FACT SHEET

April 2016

PROTECTING PIGS- IMMUNITY AND VACCINES

The pig immune system, like all other animals, is made up of many components that respond in a coordinated way to defend the animal against various bacteria and viruses. The ability to repel these bugs is provided by both innate (inborn/natural) immunity and specific (or acquired) immunity. Specific immunity, as the name suggests, is directed at specific bacteria/viruses to which the animal has been exposed through either natural infection or immunisation, which is where vaccines come into the picture.

When an animal is infected with unhealthy bacteria/viruses, the immune system of the animal kicks into gear to protect the animal, with the immune system responding to certain parts of or substances that the bacteria or virus produce. These parts or substances are known as antigens. The animal's immune system produces proteins called antibodies (also called immunoglobulins (Ig's)) that are kind of like "warning" or "to do" signs that stick to the antigens and tell the immune system what type of antigen it is, so it can be destroyed.

If the response is successful, the immune system of that animal retains a "memory" of the bacteria/viruses, & if it ever comes into contact with that particular bug again, the immune system kicks into action much faster this time because of the "memory" to protect the body (Figure 1). Vaccines work by stimulating our immune system to produce antibodies without actually infecting us with the disease. They trigger the immune system to produce its own antibodies, as though the body has been infected by a disease. Vaccines are usually made to produce a stronger response by the use of adjuvants, which are compounds which act to boost the immune response (Figure 2).

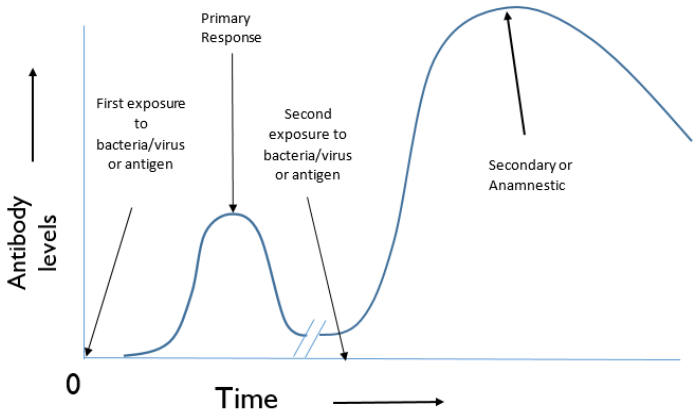

Figure 1: Antibody response after first exposure to an antigen (primary response) and second exposure (secondary or anamnestic response)

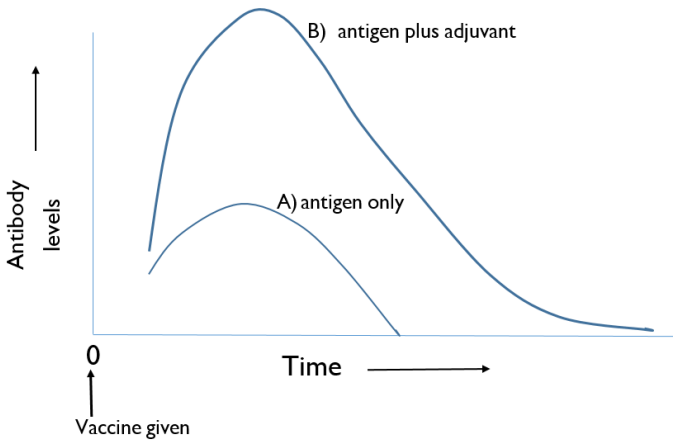

Figure 2: Compared antibody responses of vaccines made up of A) antigen and B) antigen plus an adjuvant

What's in a vaccine?

Vaccines are made up of basically three separate parts:

- Antigens;
- Adjuvants, and
- Preservatives.

Antigens

The antigen component is basically the killed bug or virus with some cell proteins. It is a specialised brew as it is not just a simple matter of growing the bug up to a specified concentration; you need to make sure that all the nasty parts of the bacteria or viruses that affect pig health are actually expressed during the growth process. If they are not expressed, and are absent from the vaccine, it's not absolutely useless (hopefully), but it won't be very effective. Growing bacteria and viruses for vaccines is a specialised line of work. Some bugs are relatively easy to grow correctly e.g. E.coli and some, like Step suis are infuriatingly difficult. Most antigen components are made up of killed or inactivated bacteria, but several live vaccines use "attenuated" strains of bacteria or viruses. These vaccines include bacterial or viral components that are still alive but "attenuated" or weakened; they produce long lasting immunity against the bacteria or virus without producing injuries in the animal.

Adjuvants

Research conducted at the turn of last century found that certain salts when combined with antigens caused an increase in antibody production and in the immune response memory in animals vaccinated with these combinations. These substances became known as adjuvants and they work by enhancing the animal's immune response to the antigen, resulting in a much greater immune response compared with the immune response produced by using an antigen alone.

Preservatives

Preservatives are added to vaccines to prevent bacterial growth which may occur during multiple use. Most farms don't open and empty a vaccine bag or bottle on the same day so preservatives are necessary. On the other hand, this doesn't mean that preservatives will save a vaccine that's been opened for a month, stored at room temperature instead of the fridge and used with dirty equipment and needles. Poor vaccine care & hygiene at best, can lead to reduced efficacy of vaccines or at worst, can lead to abscesses and sick animals.

Storage

As mentioned before, vaccines have preservatives that prevent the growth of bacteria; this doesn't mean they are bullet-proof; most still require storage at between 4-8°C to maintain their efficacy. It's best to store the vaccines in the body of the fridge (rather than the doors) and at the bottom of the fridge (rather than the top, just under the freezer). If vaccines are stored at the top of the fridge, you can run the risk of freezing the vaccine, which is pretty well disastrous. Inactivated vaccines, like E.coli vaccines, that have been frozen should be thrown out, as they are at best, useless, and at worst, toxic. Use a cooler when you are transporting them home from the vet. If you have to vaccinate many pigs and you need more than one container or bag, remember to keep the extra bag/s chilled at pen side.

Vaccine efficacy can be adversely affected if vaccines are left out too long or exposed to multiple temperature fluctuations (out-of-range temperatures) that can have a snowballing negative effect. So remember to check the temperature of the vaccine fridge regularly, just to make sure that what you think is happening regarding the temperature, really is happening. An easy way to do this is by using data loggers that can be set up from your computer, and placed with vaccines to record temperatures. Data loggers can record the temperature at set intervals over a period of time (Figure 3). They can be used nearly everywhere, and can record data from a few hours to months at a time. A recommended time period to record and download temperature could be weekly or fortnightly. After the desired monitoring period, the data logger is then reconnected to the computer and the software is used to read out and download data. The information can display the measurements in graphs that show profiles over time. Data can also be viewed as tables, or transferred to a spreadsheet for further tweaking.

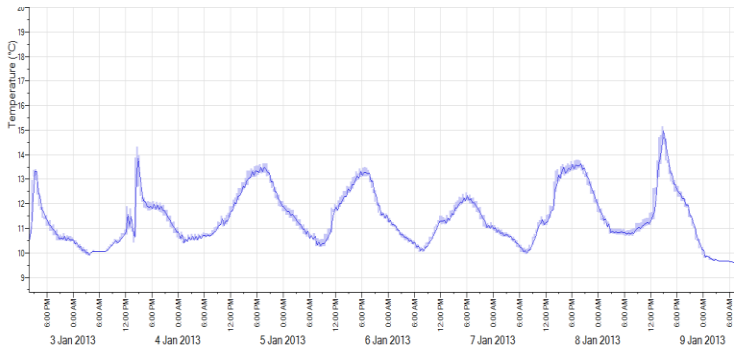

Figure 3: Temperature readings taken from the centre of a medication fridge using a data logger

Timing of Vaccination

As previously discussed, two shots (rather than one) gives a much higher protective response. Traditionally, the first dose of a vaccine is usually given 3-4 weeks before the second shot, but really the first dose could be given anywhere between eight to three weeks before the second shot. Timing of the first dose can be made to fit your production system. The most important consideration about timing is when you give the second or booster shot. The timing of the booster shot should provide protection before the anticipated danger.

For example, to protect piglets from E.coli scours we rely on the antibodies in the sow's colostrum.

These antibodies are absorbed by the piglet's gut and provide temporary or "maternal" immunity until the piglet's immune system starts providing its own. After the first 24-48 hours these maternal antibodies also provide local protection by lining the piglet's gut in antibody rich milk. The second E.coli vaccination needs to be given about 12-14 days before colostrum production in the sow's udder starts. The sow's udder starts producing colostrum roughly 10 days before farrowing. So the second vaccination against E.coli should be given at about 3 weeks before the sow's due date.

Another example concerns parvovirus infections in gilts and sows. Generally these have little effect on sows and gilts; the real effects on this infection really isn't seen until farrowing when the mothers give birth. Parvovirus affects the developing foetuses, so at farrowing, what a producer tends to see when a sow or gilt has been infected with parvo is lots of mummified foetuses. To protect the developing foetuses, sows and gilts, should be vaccinated before mating. Gilts should receive their second shot at least 2-3 weeks before mating, and sows receiving their booster shot at least 5 days to a week before weaning.

Vaccination schedules should always be discussed with your pig specialist veterinarian to be sure that the timing of vaccinations is on track.