Johne's in the Crosshairs

Promise of early Johne's detection drives new research in white blood cell response.

by **Ed Haag**

One of the major problems confronting those who battle Johne's disease, or *Mycobacterium paratuberculosis,* in livestock is the length of time an animal is infected before signs of the infection are detected. Commonly available diagnostic methods routinely fail to flag infected animals until they have reached the clinical stage of the disease. This is often preceded by a lengthy subclinical period during which animals can shed bacteria and infect others.

With this in mind, researchers such as George Barrington, Washington State University veterinary science researcher, are looking beyond the conventional bacterial cultures and antibody detection tests to early indicators on the cellular level. If this work continues to prove successful, livestock producers could have a major new weapon in the war against Johne's.

Where is Johne's?

Barrington, who has extensively studied the disease, likens a Johne's-affected herd to an iceberg with only a small segment of infected animals recognized at any given time.

"Usually animals don't become clinical until they are 2 to 5 years of age," he says. "That could mean a high infection rate in a herd with minimal, if any, indicators."

Recent data support Barrington's view. One study determined that for every clinical case detected, 15%-25% of the herd was likely to have been infected.

Scott Wells, bovine epidemiologist at the University of Minnesota, notes that the two most commonly used blood tests for Johne's are both tests for antibodies.

"The problem is that most cattle are infected as calves or as young stock," he says. "It takes them at least a couple of years for an infected animal to develop antibodies, and some don't develop them at all."

Wells adds that another test for Johne's involves culturing a fecal sample for *M. paratuberculosis.* Although it costs more than twice as much as the individual antibody tests and takes up to four months to obtain the results, he finds the fecal test particularly useful as a general, cost-effective screen for larger confined herds. Samples taken from heavily traveled areas and lagoons will test positive for Johne's even if only a few cows are infected.

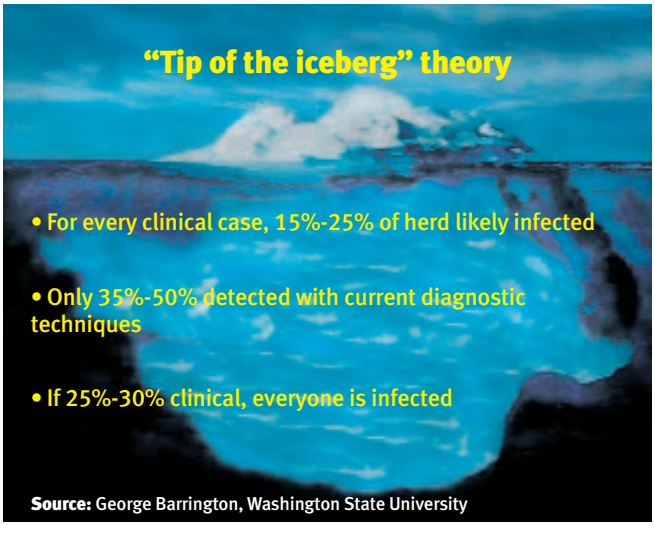
"This doesn't address the issue of individual animals, but it does test the overall herd for the presence of Johne's," he says. "It can be a very cost-effective first step."

Reason for concern

The Johne's infection rate is considerably lower in beef herds than it is in dairy operations. Still, the National Animal Health Monitoring System (NAHMS) Beef '97 survey found that 7.9% of U.S. cow-calf herds had at least one diagnosed case of Johne's, about a third of what was detected in dairy herds. But, that doesn't mean beef producers shouldn't be concerned. Unlike dairy operators, ranchers don't always have easy access to their animals for testing and monitoring purposes. This only exacerbates the detection problem in beef herds.

Nor does a lower incidence of Johne's in beef cattle herds mean that a positive test wouldn't be followed by major economic consequences. This is particularly true for seedstock producers who sell animals specifically for breeding. While milk producers can still legally sell milk from a Johne's-infected herd, the chances of recovering one's investment on a bull or heifer that has been raised with animals that have tested positive for Johne's is reduced.

Considering the high replacement costs for quality commercial animals, Johne's is also becoming more relevant to cow-calf operators who rely on reproductive longevity in their cows to recover rearing costs and make a profit. With the average Johne's-infected animal showing clinical symptoms between 2 and 5 years of age, a calf producer could lose seven to nine years of production off a single infected heifer.



A new approach

With all these unresolved issues facing livestock producers, it is not surprising that researchers are working on developing a new generation of tests that detect Johne's before it reaches the infectious stage.

"The belief now is that a good

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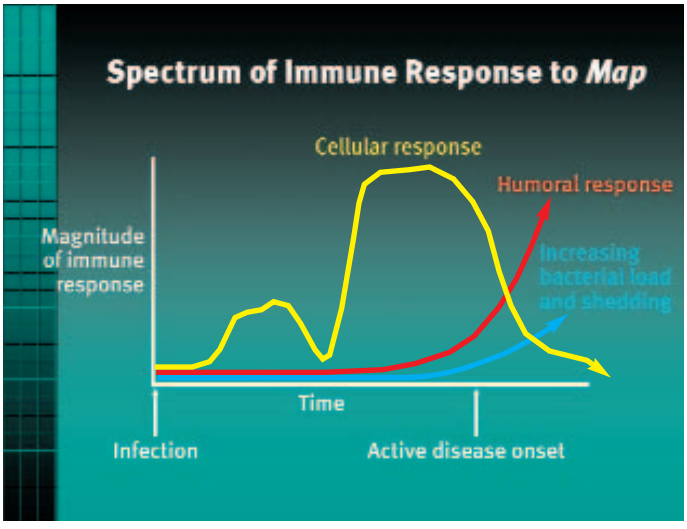

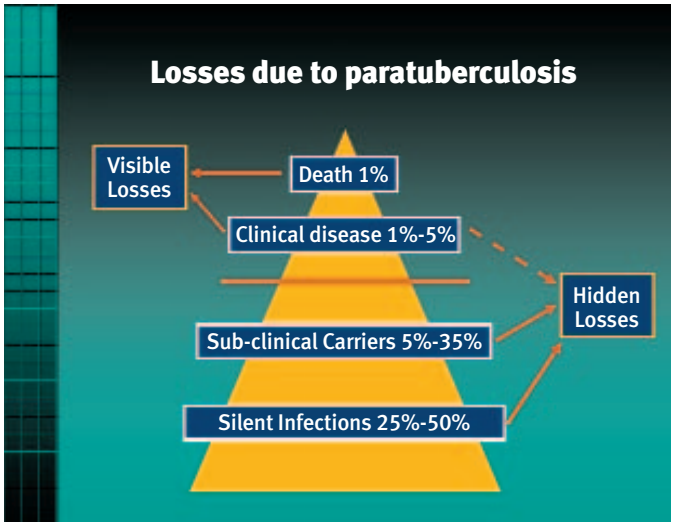

percentage of animals become infected with Johne's in the first month of their life," Barrington says. "A commercial test that accurately detects Johne's in calves or younger animals would be invaluable in controlling its spread."

The quest for this new test has led Barrington to study the immune reaction to Johne's on the cellular level.

He notes that there are two basic arms of the immune system — cellular and humoral. The cell-mediated immune response is designed to detect and destroy abnormal cells within the body. The humoral immune response consists of antibodies that are produced against invading organisms.

The cell-mediated response is especially important in protecting against bacteria that can live inside cells, such as *M. paratuberculosis.* Only when an infection persists do the antibodies from the humoral immune response begin to develop to assist and support the white blood cells involved in the cellular response.

"In our research we have looked for specific markers that identify that initial cell-mediated response," Barrington says. "We believe that is our best strategy for an early diagnosis."

Similar research in Australia has utilized gamma-interferon as a marker of cell-mediated immunity to identify tuberculosis in cattle. A similar test, developed by the same company, targeting *M. paratuberculosis* has been intermittently available in the United States.

So far, Barrington and his research team have been successful in identifying several markers unique to Johne's-infected calves.

"In initial studies, we have seen certain cell surface markers expressed in infected calves at about 6 months of age," he says. "We believe this approach holds great promise."

The next step for Barrington and his team is to convert the existing technology, which relies on highly sophisticated and expensive equipment, to a more universally available format. "Our goal is to develop a practical and economic test that is readily available to veterinarians in the field," he says. "That way we can not only identify animals before they start spreading the infection, but we can also remove them from the herd before we spend all that time and money on raising them."