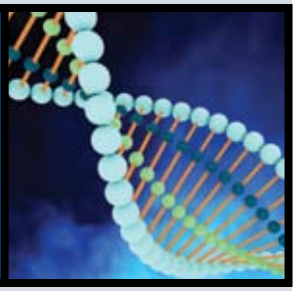
Finding The Genetic Link
To Parasite Resistance In Grazing Cattle



Article Reprint from Lancaster Farming - Pennsylvania Forage and Grassland Council Newsletter, February 18, 2006

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Dr. Lou Gasbarre stands with the herd of Angus cattle he manages as research leader for the ARS bovine functional genomic laboratory in Beltsville, Md. (Photo by Dave Lefever)

BELTSVILLE, Md. — Lou Gasbarre knows how much of a toll internal parasites can take on grazing beef and dairy cattle.

As a regular part of his work, Dr. Gasbarre records the effects these worms can cause in the beef cattle he manages on USDA's Agricultural Research Service (ARS) farm in Beltsville, Md.

Over the years, he has observed these organisms developing widespread resistance to worming drugs, making parasites increasingly worrisome to graziers across the country.

The most promising part of Gasbarre's work involves pinpointing genes that are linked to natural parasite resistance in cattle. One of the practical results of this research is that in the near future, graziers will likely have the option to select cattle that are genetically resistant to parasites.

Gasbarre is research leader in the bovine functional genomics program at Beltsville. He was trained as an immunologist, but it became clear to him early on that he would not be able to use that knowledge to develop a way to inoculate cattle against parasites. The complexity of the worms made achieving this goal unlikely, if not impossible.

"It became apparent to me that I was going to spend my career futilely because I couldn't create a (vaccine) for parasites," Gasbarre said last November during a tour of the beef operation and laboratory he manages at Beltsville.

Instead, Gasbarre sees that genetics holds the key to parasite resistance. So that's where he decided to devote his talents and energy.

The work has been paying off. The research done by Gasbarre and his team of 11 scientists, along with new gene-mapping technologies, have helped identify why some cattle are resistant to parasites while others are not.

"We know right now that in cattle there are at least eight locations (in the genome) that have genes or a group of genes that will tell whether that animal will be parasite resistant," Gasbarre said.

The most dominant and ***economically significant types of internal parasites in cattle in the U.S. are nematodes — the brown stomach worm Ostertagia and intestinal worms Cooperia and Nematodirus.***

The dominance of these parasites is "pretty consistent throughout the U.S.," Gasbarre said. He noted that some other parasites can also have an impact, mainly in the Southeast.

The worms' unhealthful effects include interfering with protein digestion, causing bleeding in the gut, and throwing off salt and protein balance in tissues. ***An often overlooked effect is that the worms can make animals lose their appetite and the cattle can actually become anorexic,*** Gasbarre said.

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Researchers have documented the increasing resistance of these parasites to medications (wormers) in recent years.

"What's happening in the U.S., unfortunately, is resistance to ivermectin products," Gasbarre said.

Ivermectin, which goes by various chemical and brand names, is the most common class of wormers used for cattle. There are few treatment alternatives to ivermectin products.

Overuse of ivermectin, along with intensive grazing, are practices that have contributed to the parasites' adapting to the point where they are no longer controlled by the drugs.

"We know that in the U.S. there are parasites that none of the drugs are effective against," Gasbarre said.

Because the nematodes' life cycle requires a grass environment, producers who keep their animals entirely in confinement operations generally don't have to worry about the parasites.

Instead of working on developing new chemicals to treat worms, Gasbarre is excited about using the burgeoning knowledge of cattle genetics to help select parasite-resistant animals.

Scientists at Baylor University in Texas are expected to soon complete sequencing of the bovine genome, mapping the complete array of genes found within cattle.

"Once that's established, it's going to help us tremendously with all this data we've backlogged," Gasbarre said.

Gasbarre and his crew collect performance data on calves that are raised on pastures heavily infested with parasites. The calves are timed to wean in mid-April to correspond with the grazing season. Weight gain and other data is collected on the animals each week through October.

In calves that have the least protection built into their genetic code to withstand parasites, the effects can often be observed by the eye in the thin, lackluster appearance of the animals.

Those that are able to withstand the heavy worm load and continue to perform well are noted as animals that are genetically superior when it comes to parasite resistance.

High-tech tools found in Gasbarre's laboratory to decipher the genetic makeup of cattle include a DNA analyzer for sequencing DNA fragments and a bead array reader (developed during the human genome project) used for identifying DNA bases.

The computer stack used to process genetic information in the laboratory is enormous, consisting of 30 high-powered processors, operating about 7,000 times as fast as a top-of-the-line home computer, Gasbarre noted. All of this research has wide implications for the livestock and dairy industries far beyond just parasite resistance. The days of relying on phenotypes (observed traits) in animals to develop bull proofs, for example, will soon be replaced by "molecular markers" that will be able to show exactly which traits are superior, Gasbarre said.

The herd Gasbarre works with on the research farm are derived from the Wye Angus originally developed on the Eastern Shore of Maryland. He also works with a dairy grazier in Somerset County, Pa. and with an organic beef grazier in Maryland on targeting parasite management.