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Early Detection

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Early detection

**Researchers develop detection test for
subclinical mastitis in dairy cows**



Each day Mike Scheffel's 608 Holstein cattle produce about 24,000 gallons of milk. Scheffel, manager of Kansas State University's Dairy Unit, has been working on dairies since age 12. Throughout the years, he's seen one of the constant challenges facing dairy producers: mastitis in the dairy cows.

"Every dairy deals with mastitis," said Scheffel, who also is a research assistant in animal sciences and industry. "That's the nature of the operation. We've been very fortunate here and have preventative steps to recognize the early symptoms, but it's a problem that's always present at a dairy."

Mastitis is a disease that inflames and eventually scars the udder tissue of dairy cows. This reduces a cow's milk production and alters the milk composition. Mastitis costs the U.S. dairy industry more than \$2 billion annually. Fast and early detection could help dairy producers reduce transmission to other cows in the dairy operation.

Kansas State University researchers Deryl Troyer, professor of anatomy and physiology, and Stefan Bossmann, professor of chemistry, developed a test that can positively identify mastitis in dairy cattle earlier and for less cost than current technologies on the market.

"The classical mastitis tests estimate the numbers, not the activity, of neutrophil cells, which are the dominant cells that travel to the inflamed udder during mastitis," Troyer said. "Many times early and emerging cases of mastitis are not caught by the tests because they count the numbers rather than the activity. These are often the most important cases to catch."

The test uses the duo's nanoplatform technology that can quickly detect cancer cells and tumors before physical symptoms ever appear. Several enzymes that cause inflammation in human cancers also cause inflammation in the udder of the dairy cows.

"We looked at about 30 enzymes and identified three that are highly indicative of mastitis," Bossmann said. "These three enzymes and this nanoplatform make it possible to detect preclinical mastitis cases that have high enzymatic activity but a low somatic cell count. These cases were previously undetectable, so there was not a test on the market for this combination."

To test for mastitis, a sample of pasteurized milk is put into a buffer solution containing the enzyme-detecting nanoplatform. The nanoplatform consists of iron nanoparticles coated with amino acids and a fluorescent dye. The amino acids and dye interact with enzymes in the milk. The sample is incubated for up to 30 minutes and then examined for three enzymes that cause mastitis.

Recent tests in the Troyer and Bossmann laboratories have detected subclinical mastitis in less than five minutes.

Researchers say their mastitis test could be used today by large-scale dairies and eventually by robotic dairy facilities.

Additional collaborators include Scheffel; Gregg Hanzlicek, assistant professor of diagnostic medicine and pathobiology and program director for the Kansas State University Veterinary Diagnostic Laboratory; Luis Mendonca, assistant professor of animal sciences and industry; Tej Shrestha, senior scientist of anatomy and physiology; Madumali Kalubowilage, chemistry doctoral student, Sri Lanka; Thilani Samarakoon, former postdoctoral researcher; and Samie Milligan, Heart of America Dairy Herd Improvement Association.

Kansas ranks 16th in the U.S. for milk production. It produces nearly 3 billion pounds of milk annually. Dairy is a more than \$5.4 million industry in Kansas.