



*Safeguarding*  
**Animal Health**



PHOTO COURTESY OF ARS

# A Helping Hand from DNA

National Animal Germplasm Program supports animal health research.

by *Laura McGinnis*

► **Above:** National Animal Germplasm Program coordinator Harvey Blackburn and technician Ginny Schmit place germplasm samples into a liquid nitrogen tank for long-term storage.

Inbreeding. Stress. Disease. It's hard out there for a herd. Modern livestock face many challenges, and DNA has become an increasingly popular tool for addressing them. While not exactly a panacea, an animal's genetic heritage can provide a lot of information — and knowing more about their genes can help researchers and producers find better management techniques to keep animals healthy and happy.

The Agricultural Research Service (ARS) currently maintains the world's largest, most diverse collection of livestock genetic resources — the National Animal Germplasm Program (NAGP). Housed at the National Center for Genetic Resources Preservation at Fort Collins, Colo., and led by geneticist Harvey Blackburn, the NAGP preserves genetic material such as semen, embryos, ova and DNA for agricultural animals.

In 2000, the NAGP accepted its first accessions: 40 chicken lines. Since then it has added material from dairy and beef cattle, sheep, goats, swine, elk, bison and aquatic animals. Breeders, universities, private owners and industry members from around the United States have donated more than 330,000 samples of genetic material from more than 7,800 individual animals.

The germplasm is made available, upon request, to researchers from the United States and around the world.

"Most of the people using material from our repository have one of three goals," Blackburn says. "They want to study genomics, create research populations or reintroduce genetic variability in live animal populations."

## On the QTL

The science of breeding relies on identifying desirable quantitative trait loci, or QTLs — areas of DNA that are associated with specific characteristics. Identifying QTLs for qualities like milk production, maturation rate and disease resistance can enable breeders to make more informed decisions when selecting potential parents. It can also help scientists conducting genomic studies.

"This work might not be directly related to animal health," Blackburn says. "But it can give researchers a better understanding of what characteristics an animal has and how those traits are connected to its genetic heritage."

One ARS study, led by geneticist Michael MacNeil at the Fort Keogh Livestock and Range Research Laboratory at Miles City,

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Mont., examined microsatellite markers taken from a herd of feral cattle inhabiting Chirikof Island, off the Alaskan coast. MacNeil and his colleagues established that the Chirikof Island cattle appear to be unique and strongly differentiated relative to breeds commonly used for beef production in North America.

Genetic material from these undomesticated animals could shed light on how they've adapted to the local environment and diseases. This information could, in turn, be useful in understanding how North American commercial breeds adapt to similar circumstances.

### Population creation

Animal breeders select dams and sires with desirable characteristics and have little motivation to breed animals that lack them. After all, sows with limited uterine capacity or dairy cows that produce little milk won't help producers turn a profit. But animals have value that goes beyond their worth as commercial products. For example, those sows and cattle could have other valuable genetic characteristics, such as disease resistance, that producers want for their herds.

Even disease susceptibility is a desirable trait — for researchers who want to learn more about a disease's genetic components.

Blackburn offers as an example the ovine prion disease, scrapie. Researchers have identified several genotypes related to scrapie resistance. Selecting rams and ewes with greater resistance could reduce the disease's prevalence, and breeders across the United States are doing just that.

Scientists who wish to study genotypes related to prion disease susceptibility will find them increasingly rare in agricultural populations, as that trait is bred out of commercial flocks. However, they can find those genotypes within the NAGP database — part of the ARS Germplasm Resources Information Network — enabling them to continue studying the disease.

The repository contains genetic material from animals that are susceptible to many diseases and genetic mutations, such as bovine leukocyte adhesion deficiency in cattle and Marek's disease in poultry. Researchers can use this material to create

research populations and increase their knowledge of these agricultural diseases, even as breeding programs, vaccines and other management techniques decrease their occurrence.

### The spice of life

Like most germplasm repositories, the NAGP prides itself on the genetic diversity of its collection.

Maintaining genetic variety is a challenge for many animal breeders.

Artificial insemination (AI), compounded by the pursuit of various desirable traits, has created cattle populations in which many members share a common sire. Reduced genetic variation leads to an accumulation of inbred animals, which generally leads to a reduction in animal performance.

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This can mean a reduction in production efficiency, end-product quality and animal health.

With thousands of accessions available, the NAGP can help reduce homogeneity by releasing more diverse germplasm to interested breeders.

“Reintroducing genetic variability into a population essentially knocks out that inbreeding problem and restores the vigor of the population,” Blackburn says. In addition, diverse genetic material can be crucial if the popularity of a specific trait rises suddenly, creating a new demand.

The NAGP collection has grown steadily since it accepted its first accessions. With every donation it grows better equipped to aid researchers, help industry professionals meet consumer demands and safeguard the diversity of our nation's genetic resources — services that help not only U.S. livestock, but the people who depend on them.

For more information about ARS's National Animal Germplasm Program, contact geneticist Harvey Blackburn.



**Editor's Note:** ARS News Service provided this article, which first appeared in the April 29 “Healthy Animals” newsletter. Laura McGinnis is a public affairs specialist for ARS. To access the report online, visit [www.ars.usda.gov/is/pr](http://www.ars.usda.gov/is/pr).