Vaccines for Dogs

What is a vaccine?

The word *vaccine* comes from the Latin word "vacca", which means cow. An English country doctor, Dr. Edward Jenner, discovered that people given a preparation or *vaccine* of material from the common cattle disease, cowpox or *vaccinia*, developed only a mild skin infection, but when those *vaccinated* individuals were exposed to the deadly smallpox virus (a virus closely related to cowpox), they remained healthy, or were *immune*. More than one hundred years after Jenner's findings, the great French scientist Louis Pasteur and his colleagues found that they could protect animals and people against a variety of diseases, including rabies, by administering injections of the infectious microorganism in an altered form. The two main alterations of these microorganisms were "inactivated vaccines" using killed virus or "attenuated vaccines" using virus that was still living but was changed into a harmless form.

What is \"immunity\"?

Immunity is a complex series of defense mechanisms by which an animal is able to resist a disease or infection or, at least resist the harmful consequences of the infection. The main components of these defenses are the white blood cells, especially lymphocytes and their chemical products, including antibodies and cytokines such as interferon. All infectious disease organisms (viruses, bacteria, protozoa, fungi, etc.) have specific components called *antigens*. These antigens will cause lymphocytes to respond in a specific way such that each antigen stimulates the production of a mirror-image *antibody,* as well as non-antibody responses called *cellular immunity*. Immunity has memory, so that a subsequent exposure to the same antigen results in a much more rapid response. This rapid response usually stops the new infection before it can cause serious illness in the individual. Such immune memory can fade with time, sometimes quite rapidly, depending on the specific antigen-antibody relationship.

"Immunity has memory."

Immunity is not absolute. Immunity can sometimes be overwhelmed when there is exposure to a high dose of a virulent or particularly harmful strain of the microorganism, or when the animal is unduly stressed or is *immunosuppressed* because of another disease or certain drugs.

What is a modified-live vaccine?

In a modified-live or live-attenuated vaccine, the causative organism (virus, bacterium, etc.) has been weakened or altered so that it is no longer harmful or *virulent,* but is still capable of stimulating protective immunity when injected or otherwise administered.

What is a killed vaccine?

With a killed vaccine, the causative organism has been killed or *inactivated* to render it harmless. Killed vaccines often need a helper or *adjuvant* included in the vaccine to stimulate a long-lasting immune response.

Which is better: a live or killed vaccine?

Both have advantages and disadvantages.

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The choice of which vaccine is better for your dog will depend on its individual circumstances. Your veterinarian will consider these circumstances when choosing the appropriate vaccine for your pet.

Why are vaccines administered by injection?

Some vaccines are given locally, for example into the nose, but most require injection so that the maximum take-up of vaccine by the white cells and stimulation of the immune system is achieved. Some vaccines are injected *subcutaneously* or just under the skin, others are injected into the muscles or *intramuscularly*. Injections may look easy, but your veterinarian considers many variables before they are administered.

Which vaccines are needed in dogs?

Depending on your locality, some infections may be more or less likely. The range of vaccines available includes *rabies*, *distemper*, *adenovirus / infectious canine hepatitis*, *parvovirus*, *leptospirosis*, *parainfluenza*, coronavirus, Lyme disease, and *Bordetella bronchiseptica* (for details on these diseases, see our handouts on each individual topic). These vaccines are often available in combinations that can be given in one dose. Combination vaccines are convenient and avoid extra injections for your dog, but sometimes separation of vaccines is advisable. Your veterinarian will advise you on the appropriate vaccines for your pet based on your dog's relative risks and specific lifestyle.

"Core" Vaccines - Recommended for all puppies and dogs by the American Animal Hospital Association (AAHA) Canine Vaccine Task Force:

- Canine distemper virus
- Canine parvovirus
- Canine adenovirus-2 (hepatitis)
- Rabies virus

"Non-Core" Vaccines - Recommended for puppies and dogs in special circumstances, dependent on the exposure risk of an individual dog by the American Animal Hospital Association (AAHA) Canine Vaccine Task Force:

- Distemper-measles virus
- Leptospira spp.
- Borrelia burgdorferi or Lyme disease
- Canine parainfluenza virus
- Bordetella bronchiseptica or "Kennel Cough"

What is maternal immunity?

"They receive this immunity from their mother, as maternal antibodies."

Newborn animals have not yet had a chance to make their own immunity so they need protection against infections present in their environment. They receive this immunity from their mother, as maternal antibodies. Part of this "passive immunity" is transferred across the placenta while the pup is still in the uterus, but most of it is transferred in the first milk or *colostrum*. This *maternal immunity* is only temporary. It declines steadily over the first few weeks of life and is largely gone by twelve weeks. The rate of decline is variable, depending on many factors.

Why is more than one dose of vaccine given to pups?

There are two reasons. First, without complicated testing it is impossible to know when a pup has lost the passive protection it gets from its mother. An early decline in a puppy's maternal antibody can leave it susceptible to infection at a very young age: a strong maternal immunity can actually interfere with early vaccination (see our handout *Vaccination Failure*). Second, particularly with killed vaccines, **the first dose is a "priming" dose, and the second dose boosts the response to a higher, longer-lasting level of immunity.**

Why does my dog need to be revaccinated?

"Immunity does decline with time and this decline rate varies with individuals."

In most properly vaccinated dogs, the immunity should last more than a year, and often several years. However, immunity does decline with time and this decline rate varies with individuals. To maintain the best immunity in a reasonable way, revaccinations have proven very successful. Because the vaccines we use are continuously improving, some do not need to be given as often, depending on individual circumstances. Most dogs with low-risk lifestyles can be vaccinated every three years with the "core" vaccines and as needed for any "non-core" vaccines (most non-core vaccines require annual boosters). Your veterinarian will discuss the need and frequency of booster vaccinations for your dog based on your pet's needs and lifestyle.

How long does it take a vaccine to produce immunity?

"It usually requires ten to fourteen days before a reasonable level of protection is established."

Within a few hours of vaccination, the earliest phases of the immune response are being stimulated. It usually requires ten to fourteen days before a reasonable level of protection is established. Killed vaccines may not provide adequate protection until after the second dose. In young puppies, maternal antibody may hinder protection until later in the vaccine series. Therefore, it is advisable to keep even a vaccinated pup away from dogs or pups of unknown vaccination history until it has finished its vaccination course.

What happens if my dog is sick when vaccinated?

The veterinary check-up prior to vaccination and sometimes pre-vaccination blood tests help prevent this situation. In most cases, minor illness would not have disastrous consequences, but it is important that an animal is healthy when vaccinated, to ensure proper development of immunity.

Will vaccination make my dog sick?

Some dogs develop mild lethargy or soreness in the day or so after vaccination. In the case of killed vaccines containing an adjuvant, some thickening or lump formation may occur at the vaccination site. If this is painful or persists for more than a week or so with no decrease in size, consult your veterinarian. A few dogs will develop more severe reactions that are forms of hypersensitivity (*allergy*). These will usually occur within minutes, but may be delayed for a few hours. The dog may salivate, vomit, develop diarrhea or have difficulty breathing. Should this occur, consult your veterinarian immediately.

Do vaccines provide 100% protection?

Vaccines have been highly successful in protecting the majority of dogs against disease. As a direct result of vaccination, diseases such as distemper that were once common are now rare. But there are situations in which the immunity conferred by a vaccine may be overcome and a vaccinated dog may still develop disease. In such cases the disease is generally milder than it would have been had the dog not been vaccinated.

Some causes for apparent "vaccine failure" are:

Maternally derived antibodies - As mentioned above, when a puppy is born and after it suckles its mother, it acquires a proportion of any antibodies that the mother has. A well-vaccinated female will confer antibodies to her puppies for the diseases she has been vaccinated against, as well as any others she has acquired naturally. Such antibodies protect the pup against those diseases for the first two or three months of its life, the most critical time. However, during this same period the maternally derived antibodies can block the pup's ability to respond to vaccination. This blocking effect decreases as the maternal antibody gradually disappears over those two to three months. A point in time is reached when vaccination can be successfully given. Unfortunately, this point varies between pups, mainly because the amount of maternal antibodies that each pup receives is variable. This is part of the reason that most "puppy programs" involve a series of vaccinations, given two to four weeks apart. Maternal antibody interference has been a particular problem with canine parvovirus vaccination.

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Incomplete immune response - There is variation between dogs in their immune system. Some respond less well to vaccination, so immunity may be incomplete or shorter-lived than normal. Certain breeds and genetic lines have a tendency for such problems.

Declining immunity - Without booster vaccinations or the natural boosting of immunity by sporadic exposure to the infectious agent in nature, immunity to the specific organism declines over time. This is particularly true in older dogs. If there is a particularly heavy dose of a specific organism in the environment, the pet's declining immunity may be insufficient and become overwhelmed, resulting in disease.

Immune suppression - Certain infections and some drugs, such as anti-cancer drugs, may cause a suppression of the immune system so that an otherwise well-vaccinated dog becomes susceptible to infection and disease if exposed.

New strains of organism - Some infectious agents exist in different strains or evolve into new strains that are not directly covered by the vaccines given. In these cases, the vaccine may give some 'cross-protection', but protection may not be complete.

The above are not the only reasons for vaccination "failure", but they are the most likely explanations.

If you feel your dog has contracted an infection for which it has been vaccinated, let your veterinarian know. Tests can be undertaken to try to establish why vaccination has failed to be protective.

This client information sheet is based on material written by: Ernest Ward, DVM