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PCR-based tests offer consumer safety, herd health assurances

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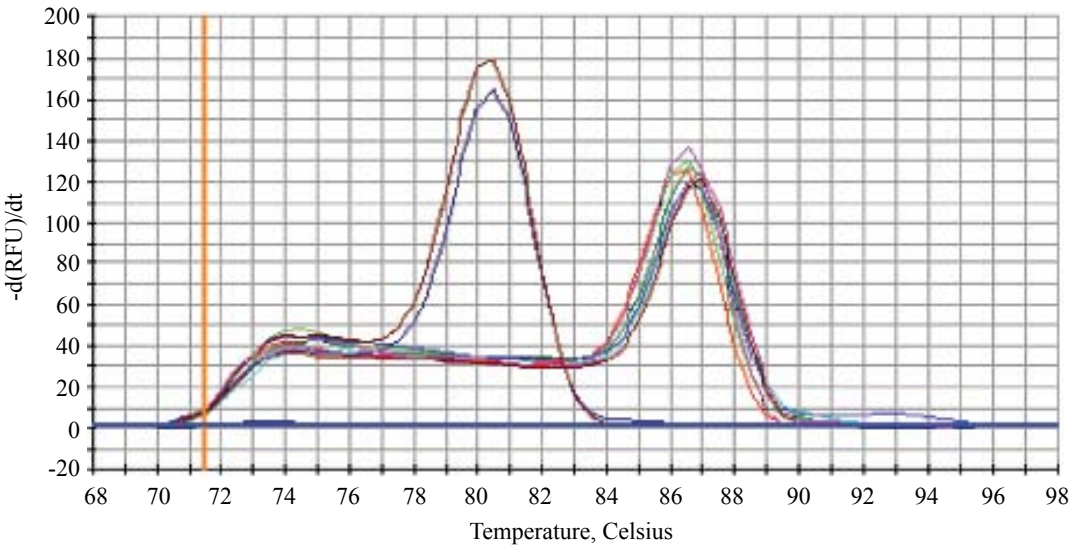
Knowing that a particular food-borne pathogen is present on the farm provides an opportunity for farmers and their veterinarians to investigate and identify the means of reducing or eliminating the health threat to their herds and consumers.

The World Health Organization defines food-borne illnesses as diseases caused by agents that enter the body through the ingestion of food. It has been reported that in 2005 alone 1.8 million people died from diarrhoeal diseases, and a great number of these cases can be attributed to contamination of food and drinking water. Although the safety of food has dramatically improved overall, progress is uneven and food-borne outbreaks from microbial contamination are common in many countries.

Food-borne outbreaks are infections caused in humans by the consumption of contaminated foodstuff. The major pathogens implicated in this form of illness are *Clostridium botulinum, Staphylococcus aureus* and *Bacillus cereus*, which produce botulinum toxin, enterotoxins and emetic toxin, respectively. Bacteria such as *Escherichia coli* 0157:H7, *Listeria monocytogenes, Salmonella* and *Campylobacter jejuni* are just a few examples of food-borne pathogens associated with meat, raw milk or raw milk cheese which can cause severe symptoms to children and elderly people. *Salmonella enteritidis* is the most common reservoir and eggs or products thereof are the most frequently implicated foodstuffs.

To reduce the prevalence of food-borne diseases and microbial contaminations in food supplies, effectively monitoring the occurrence and distribution of bacterial pathogens in food is essential. There are many methodical programs like good agricultural practices (GAP), good manufacturing practices (cGMP), hazard analysis and critical control point (HACCP), which can significantly reduce the pathogenic microorganisms in food. But still, the role of pathogen detection technology is vital, which is the key to the prevention and identification of problems related to health and safety.

While the risk of contracting such diseases may be reduced by careful food handling procedures in child and elder clinical care facilities, the most successful



Real-Time PCR test for food borne pathogens. Results show positive control *Listeria monocytogenes* (first two peaks) and producer submitted milk samples negative for *Listeria monocytogenes* (second group of peaks).

A PCR machine in the QMPS laboratory.

strategy would be to ensure an outstanding food quality and safety along all the food chain, literally "from farm to fork."

Conventional methods for the detection and identification of microbial pathogenic agents mainly rely on specific microbiological and biochemical identification. Conventional methods being used for the detection of pathogens are culture and colony counting methods and immunology-based methods. While these methods can be sensitive and inexpensive, they require more time to perform and to detect pathogens, which typically occur in low numbers in food.

Compared to non-conventional polymerase chain reaction (PCR) methods, which involve DNA analysis, conventional methods are more labor intensive, often lower in their ability to correctly identify truly contaminated foodstuffs, and can be more time-consuming. It takes 2-3 days for initial results, and up to 7-10 days for confirmation. These are some of the reasons we occasionally see massive food recalls. Additionally, conventional methods may not have the capability to identify different strains of bacteria, information which is essential in food-borne illness source investigations.

Non-conventional PCR-based methods are becoming more frequently used and relied upon to quickly investigate and address food-borne pathogen outbreak situations and to monitor food-borne pathogens at the food source before an outbreak can occur

The QMPS Molecular Laboratory provides specialized research and diagnostic services as part of a mission to support the dairy industry through use of science-based methods and cutting-edge DNA-based technology.

The laboratory offers PCR-based bacterial detection and identification, and strain typing or "DNA-fingerprinting" techniques which can all be used to quickly and effectively monitor milk safety, as well as animal health. This includes weekly detection of *Salmonella*, shiga-toxin producing *E. coli,* and *Listeria monocytogenes* in bulk tank raw milk as part of the bulk milk surveillance project.

They also screen hundreds of bulk milk samples for MRSA (methicillin resistant *Staphylococcus aureus*) as part of the nation-wide survey by the National Animal Health Monitoring System. The integration of fieldwork, routine diagnostics, and specialized diagnostics and research at QMPS provides a unique opportunity to address issues raised at the farm, and to generate information that is taken back to our dairy producers.

Rapid diagnostics has positive impact at the farm

How rapid diagnostics can affect life at the farm is illustrated by a recent event. Milk from a single cow used for family milk at a large farm was submitted to the QMPS Molecular laboratory for screening of common food-borne pathogens. The milk was positive for Shiga toxin *E. coli*. This particular strain of *E. coli* is particularly dangerous for young children, elderly people and those with other chronic diseases that diminish the effectiveness of their immune systems such as diabetes or cancer. The wife of the farmer was nursing a new baby and consuming the contaminated milk was placing the welfare of the baby in jeopardy. Further testing by PCR-based strain typing methods could have additionally determined if the milk was contaminated from the individual cow or from the farm environment. Only pasteurized milk is consumed on the farm today.

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QM^2 is the newsletter of Dairy One and Quality Milk Production Services.

How to reach us...

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QMPS is a program within the Animal Health Diagnostic Center, a partnership between the New York State Department of Agriculture and Markets and the College of Veterinary Medicine at Cornell. The QMPS staff of veterinarians, technicians and researchers works with New York dairies to improve milk quality by addressing high somatic cell counts, milking equipment and procedures, and milker training in English and Spanish. QMPS also conducts research and teaching programs.

Reach the four regional QMPS laboratories at:

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Eastern Lab, Cobleskill.
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Northern Lab, Canton.
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Western Lab, Geneseo.
877-645-5525

QMPS website:
http://qmps.vet.cornell.edu

Dairy One is an information technology cooperative, providing DHI records services and herd management software to dairies throughout the Northeast and Mid-Atlantic region. A comprehensive laboratory network provides milk quality testing as well as forage, soil, manure and water testing.

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