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## All you need to know about immunology in one shot

### What is the immune system?

Your herd veterinarian has likely discussed improving the “immunity” of your herd, but what exactly does this mean? The immune system is the body’s protection against infection, using proteins and a network of cells as defense. This newsletter will aim to help you understand and maximize the immune defenses of your herd to prevent disease before it even starts!

### Let’s start with calves

The immune system of a calf is very naive. It provides **only 1/1000th** the protection of a completely developed mature cow’s immune system. In addition, various breeds will reach **immunological maturity** at different ages. Note that the Holstein does not reach immunologic maturity until an older age.

- Holstein: 10-12 months
- Jersey: 8-10 months
- Angus: 8-10 months

Why does immunologic maturity matter? Knowing that a young calf still has an underdeveloped immune system indicates that vaccinating at a younger age will result in a shorter duration of protection from the vaccine administered.

One of the most common reasons to vaccinate young calves is for respiratory viruses, but why do we care about vaccinating calves for respiratory disease? Calves with respiratory disease are:

- **Five times less likely** to make it to the milking herd
- Are culled sooner if they do become a milking cow
- Antibiotics given to treat pneumonia in the first 60 days of life alters gut flora. This can result in a **500 kg decrease in milk production** in the first lactation.

These factors justify the few dollars spent on a calf respiratory vaccine.

### So, when do I vaccinate? And for how long will it protect my calves?

Calves will not respond to vaccines given at day 3 & 4 of life; therefore, it is recommended to **vaccinate with INFORCE in the first 48 hours of life**. However, knowing that vaccinating at a younger age provides shorter duration of immunity.

- Vaccinating with INFORCE at birth will provide 10 weeks of protection
- Vaccinating with INFORCE at 60 days of age will provide 6 months of protection

In addition, your housing system will influence the viral pressure the calf’s immune system has to defend against. Housing indoors with increased animal density leads to higher pressure on the immune system, whereas there is less pressure in an outdoor hutch environment.

- Hutches = 8-10 weeks of protection from newborn vaccination
- Indoor = 4-5 weeks of protection from newborn vaccination

### So now I have protected my calves from respiratory disease, how do I transition from INFORCE to BOVISHIELD?

NOT ONLY does vaccinating calves with INFORCE protect against respiratory disease, but vaccination at birth “trains” white blood cells (the fighters) in antigen presentation (alerting the body to a disease invader)!

Administration of an intranasal dose of INFORCE before transitioning to a Modified Live Vaccine (MLV) such as BOVISHIELD will prime and improve immune responses for protection against respiratory disease and

abortion. The ideal program would include 2 doses of INFORCE as a calf (one at birth, the second at 5-10 weeks depending on housing) then transitioning to an injectable MLV.

Further, we know that giving an injectable MLV early on will not provide long lasting protection through to pre-breeding (ever notice that we vaccinate heifers at 6 AND 12 months of age?). So, the most effective duration comes from the **pre-breeding** dose of MLV given. See below for the least to most reliable vaccine programs for older calves, as you can probably guess, we would recommend the most reliable one!

#### **Least to most reliable vaccine programs**

1. Vaccinate heifers 1 dose Killed Vaccine (KV)
2. Vaccinate heifers 2 doses KV (only 60% protection against BVD, incomplete IBR protection)
3. Vaccinate heifers 1 dose MLV 30 days before breeding
4. **Vaccinate heifers 2 doses MLV, 2nd dose is 30 days before breeding**

#### **Now, let's discuss the immune system of your post-partum dairy cow...**

We have always considered the post-partum dairy cow to be immunosuppressed, so how does she survive? Especially as her uterus and udder are at high risk as she has just calved and is now producing milk? After investigating the post-partum cow's local immune system, the most plausible theory is that she is not "immunosuppressed", but rather has shifted her immune fighting power to highest risk sites... her uterus and udder. She has shut down her systemic (whole body) immunity for the sake of focusing on high risk areas! It is currently still being investigated, but some data has suggested that giving INFORCE at calving, or two doses at close-up and at calving can enhance her local immune system at high risk sites. There has been a correlation of vaccinating with INFORCE at calving and reduced levels of mastitis, metritis, culls and deaths.

#### **Heat Stress, Adverse Reactions, and Vaccination**

Finally, vaccinating during periods of heat stress can increase the number of adverse reactions, and even result in dead cows. **Avoid vaccinating if >29.4 C** at 30% humidity. Do not administer more than two gram-negative bacteria vaccines to dairy breeds in one day (ask your vet for details on this).

Reactions are often observed 12-18 hours later and can include: abortions, early embryonic deaths (EED), early calvings, decreased milk (5-10 kg/day), down cows, death. If an excessive number of adverse reactions are observed, investigate mineral intake of Vitamin E, Selenium and Copper.

Dry cow vaccines may result in early calvings if given during times of heat stress.

Prevention is always better than having to treat a sick animal!

Melanie Thompson, DVM

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