



MARC: 50 Years of Collaborative Effort

by **Troy Smith**

Westward of Clay Center, Neb., the terrain appears nearly level, except for those odd mounds. They dot the landscape like little man-made hills — all of about the same size, evenly spaced and arranged in rows. During World War II and the Korean War, this was the site of the

largest munitions manufacturing and storage facility in the U.S. And beneath those sod-covered mounds are the concrete storage bunkers that once housed bombs, mines and shells produced for the U.S. Navy.

For the last 50 years, however, much of the acreage occupied by the former Naval Ammunition

Depot has been home to the Roman L. Hruska U.S. Meat Animal Research Center (MARC). Cattle grazing among the old bunkers comprise the largest beef herd devoted to scientific research conducted by the U.S. Department of Agriculture (USDA) Agriculture Research Service (ARS).





In June 1964 Congress authorized 34,000 acres for the facility. It is unique — considering the acreage involved, its large animal populations and the sustainable funding MARC receives for long-term research. Some 3,000 acres are cultivated, producing irrigated corn and soybeans, alfalfa, and alternative forage crops. Most remaining acres are in permanent pasture, although 1,900 acres are in irrigated grass. Presently, research programs are using a female breeding population of 6,750 cattle, representing 18 breeds, and 2,800 sheep. MARC sows also produce 950 litters of pigs per year. Research pertaining to all three species is divided among four units.

MARC units

The **Genetics, Breeding and Animal Health Research Unit** has focused on breed differences, heterosis and genomics (DNA sequence differences) and on how related knowledge can be used to enhance animal selection for breeding. This unit also studies interactions between disease pathogens and their animal hosts. Of particular interest is how genetic variation influences resistance to disease.

Lowering the cost of meat animal production through improved feed efficiency is a focus of the **Nutrition and**

Environmental Management

Research Unit. Here too, the role of genetics is investigated, along with different types of feed, feeding strategies and management. The nutrition scientists are seeking more knowledge about how the dam's nutrition during gestation influences the health and performance of her offspring.

Environmental research includes manure-handling practices, along with evaluation of the short- and long-term effects of nutrient application to crop fields. Scientists in this unit also evaluate feedlot surface management as it relates to control of runoff, dust and odor. Additionally, they investigate how climatic conditions affect animal health and well-being, focusing on methods for managing livestock stress.

The **Reproduction Research Unit** investigates strategies for improving conception rates and embryo-fetal development. MARC reproductive physiologists also look for reliable predictors of lifelong productivity.

The **Meat Safety and Quality Research Unit** studies foodborne pathogens and methods of controlling potential sources of contamination in meat products. The research team has developed interventions that are successfully applied, preharvest through harvest, to reduce the risk of foodborne illness. Meat scientists also are seeking methods to extend meat shelf life and are exploring areas of the genome that influence carcass composition and quality.

While each unit has specific areas of focus, much of the

phenotypic information collected from MARC animal populations is shared. And genomics has become an integral part of the research activities of most units.

Focus on genomics

“MARC has become the ARS center of genomics for beef cattle,” says its director, John Pollak. “This is the place of major ARS investment in genomics research.”

And MARC is one of eight collaborating institutions involved in the National Program for Genetic Improvement of Feed Efficiency — a USDA grant-funded project for developing DNA-based technology to predict genetic merit for feed efficiency in beef cattle. Other partners in the research include the University of Missouri, Texas A&M University, Iowa State University, the University of Illinois, the University of Nebraska, the University of Minnesota and Washington State University.

MARC has a long history of collaboration with land grant universities, breed associations and cattle breeders. It began more than 40 years ago with the Germ Plasm Evaluation (GPE) Program, which has sampled industry relevant sires representing 26 breeds, in order to estimate breed differences, heterosis and genetic correlations for economically relevant traits.

MARC and Hereford

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Larry Kuehn, MARC geneticist, drawing blood from a calf in a research project.

has been a primary partner,” says Larry Kuehn, MARC geneticist, explaining that GPE research provided the foundation for continuing work in genomics and gene sequencing.

The American Hereford Association (AHA) and Hereford breeders have contributed to other research conducted at MARC, including the Weight Trait Project — another collaboration whose goal is to move DNA technology into the commercial sector.

“Herefords and Hereford breeders have played a role in MARC research since its beginning,

providing data and semen, and the breed has benefited from the partnership,” says Jack Ward, AHA’s chief operating officer and director of breed improvement. “Work at MARC contributed to our in-house genetic evaluations. In our genetic panel, we use the tenderness marker and parentage verification that MARC scientists developed.”

MARC research helped develop the tools individual breed associations are using for genetic evaluation programs and to pursue genomically enhanced expected progeny difference (EPD) values for various traits of interest. And now, says Pollak, MARC scientists are turning their attention to traits for which data collection is difficult, such as animal disease resistance and the healthfulness of meat.

“For that, we believe the best route is not to depend on the existing genomic panels, but to collect and use gene sequencing data,” explains Pollak. “We’re focusing on sequencing bulls used in the GPE program, our own cattle population and others. We’re currently sequencing 16 to 18 animals per week and amassing a huge amount of data.”

Pollak says MARC scientists are also sequencing the genomes of microorganisms. Of particular interest are the pathogens associated with the bovine respiratory disease complex. They are also looking at organisms related to food safety, such as



During the 2005 Hereford Young Guns Conference on Aug. 26, attendees enjoyed a bus tour of MARC, viewing different research herds and the MARC facilities.





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shiga toxin-producing E. coli and salmonella. A significant amount of this work and other projects is supported by grants secured through collaborations.

“We’ve been very successful in teaming with other entities to secure competitive grants,” states Pollak. “This year, we’re operating on \$2 million received from government and industry sources. Included in that is a grant from the Nebraska Beef Council to help us look at beta agonists and their potential effects on animal mobility.”

Along with the research, MARC-based collaborative efforts are grooming researchers for the future. Numerous graduate students from the University of Nebraska, South Dakota State University and Kansas State University spend time working with specific MARC scientists. Additionally, Pollak says funding has recently been secured for six positions in a new and more formal training program created in cooperation with the University of Nebraska. A total of 11 program positions are expected to be filled.

“With programs like these,” explains Pollak, “we’re preparing the next generation of scientists.” **HW**