Maternal Immunity: Disease Protection

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Over the years, we have found that there are many, many, misconceptions about the immunity that puppies and kittens derive from their mothers. When a puppy or kitten is born, its immune system is not fully developed. Therefore, on its own, this animal would be completely susceptible to almost any infectious condition. If a serious disease were encountered, the animal would probably die. Fortunately, this is not the case, as Mother Nature has devised a method to provide newborn animals with protection.

Active Immunity
When people or animals are exposed to a disease-causing organism by natural means or vaccination, the organism, or a part of it interacts with the cells of the animal's immune system. These cells then make antibodies (large protein molecules) that reside in the animal's body and will recognize foreign organisms and destroy them. And the body activates cells which can kill the disease-causing organism more directly. When an individual has an immune system that will effectively protect it against a disease-producing organism, it is said to have 'immunity' or be 'immune' to that organism. When an animal's own immune system provides that protection, it is referred to as 'active immunity.'

Passive immunity
When an animal receives another animal's defense mechanisms (antibody and/or lymphocytes), rather than developing its own defense system, we refer to it as 'passive immunity.' Examples of passive immunity include the antibodies received by a fetus through the placenta, antibodies the newborn receives from its mother through colostrum, antivenins to treat snakebite, and bone marrow transplants which help replace the lymphocytes. A disadvantage of passive immunity is that the animal's body does not have the ability to replenish it (except in the case of a bone marrow transplant). As the antibodies the animal received break down through natural aging, or are used up destroying disease-causing organisms, the animal's body cannot replace them. However, in the case of active immunity, more antibodies are produced whenever the immune system comes in contact with the same organism again. Active immunity is self-perpetuating. Passive immunity is not.

Two types of passive immunity protect young puppies and kittens. All antibodies derived from the mother, either via her blood or colostrum (first milk) are called maternal antibodies. It must be noted that the puppy or kitten will only receive antibodies against diseases for which the mother had been recently vaccinated against or exposed to. As an example, a mother that had***NOT*** been vaccinated against or exposed to parvovirus, would not have any antibodies against parvovirus to pass along to her puppies. The puppies then would be susceptible to developing a parvovirus infection.

Passive Immunity In Utero (Through the Placenta): In some species, protective antibodies pass through the placenta (the organ by which a fetus is connected to its mother) from the mother's blood system into the fetus while the unborn animal is still in the uterus. A young animal, therefore, carries this protection with it when it is born. It has immunity to protect it against disease conditions that it may encounter before its own system is operating. Humans get most of the immunity they receive from their mothers in this same manner.

Passive Immunity through Colostrum: Dogs and cats, like many other mammals, pass the majority of the mother's antibodies to the newborn via colostrum. Defined as the first 36-48 hours of milk flow following birth, colostrum is a highly concentrated mixture of large protein antibody molecules, vitamins, electrolytes, and nutrients.

The puppy or kitten absorbs the colostral antibodies into its blood system through the intestine. The ability to absorb such large protein molecules unchanged across the intestinal wall is one of the peculiarities of newborns. As animals mature, they cannot absorb these large molecules and their digestive systems break down these large protein molecules into smaller pieces. Newborn puppies and kittens, through some process that we do not quite understand, are able to absorb the large antibodies unchanged. This is important because if the antibodies are broken down into small pieces, they lose their ability to destroy bacteria or viruses. Usually, before the puppy or kitten is one week of age, it loses this ability of absorption, and all large proteins are broken down. Therefore, even if the mother continued to produce colostral antibodies, they would be destroyed and not provide any protection to the newborn.

It is important that we now clarify one often-misunderstood point. As stated, colostrum with its antibody protection is only present in the first 36-48 hours of milk flow. Puppies and kittens can only gain immunity from colostrum if they nurse during that time frame, and they are less than two days old. After that, it makes no difference how much or how little they nurse, they will not receive any more antibodies.

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Many breeders and pet owners believe that as long as the puppy or kitten is nursing, it is gaining more protection. Wrong! Others feel that by allowing older animals to nurse on a new mother immediately after she gives birth, she will give these older animals another dose of antibodies. Wrong again! Remember, the puppies and kittens cannot absorb antibodies after their digestive tracts lose the ability to absorb large unaltered protein molecules. All the colostral protection the puppy or kitten has is what it received in that first day or two of life. Later on, we can only augment this by vaccination.

Level of protection from colostrum

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The amounts of immunoglobulins (antibodies) that are present within the milk are directly proportional to the levels of antibodies present in the mother. We often speak of 'titers' as a way to qualify the levels present in an animal. Tests are run on blood from the animal in question, and in simple terms, the higher the titers, the more antibodies are present. Mothers with high titers pass higher concentrations of antibodies across the placenta and through their milk. Puppies and kittens that have taken milk with larger quantities of antibodies are able to absorb more antibodies, and therefore, have higher concentrations in their blood. Newborns, that start out with higher levels of these colostral molecules carry this protection for longer periods of time. This explains why we want to be sure the mother has a high antibody titer before breeding since she will be able to pass more protection to her offspring. Her offspring will then possess higher levels of protection for longer periods of time against the diseases that we commonly vaccinate for such as distemper, parvo, and coronavirus in dogs, panleukopenia (feline distemper) and calicivirus in cats, etc.

Window of susceptibility

The age at which puppies and kittens can effectively be immunized is proportional to the amount of antibody protection the young animals received from their mother. High levels of maternal antibodies present in a puppy's or kitten's bloodstream will block the effectiveness of a vaccine. When the maternal antibodies drop to a low enough level in the puppy or kitten, immunity (protection from disease) can be produced through vaccination.

The antibodies from the mother generally circulate in the newborn's blood for a number of weeks. There is a period of time from several days to several weeks in which the maternal antibodies are too low to provide protection against the disease, but too high to allow a vaccine to work. This period is called the window of susceptibility. This is the time when despite being vaccinated, a puppy or kitten can still contract the disease.

The length and timing of the window of susceptibility is different in every litter, and even between individuals in a litter. A study of a cross section of different puppies showed that the age at which they were able to respond to a vaccine and develop protection (become immunized) covered a wide period of time. At six weeks of age, 25% of the puppies could be immunized. At 9 weeks, 40% of the puppies were able to respond to the vaccine and were protected. The number increased to 60% by 16 weeks, and by 18 weeks, 95% of the puppies could be immunized.

As you can see, it is really impossible for us to determine, when in the presence of passive immunity, an individual puppy or kitten should be vaccinated. There are just too many variables. Even if we did blood tests on them, each animal in the litter would probably have a different titer. Some will have absorbed more antibodies, the antibodies may have broken down more quickly in others, or some may have used a portion of their antibodies if they encountered harmful bacteria or viruses. Additionally, a young animal may have a protective titer (level of antibodies) for one disease but not enough for another.

Progress is being made. Some of the newer vaccines can stimulate active immunity in the young animal even when maternal antibodies are present. These are called 'high titer, low passage vaccines.' These modified live vaccines contain a higher number of virus particles (high titer) which are less attenuated (low passage) than the 'average' vaccine. 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. As vaccines improve, we will hopefully be better able to protect puppies and kittens throughout their early life.

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