

## Creating your defense on barnyard pathogens

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As we wander around a typical dairy (or any other CAFO), we are surrounded by bacteria. Even the air we breathe is inundated with culturable quantities of bacteria. Thanks to our innate immune system, ordinary commensal microbiota, and the lack of pathogenicity of these bugs, we are free to go about our daily barnyard activities without infectious diseases overcoming us. But let's take a deeper look at some of these pathogens and the scenarios in which they are found to get a better understanding of the stress that our livestock are under every minute.

### Neonates

If we look to where it all begins, we start at the neonatal age. The most critical point of susceptibility to pathogens is at this life stage. Susceptibility is at its highest at this point because the calf, in this case, is born with a complete lack of innate immunity and typically is covered in nosocomial, commensal and environmental pathogens. The exposure is immediate and quite abundant in most operations. E Coli. & Salmonella run rampant in the environment. Clostridium(s), Rotavirus, Coronavirus Campylobacter, and BVDV are typically all present in lethal amounts from day 1. Cryptosporidium & Coccidia are two very common protozoa that are found almost everywhere in the environment, and that can have harmful effects within the first 21 days, as well as from then on out. These pathogens all affect calves at an early age but at different stages (Fig 1). Where an adult animal has an exponential amount of commensal bacteria which pose little or no threat, a calf sees a mortal danger. We do not need a 100 billion bacteria to seed the gut for problems to arise. As newer research has shown, the openness in the neonatal gut will accept bacteria just as easily as IgG. Once that seat on the bus is taken it cannot be undone. It is a race against time and dirtiness to make sure that we get as much IgG into that baby as fast as we can.

To further complicate this issue, besides the maternal bacteria, everything with which the young calf comes into contact - workers, trailers, jackets, bottles, esophageal feeders, buckets, hutches, colostrum and even other calves - are opportunities to contaminate the calf. As we work with our dairy operations and the teammates that work in the maternity and calf raising areas, we must make it abundantly clear that being clean is not good enough. We also need to be sanitary. Communicating to them the vulnerableness of the young animal, and that we as fomites in every way contribute to the wellness or illness of our youngest contributors, is vital.

**Figure 1:** Calves are born with a lack of innate immunity and can be susceptible to pathogens throughout the early stages of life, The chart below outlines the pathogen and age of the calf when it is most susceptible to that particular pathogen.



## The Adult Cow

If we step away from the most vulnerable part of our production team and instead target the largest contributors of pathogens on the dairy, we look at the adult cow herd. Certainly, adult periparturient cattle are not immune to the effects of environmental bacteria, but they are more resistant to colonization and the effects therein. A great example of this is bedding. The greatest interaction that a cow has with the environment is bedding. Whether freestall or open lot, the majority of bedding on the West Coast is made up of recycled manure solids. Composted or dried, settled or digested - all make considerable differences in the consistency and amounts of bacteria present. On a study of ten large California dairies, it was found that housing type, individual farm, and dietary components significantly affected the alpha diversity of the fecal microbiota. But, while only one Operational Taxonomic Unit (OTU) was common among all the sampled individuals, 15 bacterial families and 27 genera were shared among 95% of samples. E Coli, Campylobacter and Salmonella are all abundant in fecal material and have shown the ability to remain viable through many of our treatments to prepare solids for bedding. As with any type of heat treatment, the dirtier the material in, then the dirtier it will be after treatment. We cannot hope to eliminate all of the bacteria, but instead just hopefully get as much as possible.

oil contaminants that have varying levels of presence in the environment are of concern. Clostridium spp are the major culprit that we focus on. This group of bacteria has many species that cause a great number of pathologies in cattle. Purple gut, red water, black leg and tetanus are all diseases that present when Clostridium growth overwhelms the body's natural defenses. We can help accentuate those defenses through several means. Later comments will address vaccination and pre/postbiotics as options for controlling some of these pathogens.

## The Milk Parlor

As we are looking at diseases and the bacteria or pathogens that cause them, we immediately gravitate to mastitis. Mastitis is the number one economic infectious disease drain on a dairy. Estimates from \$200-700 per case in costs, combined with the total milk lost over the rest of the lactation, make it a priority for us to prevent and treat mastitis as efficiently as possible. Cows leave the parlor with open teat ends that are hopefully covered with an effective post dip, but when this fails the teat end is an open conduit for all the bacteria that is harbored in bedding. This is true of any type of bedding. When we have conditions for bacterial growth, warmth (cow), substrate (bedding, milk) and energy source (milk), we will see a flare in cases of mastitis. Typical environmental mastitis pathogens include: E Coli, Streptococcal spp, Klebsiella, Staph spp (not aureus), and pseudomonas. We can also see wild yeasts and prototheca make an appearance. Once again, we need to consider that an ounce of prevention is worth a pound of treatment. Unfortunately, many of these bugs are not susceptible to current IMM therapies.

Now that we are in the milking parlor, we bring Staph. aureus, Mycoplasma Bovis, Strep. uberis & Strep. ag into the discussion. Milk loss, chronic inflammation and eventual damage to the mammary gland are all consequences we see. Realize that contagious mastitis is typically transmitted only in the milk barn, but our previously discussed environmental pathogens can make a home here too. We see fresh manure, recycled solids, and many of our outside sources attached to the teats and in the teat ends of cows as they are brought in for milking. Without proper milking procedures we can make the parlor the central cog in the environmental AND contagious mastitis gear.

### How Do We Do It Better?

I have found in discussions with owners, employees, veterinarians, and other professional consultants that there is an underlying issue with larger operations. This bacteria load builds over time. Where a smaller operation can get away with being “clean enough” a larger continually populated facility cannot. When these pathogens in our everyday environment reach a certain threshold, they begin a meteoric exponential growth cycle that cannot be stopped without heroic action. In certain cases, this may even include depopulation of the facility or regions within the facility. We can no longer “do it like the other guy” when this happens. We have to do it better. But how?

- A. There must be a multifaceted approach. First, we need to work with the cow’s immune system. We do this through appropriate vaccination, considering a few different factors: Do we need to vaccinate for this pathogen or group of pathogens?
- B. Is it the correct time in the animal’s life to vaccinate?
  - a. Does the animal have enough energy and low stress so that the immune system will be able to respond?
  - b. Does the immune system have enough time to develop antibodies for the upcoming challenge?
- C. Is the vaccine efficacious?

- D. The vaccine needs to be cared for properly.
- E. The vaccine needs to be administered into the right tissue at the right dose with the right technique.

How else can we assist the animal in being prepared to fight off infection or have better immune status? Research has shown that Mannan Oligosaccharides (MOS) and Mannan Rich Fractions (MRF) of the *Saccharomyces* yeast cell have the ability to agglutinate Gram (-) bacteria. This helps the animal in two ways: removal of the offending bacteria and allowing the cow's immune system to focus on other threats. There are other probiotics such as *Bacillus licheniformis* that have been shown to help curb the growth of *Clostridium perfringens* type A. In literature reviews it has been repeatedly noted that the exact mechanism of action for probiotics is not fully understood, but we do know that probiotics by design are fast-replicating bacteria, and they may simply "outhead" the competition. By introducing a varied package of probiotics every day, we are also encouraging a diverse microbiome, which is always a benefit.

### **Our Teammates**

Finally, we look at the human teammate element of management. I am a huge proponent of getting teammates engaged and invested in our operations. We need to be aware that many of these pathogens are zoonotic and our teammates need to be prepared to face them as well. Having the proper Personal Protective Equipment (PPE) not only encourages safety among employees, but it's typically more sanitary for the cows as well. Tuberculosis, Q fever, Listeriosis, Rabies, Tetanus, Ringworm, Salmonellosis and E. Coli bacterial infection are just a few common livestock diseases that can easily invade our team members. Bringing this message home to them is an assurance that we are looking out for them just as much as we are looking out for our four-legged production team. They would never feed spoiled milk to their children; we should not feed dirty feed to our cows either, for example.

To make sure plans are implemented in the manner we want, we need to bring this complex information to them at a level they can understand. We can do this by being **Clear & Concise**:

- A. **Clear & Concise** education & training to address the problems we are facing together.
- B. **Clear & Concise** protocols and procedures for daily/weekly/monthly job duties.
- C. **Clear & Concise** feedback and retraining to show our teammates their progress.
- D. **Clear & Concise** positive feedback and congratulations when things go well!

Barnyard pathogens are all around us, from birds depositing high concentrations of *Salmonella* onto our feed and water sources, to the water that we pump from the ground potentially containing Coliforms, to wild and domesticated canines depositing *Neospora* onto our feedstuffs and into our lanes, to unknowingly harvesting contaminated feeds. The possibilities are almost as numerous as the bacteria we are trying to control. It is our responsibility as stewards of our operations to assure that our animals live a healthy and productive life free from pain and as much stress as we can prevent. Through the use of technology, vaccines, antibiotics, pre/postbiotics and sanitizing agents, as well as capitalizing on the efforts of our human teammates in their cleaning and sanitizing protocols, we can make a difference in the bacterial load and hopefully the disease outcomes seen on our operations.