dvm
THE NEWSMAGAZINE OF VETERINARY MEDICINE
www.dvmnewsmagazine.com
September 2002

FOOD ANIMAL

A light is triggered on *a diagnostic machine if a sample tests positive for Johne's disease, an illness that affects nearly a quarter of the dairy cattle herds in the United States. Dr. Ching Ching Wu, a microbiologist with Purdue University and the Indiana Animal Disease Diagnostic Laboratory, uses the machine in search of ways to halt the malady.*

New technology to help speed Johne's diagnosis

WEST LAFAYETTE, IND. – Purdue University scientists are using their breakthrough molecular research and other new technologies to slash diagnosis time in a battle against Johne's disease, a usually fatal infection that causes $1 billion in U.S. cattle industry losses annually.

The worldwide, chronic illness – also known as paratuberculosis – is characterized by weight loss without loss of appetite, diarrhea, and finally wasting and death.

The disease can attack all ruminants. Scientists say the malady is closely related to the human Crohn's disease and affects nearly a quarter of the nation's dairy herds.

"It used to take us 12 to 16 weeks to get a final diagnosis. Now we can detect the organism as early as two weeks," says Dr. Ching Ching Wu, a microbiologist with Purdue and the Indiana Animal Disease Diagnostic Laboratory. "Having the molecular techniques and this fast, large-capacity system, we will be able to handle a lot of samples in a shorter timeframe.

"This combined technology can identify clean herds and maintain their disease-free status by preventing the introduction of infected animals."

Molecular techniques that Wu and her colleagues developed make the fast, accurate diagnosis feasible. By coupling her technology with a new, automated incubation unit, the laboratory can identify highly infected animals in two to three weeks and those with low levels of infection in 42 days, far quicker than the traditional time needed for final diagnosis.

The manufacturer, Trek Diagnostics Systems Inc., earlier this year commercially introduced the new machine, ESP para-JEM system, which detects growth of Mycobacterium avium subsp. paratuberculosis (Mpt), the bacteria that causes Johne's disease.

JOHNE'S DIAGNOSIS CONTINUED

"Information about existing infection will help farmers separate herds so infected animals can't cross-contaminate the rest of the herd. The goal is to create Johne's-free herds," says Wu, whose molecular research is aimed at determining how paratuberculosis wreaks its destruction in animals, and developing treatments or cures for Johne's disease.

"Being able to test more samples allows us to know the extent of the illness' spread and to learn more about its workings."

According to the U.S. Department of Agriculture, about 22 percent of the nation's dairy herds – and about 24 percent of those in the Midwest, including Indiana – are infected with the intestinal illness. To make matters worse, the agency says at least 45 percent of U.S. dairy producers don't know about the disease.

It is voluntary to have animals tested for Johne's, although some states now prohibit transport of infected animals and/or require that they be branded to show Johne's infection. No scientific evidence exists that consumption of meat or milk from infected animals can cause the malady in people.

Education priorities

Educating producers about Johne's disease and its control is a priority of the Indiana State Board of Animal Health, says Thomas Conner, director of the board's Cattle and Ruminant Division. For many years, the agency has required reporting of the disease and has handled recording testing results and maintained herd records.

Although a vaccine exists that will reduce the symptoms and prolong an animal's life, it does not prevent infection, Conner says. The vaccine is only available for cattle under a special agreement between the state veterinarian, the producer and the producer's local veterinarian.

Management strategy based on the number of infected animals is the best way to prevent, control and eliminate Johne's disease while minimizing the economic impact, he says.

"Diagnosis is one of the biggest problems," Conner says. "The findings of Dr. Wu and her group will help to advance Johne's disease control in dairy and beef herds alike."

> "The findings of Dr. Wu and her group will help to advance Johne's disease control in dairy and beef herds alike."
>
> Thomas Conner
> *Indiana State Board of Animal Health*

Wu and her team of researchers do much of the Johne's testing for Indiana in the Animal Disease Diagnostic Laboratory on the Purdue campus. Their main focus however, is studying the disease process, especially the mechanisms involved with the bacteria. They have published several papers on their findings, the most recent in the May 2002 issue of the journal Infection and Immunity, an American Society of Microbiology publication.

"We have identified a bacterial protein, fibronectin attachment protein (FAP), on Mpt that apparently facilitates the ability of the bacteria to attach itself to the intestine and invade animals' disease-fighting cells," Wu says.

How and why

This finding is important information for discovering how and why the bacteria are able to infiltrate animals' intestines, attach themselves to the walls, and proliferate inside disease fighting cells, called macrophages, she says. The knowledge could lead to new drugs or vaccines to treat and prevent Johne's disease and possibly even related diseases, such as Crohn's.

Johne's disease can be spread to animals from infected feed, water and colostrums, and females with high infection can spread it in utero to fetuses. Most animals are infected at less than 6 months of age, although symptoms don't appear for two to five years.

Besides dairy cattle, other types of cattle, deer, elk, sheep, goats, antelope and bison also can fall victim. However, it is more prevalent in animals that are kept in confined conditions and relatively unusual in wildlife, Conner says.

According to the USDA, some reports exist of the same bacteria infecting horses, pigs, chickens, rabbits, fox and non-human primates. Scientists are unsure of the exact relationship between Johne's and Crohn's.

Trek of Westlake, Ohio, developed the new diagnostic machine and Cornell University performed validation testing over the past year.

Purdue and other veterinary laboratories are using the machine on a trial basis. These include the University of Pennsylvania, University of California, Davis, University of Wisconsin Diagnostic Veterinary Laboratory and the National Veterinary Service Laboratory in Ames, Iowa.

Wu's research team includes Tsang-Long Lin, Purdue associate professor of veterinary pathology, Michael Ward, associate professor of veterinary epidemiology, Ramesh Vemulapalii, assistant professor of veterinary immunology and Timothy Secott, veterinary pathobiology graduate student.

A USDA agricultural experimental station Hatch grant, a Purdue School of Veterinary Medicine competitive internal grant and a Purdue President's Distinguished Fellowship are providing support for the paratuberculosis research. □