HOW A VACCINE WORKS

What does happen when we vaccinate a dog? How does a vaccine help prevent disease ad what exactly is immunity?

You might think the answers to these question could be simply explained but the science of immunology is still in its infancy and the explanations are not that easy.

A vaccine is a preparation containing material foreign to the body (antigen) and is usually made up from part of bacteria or viruses to which the body normally reacts to produce antibodies.

Now we all know that antibodies are something to do with immunity but where are they made and how do they work? Antibodies are specific proteins, manufactured by special white blood cells and designed to bind with specific antigens. Thus each antibody is produced to counter each type of antigen and therefore the body needs to be exposed to an antigen before it can make the antibody to neutralise it. Normally this exposure is by infection but by using a vaccine we can mimic infection and produce immunity.

Antibodies can neutralise or destroy viruses or bacteria directly, or simply coat the invader so extensively that white blood cells recognise the foreign material and engulf and consume the alien protein (be it virus of otherwise). This very basic description oversimplifies the immune response but is the bases of the earliest work on immunity and vaccination.

Thus, in its simplest form, we can use vaccines to promote an immune response by infecting killed bacteria or viruses into the mammalian body. This immunity will then act to prevent a subsequent infection by the organisms used in the vaccine.

Neutralising infections rapidly in this way not only protects the individual but also greatly reduces the level of infection in the environment, thus reducing the foothold infectious agents have in the community. In short, even non-vaccines benefit if a sufficient number of animals are protected by immunisation.

A simple and well known example would be the prevention of tetanus. By growing the bacteria involved (Clostridium Tetani) and collecting and detoxifying the toxins they produce, we can manufacture a toxoid. When injected into a mammal, the toxoid will produce an immune response and antibody is produced.

Circulation in the blood stream the antibody will neutralise toxin form any natural infections of C1 tetani that may occur, thus precenting the disease by inactivating it as it is produced.

Furthermore, any tetanus toxin produced by an infection further stimulates the white blood cells to produce more antibodies, thus maintaining the protection. Such simple vaccination has saved the lives of many humans and horses over the years.

In dogs we produce a similar protection by using killed leptospira bacteria. The infection of two doses of dead cells, as a vaccine, two to four weeks apart, will produce an immune response and protect the animal against infection. This simple vaccination technique ha been refined further to improve the immune response to vaccines for several canine viral diseases (eg distemper, hepatitis and parvovirus).

In this case, the infectious agent is modifies (or attenuated) so it loses it ability to promote immunity. Such vaccines are administered as live organisms and as a single dose.

The live viruses un the vaccine undergo limited multiplication within the dog's body and strongly stimulate the immune system and because of this they only require a single infection to produce an excellent immune response.

Live vaccines are also used to produce what I known as a cellular response (cell mediated immunity) which doe not necessarily involve antibody production but encourages the ability of some white cells to engulf and destroy invading bacteria and viruses and neutralise them. Cell mediated immunity is probably one of the future areas of new vaccine technology.

The whole point of a vaccine is that we are mimicking a natural body reaction to disease, with the advantage of producing immunity without the dog ever suffering the full ill effects of the disease itself. I say full effects because with some of the early live vaccines a dog could suffer some mild symptoms as the 'attenuated' agent in the vaccine multiplies in the dog's body. However these symptoms were reasonably rare, transitory and far less life threatening than the disease itself.

The mammalian body ha a quite remarkable immune system. It has the capacity to remember specific disease agents, to the extent that years after the antibody level has dropped away it can recognise an infection, similar to that which caused the original immune response, and respond by producing antibodies.

The infection may take hold but it is neutralised thanks to a rapid response by the now primed white cells. The dog may well be ill, but symptoms will subside rapidly once immunity has been re-established and in many cases full protection may still be achieved.

I have said the immunity produced tends to be disease-specific and this is true. However some cross-protection can occur. For example, human measles and canine distemper viruses are closely related and if we vaccinate a dog with measles virus it will be protected against distemper.

Similarly, when we first experienced the parvovirus outbreak in dogs there were no specific vaccines available, for this was a wholly new disease for dogs. So, cat vaccines for feline enteritis (Panleucopenia) were used. This feline parvovirus vaccine gave some cross-protection to the dogs and helped limit the disease tremendously.

So far the comments have been fairly generalised and it is important to remember that an immune response varier depending upon the disease involved. Thus with hepatitis the response is so strong that a single vaccination will last for many years, while at the other end of the scale the immune reaction to Leptospirosis may not be wholly necessary regularly to administer booster vaccines annually for every disease.

However the track record of modern vaccine ha been fairly trouble-free and thus we have tended to boost the immune response annually tot he whole range of canine diseases, especially as the cost was relatively similar, how ever many components the vaccine contained. This may have resulted in unnecessary vaccine being administered by t regular boosters have played a strong role in reducing the incidence of canine disease to the low level we experience today.

Malaysian Kennel Club

FIRST SPACE DOG

Laika, the first dog in space, died after a few hours in orbit, according to new research by a Russian space expert.

The Siberian Husky with a mongrel mix, rounded up as a stray and trained as the planet's first cosmonaut, probably died from overheating on November 3 1957 when Soviet ground engineers failed to notice the problem.

Laika (meaning "barker") went to an altitude of almost 2,000 miles aboard Sputnik 2, one month after the Soviet Union stunned the world and triggered the space race with Sputnik 1, the first object in orbit.

For the next 40 years, Kremlin chiefs allowed the rest of the world to believe that Laika lived to see the 40th anniversary of the October Revolution and then died peacefully.

Laika was one of 10 dogs to complete a special space training course, and one of three selected by space scientists: Laika was to be the cosmonaut, Albina her understudy and Mushka the "technological dog" on which ground crew could test the satellite's life support systems.

For the first few hours after launch, Laika's heart beat normally, cabin pressure stayed steady and oxygen levels were constant. But humidity and temperature gradually increased.

After about five hours, the telemetry system began to fail: what happened thereafter can never be known, but Laika probably died, said Dr Dmitry Malashenkov, of Russia's Institute of Biomedical Problems. The capsule that became her coffin burned up in the atmosphere in April 1958 after 2,570 orbits.

Laika became the most famous dog in space - US newspapers christened her Muttnik - but she was only the first. The Russians put up 13 others. Only five died in flight. Strelka and Belka went into orbit in 1960 with 40 mice, two rats and some plants, in what was by then an obvious preparation for a human launch.

President John F Kennedy angrily asked US scientists why the world's first pair of space dogs were called Strelka and Belka rather than Rover and Fido. Soviet scientists took note: after their heaven-sent hounds returned to Earth, they bred puppies from Strelka and gave one to Kennedy.

A human soon followed Laika's lead. Yuri Gagarin made history aboard Vostok 1 in April 1961.

Laika became the name of a brand of Soviet cigarette, and a face on a monument at Star City, Moscow. There is also a plaque bearing her name at the biomedical research centre where she was trained.