New Horizons in Johne’s Disease Control: Summary of Talks Presented at the Conference

In April, top scientists from around the country gathered at Michigan State University for a 3-day research conference on Johne’s Disease (JD). They shared results from their studies and talked about future research and educational needs and courses of action. In conjunction with this conference, a single-day educational conference, “New Horizons in Johne’s Disease Control: Integrating Cutting Edge Research into On-Farm Practice” was held simultaneously to draw upon some of the presenting scientists to speak on topics of a more applied nature. Over 90 veterinarians, dairy industry personnel, and dairy producers attended. Here are summaries of some of those presentations. The full proceedings are available on the web at <http://www.jdip.org>.

Phil Durst
Extension Dairy Educator
NE Michigan

Dan Grooms
Dept. of Large Animal Clinical Sciences

Best Management Practices for Control of Johne’s Disease (JD).
Scott Wells and C. Ferrouillet, University of Minnesota.

The authors assessed the results when commercial dairy producers implemented recommended practices for Johne’s control in their farms. They asked the questions; “How effective are these practices for the control of JD?” and “What are the best control strategies for use in dairy herds?”

They stated that while testing and culling of positive cattle and, in some states, vaccination have their place and are beneficial, management to protect vulnerable calves from exposure to the bacteria that cause the disease is the most important tool to control JD.

As in Michigan, Minnesota has been involved with a herd demonstration project for 5 years. Six Minnesota herds were involved. These herds had a risk assessment done at the start of the project, with a risk score calculated. The farm owners could decide what control practices they would implement. Annual testing using both serum ELISA and fecal culture provided a means to measure progress. Over the 5 years of the study, the prevalence of JD within the herds decreased as indicated by
both serum ELISA (from 8% down to 3.1% of cows) and by fecal culture (from 10% down to 5.6% of cows).

In addition, producers throughout Minnesota have enrolled in the Minnesota Voluntary JD Control Program. Surveys showed that these producers effectively reduce their risk score by changing their practices during their first 2 years in the program and then level off in their risk control. Over that same period, the prevalence of cattle testing positive by serum ELISA test decreased for the first 4 years, but increased in year 5. This further indicates the necessity of continued effort in the control of JD.

They concluded that implementing risk control practices (see box on page 17 for a list of some recommended practices to control Johne’s Disease on the farm) does indeed reduce the rate of JD within herds by reducing the number of new infections. However, even over a 5-year period, the disease was not eradicated in any of these herds. It will take more time and a continued commitment to maintain tight JD control practices and ceasing purchase of cattle from herds of unknown Johne’s status, to eliminate the disease.

Consensus Recommendations on Diagnostic Testing for Johne’s Disease (paratuberculosis) in the U.S.

Michael Collins, University of Wisconsin.

A review was undertaken by a team of experienced veterinarians in the field of Johne’s Disease to define the best course of action regarding testing for JD in dairy and beef herds based on business type, infection status and prevalence. However, even in doing so, they first acknowledged that producers should focus on management as the primary means of JD control with testing used as a secondary tool to further manage the disease.

They looked at available testing options and based their work on the accepted sensitivity and specificity of each of those tests. They also recognized that there are various purposes for testing. These include classifying a herd as infected, controlling the disease, surveillance, eradication and confirming the disease in herds with no prior confirmed JD cases and in herds that are known to be infected. Because each test has strengths and weaknesses, test selection should be based on the objectives of the testing.

The principles guiding them were facts or assumptions about herd management which included:

● Only low-cost tests are sellable to producers.
● Speed of test results is over-rated – more important is having the results at the time when the producer needs to make a decision about culling or classifying as “do not breed”.
● Look at every test result quantitatively, considering that indications of the state of disease progression may be determined by response to test.

The authors prepared a table with recommendations for commercial dairy herds, seedstock dairy herds, cow-calf beef herds, and for seedstock beef herds. For instance, the recommended test to classify a commercial dairy herd as infected is a pooled environmental culture, whereas the recommended test to control disease in the same herd is the ELISA. To confirm a clinical diagnosis of JD in a herd with no prior confirmed cases they recommend a necropsy of animals that die or can be sacrificed, or fecal culture or polymerase chain reaction testing of others.

The full table and explanation is included in the proceedings on the Internet at <http://www.jdip.org>.

MAP Super-shedders: A New Paradigm Shift in Johne’s Disease.

Robert Whitlock, University of Pennsylvania.

Having previously defined JD-infected cows that are super-shedders of the bacteria, and knowing that the risk of exposure to bacteria by herdmates on the farm is high, a team working with Dr. Whitlock tested the hypothesis that some cows may ingest the bacteria Mycobacterium avium paratuberculosis (MAP) and subsequently excrete it without becoming infected. By excreting the bacteria as pass-through bacteria, they risk being identified as infected animals when they, according to the hypothesis, are only passive shedders of the organism.

To test their hypothesis, they tested almost 2300 fecal cultures from 556 cows in three herds in three states. Seventy-eight of those cows were culture positive for an apparent prevalence rate of 3.5%. Bacteria in cultures from manure samples are measured as colony forming units (cfu) of MAP per gram (gm) of fecal material. Low shedders may have 5 cfu/gm of manure, moderate shedders may have 50 cfu/gm while heavy shedders may have 500 cfu/gm. Supper-shedders are defined as shedding 10,000 to 10 million MAP bacteria per gram of manure.

In these three herds with a fairly low apparent prevalence of JD, 15 cows (some from each herd) of the 78 culture positive cows (19%) were defined as super-shedders. A single super-shedder cow puts out bacteria approximately equivalent to 7 clinical cases or 160 heavy shedders, or over 2000 moderate shedders or almost 24,000 low shedders. These cows account for tremendous numbers of bacteria in the barn environment.

It is evident that super-shedders do exist and play an important role in the epidemiology and control of JD. These few animals put many other animals on the farm at risk of infection. Therefore, identifying and eliminating super-shedders is important in controlling the transmission of JD.

Diagnostics and Strain Differentiation of Mycobacterium avium paratuberculosis: Current Tools and Challenges.

Srinand Sreevatsan, University of Minnesota.

The current tests for Johne’s Disease are valuable but limited. They are limited in their sensitivity, ability to detect
subclinically infected animals, determine the stage of the disease and to specifically identify differences in the strain of the bacteria causing the disease.

However, scientific advances including the recent characterization of the complete genome sequence of a cattle isolate of *Mycobacterium avium paratuberculosis* (MAP) allow researchers to continue to seek ways to overcome those limitations with new tests and new means of identification.

The immune reaction within an animal in response to an infection has a progression that is well-defined. Research is being conducted to identify bio-markers that could help to pinpoint the state of the disease. Bio-markers also may serve as tools in the development of therapeutics, determining response to therapy and predicting prognosis. The technologies used in bio-marker discovery include traditional in vitro analysis of DNA variation (disease susceptibility), circulating DNA or RNA (disease progression and prognosis), RNA expression (disease induced alterations), protein expression (disease progression), and metabolite quantification.

Similarly, researchers are working at distinguishing between strains of the MAP organism. Measuring the genetic diversity within a population is of particular importance for bacterial pathogens as it can result in differences in virulence, antibiotic susceptibility and other phenotypes important for the treatment and control of infectious diseases. Work on the MAP bacteria will have application to other bacterial diseases. Sreevatsan’s study is also looking at Crohn’s disease to see if there is a particular group of MAP strains that may be involved in this disease. Strain-specific differences may hold the key to understanding and, therefore, improved management of disease.

**Vaccines against Johne’s Disease and Mycobacterium avium subspecies paratuberculosis (MAP): An Introduction and Update.**

*Paul Coussens, Michigan State University.*

There is one vaccine for Johne’s Disease (JD) currently on the market in the US. It is not approved for use in Michigan due to the cross-reactivity with testing for bovine tuberculosis. In addition, it apparently does not protect against cattle becoming infected, rather it seems that it does work in reducing clinical signs of the disease and reducing the shed of bacteria.

The purpose of vaccination is to “educate” the immune system and prepare it for a rapid and strong response to live pathogens. Given the cost and widespread nature of JD, there is a desire to develop a vaccine that would overcome many of the current challenges associated with vaccinating against this disease.

The immune system is amazing, complex and effective in many ways. However, the MAP bacteria, in effect, hijack the immune system and use it to hide and disrupt the response to its invasion. New vaccine types that have the promise of overcoming the challenges this bacteria present are being studied. The process of developing those potential vaccines takes time and money. Vaccine candidates are selected from in vitro studies. Then certain ones are evaluated in mice. The field is narrowed and tried in baby goats before the best 2-3 mutants are evaluated in calves.

JDIP, the Johne’s Disease Integrated Program, funds promising research in this and other areas reported on at the conference.

**The Future of Johne’s Disease Control in the US.**

*Ken Olson, JDIP Outreach Coordinator.*

In 2004, a 5-year strategic plan was developed and approved to target funds available for JD research and outreach. Since then, there has been much success in creating awareness by producers and getting many to start control practices. However, participation nationally in JD control or certification programs has been low. In addition, federal funding has decreased significantly.

The US Animal Health Association Johne’s Disease Committee established a new Strategic Planning Committee and charged them to develop a new plan. They have done so and now have a draft Strategic Plan available for comment. Their intention is to consider comments made now and to present a recommended plan at the 2008 USAHA Annual Meeting in October.

The proposed Strategic Plan is different in several ways from the previous with these main points:

- Move from a primarily federal/state program to a more public/private partnership.
- Simplify the herd classification system while continuing to provide recognition to low-risk herds.
- Focus education efforts on those who can help producers manage, control and prevent JD (e.g., veterinarians).
- Focus research on control and prevention of JD with the highest priorities given to work on diagnostics, effective control strategies and vaccines.

Input is being sought relative to the goals, measures and strategies of the proposed plan and will be used to design a program that will work for producers under current conditions.

**Conclusion**

Johne’s Disease is a critical concern impacting the future profitability and potentially market access for the dairy and beef industries. Management of the disease requires knowledgeable industry professionals and producers and a dedicated effort on all farms to reduce risk and to control the spread of this disease. Researchers and Extension at MSU and in other states are working to help meet those goals.

For more information see:

- [http://www.jdip.org](http://www.jdip.org)
- [http://www.johnes.org](http://www.johnes.org)
- [http://old.cvm.msu.edu/extension/johnes/](http://old.cvm.msu.edu/extension/johnes/)