



## The bacteria

Johne's disease is a chronic, incurable, fatal infectious disease of cattle caused by the bacteria *Mycobacterium paratuberculosis*, also known as *Mycobacterium avium* subspecies *paratuberculosis*.

The name of the bacteria that causes Johne's disease is often abbreviated MAP, although sometimes it is abbreviated M paraTB or Mptb.

MAP is a distant relative of the bacteria that cause other human and animal diseases, including tuberculosis and leprosy.

MAP is a very hearty bacteria. Although outside the animal it does not multiply, it can survive in water, manure, or in the environment at low temperatures for almost a year. This is one of the things that makes Johne's disease such a complicated problem – manure containing the bacteria that cause Johne's disease can be left in a pond, and a year later a baby calf can drink out of that pond and ingest enough bacteria to become infected. Years later this calf will develop clinical Johne's disease.

Once ingested by the calf, the bacteria invade the wall of the last part of the small intestine (the ileum) where they multiply very slowly in cells called macrophages. The usual job of the macrophage is to kill bacteria. However, MAP have created strategies to avoid being killed by the macrophage. In fact, these bacteria destroy the macrophage and slowly infect other cells in the intestine. Eventually, billions of bacteria are found in the intestines and spill out of the infected animal in the manure.

Young animals are the most susceptible to infection. Most infections in calves are a result of ingestion of the bacteria in manure – sucking on manure-contaminated teats, licking a gate covered with manure, drinking out of a manure-contaminated pond or puddle.

The bacteria can also be found in colostrum and milk of infected cows. Finding MAP in colostrum or milk is more likely if the cow is clinically sick with diarrhea and weight loss, but cows that are infected and appear healthy can also shed bacteria in their milk. Calves can also become infected by getting the bacteria in utero from their dam. Again, this is more likely if the cow is clinically sick (showing signs of Johne's disease, diarrhea and weight loss).

MAP grow very slowly, both in the cow and in laboratory culture. The slow growth of the bacteria is one reason it takes a long time for the infected cow to show signs of disease. The slow growth also makes it difficult to quickly diagnose the disease by culturing the bacteria in manure samples.

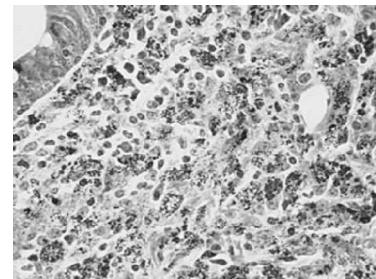
Several things about the MAP bacteria explain the unusual nature of the disease. The fact that the bacteria live inside the cells means that they are hiding from antibodies that animals typically use to fight infectious disease. Since the blood test (ELISA) measures antibodies to the bacteria, and in the early stages of the infection the bacteria are hidden from the antibodies, the ELISA has nothing to measure, so the test results are negative. As the disease progresses, the bacteria multiply outside the cells and antibody production begins. This is why the ELISA is more accurate as Johne's disease becomes more advanced.

Another complicating factor is that except late in the disease, bacteria are not constantly shed from the intestines in the manure. This means that a negative culture does not mean that the animal does not have Johne's disease, only that she is not shedding at the time the sample was taken.

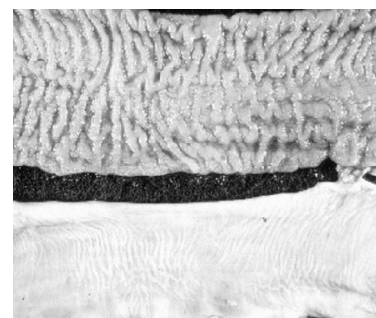
Since the bacteria is slow growing, it takes a long time for the bacteria to multiply enough to cause disease. This results in a long time from the onset of infection in baby calves to the development of disease in adults, usually in the 3-to-7 year old range.

And finally, the slow growth of MAP means it takes a long time to grow it in culture. Diagnosis of infection by fecal culture can take up to 16 weeks.

The ability of MAP to grow inside cells, to survive for a long time outside the animal, and its slow growth in the laboratory are some of the reasons the disease is so difficult to diagnose and manage.



*Microscopic view of many MAP bacteria in the small intestine (ileum) from cow with clinical Johne's disease. The bacteria stain red (seen here as the dark spots)*



*Sections of ileum from normal cow (bottom) and a cow with MAP infection (top). Note the corrugated cardboard appearance of the intestine from the infected cow, which limits the ability of the intestine to absorb water and nutrients.*

Things that will decrease the ability of MAP to survive in the environment.

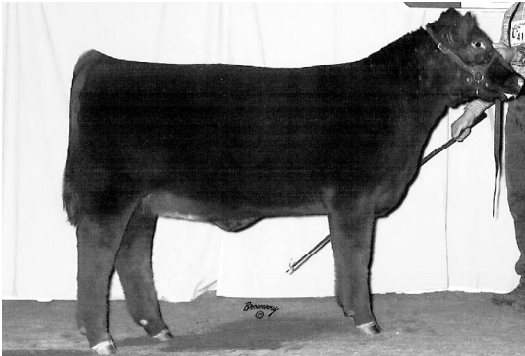
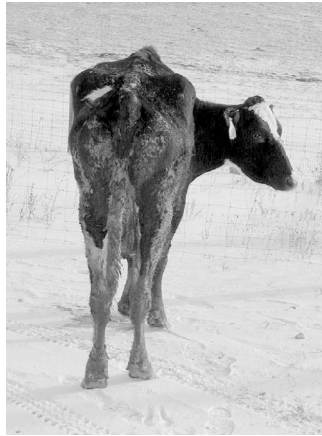
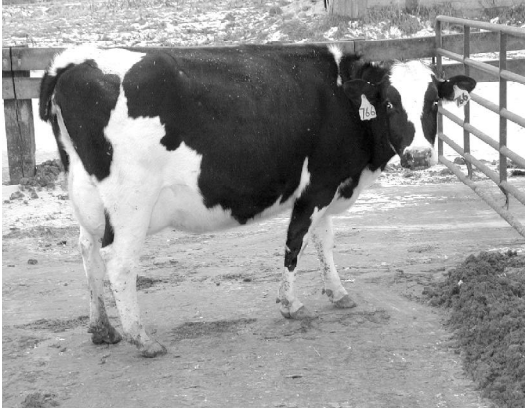
Sunlight

Drying

High (alkaline) pH

## The many faces of Johne's Disease

Johne's disease is an equal opportunity infection. Cattle of all breeds are susceptible. Rare breeds and common breeds can become infected. Beef cattle, dairy cattle, working oxen, miniature cattle, show heifers, rodeo stock and pet cows can become infected. Every animal on this page was infected with *Mycobacterium avium paratuberculosis*, the bacteria that causes Johne's disease. Every animal on this page died, was euthanatized, or sent to slaughter because of Johne's disease.



*Beef cattle, dairy cattle, working oxen, miniature cattle, show heifers, rodeo stock and pet cows can become infected.*



*No picture available of the Famous Bucking Bull, deceased.*

