus](#) or bacteria antigens into a liquid. The liquid is then introduced to the animal's [immune system](#) either by injection or inhalation.

Number of components

Vaccines are manufactured that produce protection against only one disease. These are called monovalent vaccines. Rabies vaccine is a good example. Multivalent vaccines are those which are prepared to stimulate protection against several diseases at the same time. Most 'distemper' vaccines for puppies are of the multivalent type, and are a combination of components to produce protection against several diseases including [canine distemper](#), [parvovirus](#), adenovirus cough, [hepatitis](#), parainfluenza, etc. Many different vaccine combinations exist and are part of every veterinary practice.

Methods to prepare the components

There are three common manufacturing methods used to prepare a virus or bacteria so it will not cause harm once inoculated into the patient. One vaccine is referred to as a 'modified live,' another is 'killed,' and the third is 'recombinant.' Each has its own advantages and disadvantages.

Modified Live Vaccines: Modified live vaccines are made up of live virus particles that have been altered in a laboratory to a non-disease causing state (attenuated). That is, they are alive, but are incapable of producing disease. These live viral agents are fully capable of reproduction within the cells of the animal into which they have been injected. What this means is that if you inject a vaccine into an animal and this vaccine contains 100 live viruses, then these viruses will increase in numbers once inside the animal, perhaps to millions. As these viruses increase in numbers, the animal's immune system will respond by producing antibodies to ward off these virus particles. These antibodies will be capable of destroying the real disease viruses if encountered. The immune system responds much more quickly to vaccination with modified live products than to those which have been killed. Also, the antibodies stimulated by modified live vaccines are usually produced in larger quantities and last for a longer period of time.

High Titer, Low Passage Vaccines: Modified live vaccines that contain a higher number of virus particles (high [titer](#)) which are less attenuated (low passage) than the 'average' vaccine have been developed. High titer, low passage vaccines can generally elicit an immune system response in young animals who have a [maternal antibody](#) level that would prevent them from responding to an 'average' vaccine. A common way to describe this is the vaccine 'breaks through' the 'maternal antibody.' This vaccine technology is used most often with parvovirus.

Killed Vaccines: Killed vaccines are laboratory-made by taking real viruses or bacteria, killing them, and putting them into a liquid base. These killed viruses (or bacteria) have no ability to increase in numbers once inside the pet. If you inject 100 viruses, there will always be 100 - no more. Because of this, the



pet's immune response and antibody production will usually be less when using a killed vaccine compared to a modified live vaccine. In an attempt to promote a better immune response, killed vaccines usually have more virus or bacterial particles per dose and have added chemicals ([*adjuvants*](#)) to improve the pet's immune response. These characteristics also increase the risk of an allergic reaction to the vaccine.

Recombinant Vaccines: For many bacteria and viruses, scientists have found there are certain antigens on these organisms which are better at stimulating an antibody response by the animal than others. In the laboratory, the genes of the virus or bacteria can be broken into various pieces. Those genes that code for the antigens that produce the best antibody response in an animal can be isolated. Using various methods, scientists can have these isolated genes produce large quantities of the antigens they code for. The recombinant vaccine, then, does not contain the whole virus or bacteria, but just those parts which produce the best antibody response in the animal to be vaccinated.

Methods of administration

There are currently two main methods to administer vaccines: intranasally (into the nose) and by injection.

Injectable vaccines: Injectable vaccines are given into the muscle (intramuscular) or under the skin (subcutaneous). Some vaccines can be given either way, others must only be given one way, e.g., some rabies vaccines can only be given in the muscle. Sites at which the vaccine can be administered will appear on the vaccine label. Care must be taken to avoid getting any of a vaccine made for injection into the animal's eyes, nose, or mouth.

Intranasal vaccines: Some vaccines which protect against [*respiratory*](#) diseases such as '[*canine kennel cough*](#)' and feline rhinotracheitis are manufactured to be given as drops (or 'squirts') into the nose. These vaccines generally provide faster protection than those given intramuscularly or subcutaneously. Intranasal vaccines are less likely to cause allergic reactions, and are more likely to provide protection if maternal antibodies are still present. In the case of *Bordetella*, intranasal vaccines may need to be given more often than injectable vaccines. Intranasal vaccines should NEVER be injected into the animal.

Consult your veterinarian as to which vaccines are appropriate for your pet. Recommendations vary depending on the age, breed, and health status of the pet, the potential of the pet to be exposed to an animal who has the disease, the type of vaccine, and how common the disease is in the geographical area where the pet lives or may visit.

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