



DNA Fingerprinting

DNA-based technology promotes health and safety.

by *Laura McGinnis*

In December 2003, Agricultural Research Service (ARS) scientists at the Roman L. Hruska U.S. Meat Animal Research Center (MARC) in Clay Center, Neb., used DNA markers to confirm the Canadian origin of the first U.S. case of bovine spongiform encephalopathy (BSE). The incident demonstrated the necessity of instituting a rapid way to identify animals at every level of production — to protect U.S. agriculture and to reduce the economic and social effects of a disease outbreak.

The ability to determine an animal's identity is essential for controlling diseases and monitoring imports and exports. Brands, tattoos, tags and implants are often used to identify cattle, but these labels can be damaged, altered or lost. Retinal scans are gaining popularity. But all these forms of identification (ID) are lost after harvest.

Fortunately, there is another approach to verify identity and trace individual cuts of meat back to the animal — DNA.

Molecular fingerprints

DNA-based technology is an effective complement to physical markers and can clearly identify animals in situations where physical markers cannot. Using genetic markers, scientists generate molecular fingerprints to match multiple samples from one individual.

Since 2003, MARC researchers have identified thousands of markers and placed them in the public domain, where they can be accessed by researchers around the world.

DNA can be obtained and analyzed from cattle at any stage of life, as well as from fresh, frozen or cooked products. It's stable and unique to each animal.

"It's the best way to confirm other methods of animal identification," says William Laegreid, research leader of MARC's Animal Health Research Unit.

The most common type of genetic marker present in U.S. beef and dairy cattle is known as a "single nucleotide polymorphism," or SNP. The MARC researchers are developing more than 120 highly specialized parentage SNPs to assist in difficult traceback scenarios. They have already identified more than 120 and annotated more than 1,600 neighboring SNPs that improve the accuracy of assays and identification tests, says microbiologist Michael Heaton.

In the 2003 BSE case, U.S. and Canadian scientists used parentage analysis, which involves testing DNA samples for patterns that are consistent with parent-offspring

CONTINUED ON PAGE 112



PHOTO BY SHAUNA ROSE HERMEL

► DNA-based technology complements traditional methods for identifying cattle, like ear tags, and provides a means for identifying the sire in pastures where multiple bulls are used for breeding.

DNA Fingerprinting CONTINUED FROM PAGE 110


relationships. Using SNPs to match two samples from one animal is easier and more accurate, but those samples are not always available, Laegreid says. Every addition to the genetic database improves the precision of these tests.

MARC researchers have placed more than 7,000 SNPs in publicly available databases, such as dbSNP and GenBank, aided by scientists at the ARS Henry A. Wallace Beltsville (Md.) Agricultural Research Center, the University of Alberta, the University

of Louisville, and the National Center for Biotechnology Information.

“Technology currently exists to identify every bovine in the United States with DNA markers,” Heaton says. “Like computer technology, price and availability will improve with time and increased demand.”

During the last decade, technological advances have made SNP identification easier and cheaper. Today, the procedure typically costs about 2¢ to 20¢ per sample, but scientists hope it will decrease to less than 1¢.

“If done on a grand scale, DNA fingerprinting of a calf could be accomplished for less than the price of a hamburger,” Heaton says. Lowering its cost could enhance animal health and food safety by promoting widespread use of SNP genotyping in cattle. 

Editor's Note: “DNA Fingerprinting Promotes Health and Safety” was first published in the January 2007 issue of *Agricultural Research magazine*. The research presented is part of *Animal Health*, an ARS National Program (#103) described at www.nps.ars.usda.gov.

Mike Miller Returns to Cattle-Fax

Cattle-Fax, a provider of cattle and beef market information, research and analysis, announces the return of Mike Miller in the capacity of chief operating officer (COO). As COO, Miller will lead efforts to expand the quantity and quality of data collected from Cattle-Fax members, as well as remodeling the entire Cattle-Fax data collection, benchmarking and reporting systems. Miller will also direct Cattle-Fax's newly created Customized Business Solutions division.

Miller had been with Cattle-Fax for 10

years before leaving the organization in 2006. He served most recently as director of research. Previously, he served as director of business development, director of cost and performance analysis, and as editor of several Cattle-Fax publications.

"We have made some outstanding additions to our staff over the past year," said Randy Blach, executive vice president of Cattle-Fax, "and Mike's return will help this team provide an even higher level of service to Cattle-Fax members."

Miller holds a bachelor's degree in agricultural business from Colorado State University. In addition to the services he provides to Cattle-Fax members, Miller's business presentations and reports are well-known and widely requested throughout the cattle and beef industries.



Editor's note: *This article is adapted from a release provided by Cattle-Fax.*