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## National Research Initiative (NRI)

# Identifying Economically Important Traits in Animal Genomes

by Stacy Kish, CSREES

The livestock industry accounts for almost \$100 billion of the annual agricultural gross domestic product. Scientists now believe a new tool, called a “snip chip,” may revolutionize the livestock industry and help farmers and ranchers produce even more. >>

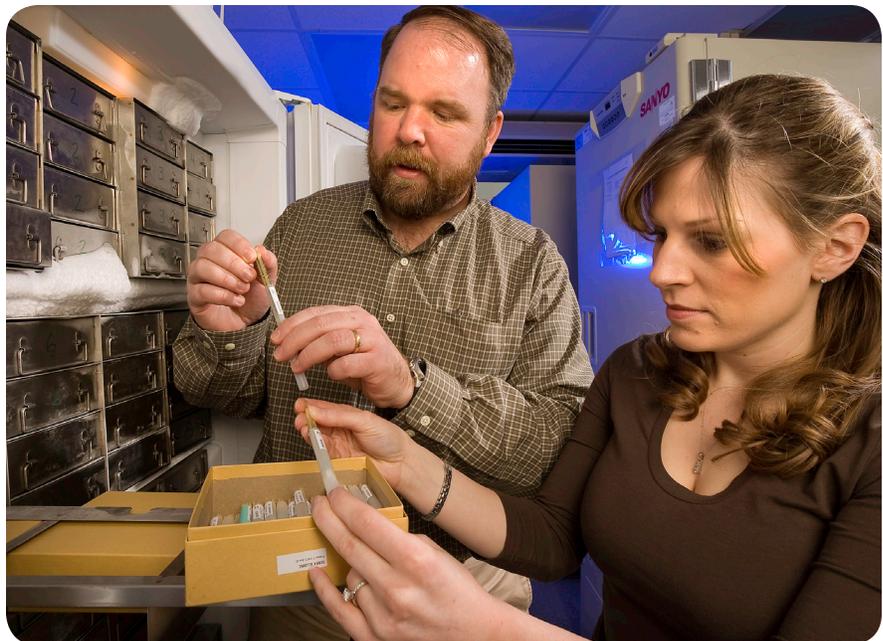
With funding from USDA's Cooperative State Research, Education, and Extension Service (CSREES), Agricultural Research Service (ARS), and industry partners, a team of scientists in Missouri and Maryland developed the snip chip to identify DNA markers for economically important traits in livestock, including disease susceptibility, milk production, reproduction, and growth.

All living organisms contain DNA, the blueprint of life. Within the DNA are chromosomes that house

neatly packaged genes. Each gene encodes a protein that performs the functions necessary to support life. The genome of an organism is the complete assemblage of all of the chromosomes found in that organism.

Variations within a gene produce variations in agriculturally important traits. On the positive side, those variations can lead to cattle that produce more milk; on the negative side, it can mean susceptibility to pathogens.

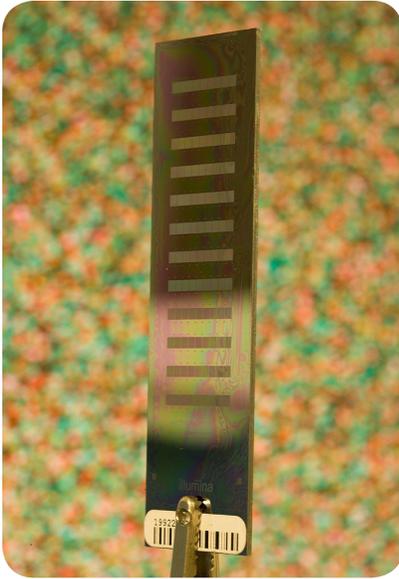
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Right: Geneticist Curt Van Tassell and biological technician Alecia Bertles select bull semen samples for DNA extraction and testing using the SNP50 BeadChip technology.

Credit: Stephen Ausmus

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Above: The Illumina Bovine SNP50 Chip.  
Credit: Curtis Van Tassell

These variations are often caused by single nucleotide polymorphisms (SNP) – a snip. A snip is a change in a single location in the DNA structure. Each SNP provides an indirect measure of the nearby genetic variants.

SNP tests have revolutionized the scientists' ability to detect the regions of the genome that harbor variations associated with traits. These tests, however, must be performed in a large number of animals to properly match the SNP variations with differences in traits of economic importance.

Curtis Van Tassell and colleagues at the ARS Beltsville Agricultural Research Center in Maryland and Jerry Taylor and colleagues at the University of Missouri developed a new tool for cattle, called the Illumina BovineSNP50 Chip. This tool allows scientists to examine the animal's entire genome to detect variations in a more efficient and economical way.

Researchers around the world are using the chip to identify regions within the bovine genome that harbor variants that cause animals to differ in the outward expression of important traits. More importantly, the high resolution of this snip chip will allow scientists to predict an animal's total genetic merit from its SNP profile.

Breeding companies are using the chip to assist in the genetic selection process of dairy animals. As a result, the industry is saving millions of dollars annually by more efficiently prescreening young bulls and streamlining the process of identifying elite cows.

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The beef industry is following fast on the footsteps of the dairy researchers. Large populations of beef cattle have been assembled and genotyped to develop models to predict their genetic merit for feed efficiency, growth, and carcass composition.

"Application of this research to the beef and dairy industries, and eventually the use of comparable tools for the swine and sheep industries, will forever change selection programs in livestock. In addition, these tools are rapidly expanding the understanding of the genetic control of economically important traits in all domestic livestock species," Taylor said.

CSREES funded this research project through the National Research Initiative Animal Genome program. Through federal funding and leadership for research, education and extension programs, CSREES focuses on investing in science and solving critical issues affecting people's daily lives and the nation's future. For more information, visit [www.csrees.usda.gov](http://www.csrees.usda.gov). ■