

DNA GOES



*Molecular biology technician
Renee Godtel
prepares bovine
DNA samples for
sequencing.*

*The gene
pool is open,
and producers
are testing
the waters.*

MAINSTREAM

BY JOHN MADAY

A wealthy, unmarried celebrity dies soon after giving birth. Subsequently, almost every man who knew her, and some who didn't, claims fatherhood with dollar signs in his eyes.

Perfect fodder for the Hollywood tabloids, but what does it have to do with beef production? Quite a bit actually, because in both cases, a DNA test can confirm parentage.

While proving parentage among calves might not reap millions in high-drama court battles, it can mean money in the bank for beef producers. And parentage testing, which offers the potential for directly improving performance and beef quality, is just one application of DNA technology.

MORE GENES IN THE POOL

DNA technology is advancing quickly, with companies adding new genetic markers for important production and beef-quality traits to their packages of testing services.

Bovigen, for example, added two new quality grade markers in February 2007, and now offers a total of four. More verified markers allow more accuracy in the testing — a high marbling score in the test is more likely to translate to a high-grading carcass in that animal and its offspring. The company also offers GeneSTAR tests for tenderness, sire verification and black coat color. Calvin Gunter, Bovigen's director of corporate development, says the company plans to continue adding markers for multiple traits once they are independently validated. Bovigen recently contracted with NCBA to develop applications for genetic information from the Carcass Merit project.

IGENITY, a business unit of Merial Ltd., recently completed a multi-year cattle genotyping project, collecting up to 50 data points

on 50,000 head of cattle. The project helped validate DNA markers used in the company's genetic profile. Rather than individual tests for each trait, IGENITY offers a genetic profile that includes markers for parentage, coat color, breed specific horned/polled, and carcass characteristics including back fat, ribeye area, carcass weight, quality grade, yield grade and tenderness. A single sample allows the profile and a test for BVD. IGENITY technical services director Kevin DeHaan says DNA and performance records will allow researchers to refer back to the 50,000-head population as they evaluate new markers, comparing actual performance with predicted results.

MMI Genomics Inc. has worked in collaboration with Cargill for the past four years developing DNA tests based on a "whole-genome association" study completed in 2006. The intention of the study was to identify and validate groups of predictive markers associated with beef tenderness and marbling. Early this year, the companies launched Tru-Marbling and Tru-Tenderness DNA-based selection products. These tests, says Ben Brophy, manager of Value-Added Alliances for Cargill Meat Solutions, "will be valuable tools for livestock owners to make breeding decisions that ultimately can lead to the production of superior cattle and beef." MMI Genomics also offers tests for parentage, polled and coat color.

DNA testing costs about \$20 to \$45 per head, depending on the service and the number of traits or markers included.

POTENTIAL BENEFITS

DNA testing offers both short- and long-term benefits to beef producers. Verification of parentage is one that can generate quick results in a seedstock or commercial pro-

ducer's selection process. In most production systems, ranchers easily associate each calf with its dam, but the sire often is unknown. Confirming parentage of calves allows a producer to measure actual, rather than just expected progeny differences within a herd. Identifying the sires of the best-performing and poorest calves, DeHaan says, can help producers build upon the top 20 percent of their genetics and work to eliminate the bottom 20 percent. Testing also could help identify infertile or low-libido bulls.

Improving beef quality is a longer-term but powerful application of DNA testing. Consider the demand for marbled beef in light of today's high grain prices. When corn cost \$2, Gunter says, feedyards could improve grading percentages in cattle with marginal genetic ability to marble just by feeding them longer. With corn at \$4, demand will grow for cattle with the genetic ability to grade Choice or better with less time in the feedyard. DNA testing can help identify those cattle, and allow producers to multiply their genetics.

Beef tenderness has been an on-going quality challenge, but the industry now is in a position to make significant improvements. Management, of course, plays a role, but an animal's potential to produce tender beef is determined by genetics.

More objective carcass valuation could drive increased focus on tenderness. Packing plants now have access to an electronic system called QualitySpec BT, a three-second infra-red scan that analyzes carcasses for tenderness in real time at the grading station. Gunter believes that once packers can measure tenderness, they will include it in their value-based pricing structures.

Beef tenderness has value inde-

MAKING IT WORK

Potential applications of DNA testing are as diverse as the operations that use it. Following are examples of how some seedstock and commercial operations use the technology.

SAN BENITO CATTLE COMPANY

Mitt French, manager of San Benito Cattle Company, a large cow-calf operation in California, says his team has used DNA testing for several years. The operation finishes some of its calves and collects carcass data for evaluating sire lines and blood lines.

French says he initially worked with IGENITY for sire verification, and recently expanded the effort as the company moved to offer the broader DNA profile.

With a DNA inventory on all bulls, French says sire verification has been valuable for identifying the most- and least-productive bulls, determining actual progeny differences in calves, and selecting AI bulls and donor cows.

He now is applying DNA data toward performance and carcass characteristics. French says the operation's Angus and Charolais breeding program has resulted in good quality grades, and he is working to maintain that trait while improving yield grades.

French says he hopes to use DNA test results to help market calves or yearlings based on genetic merit. He sees the technology, though, as just one tool toward producing cattle that fit the marketplace. Years of applying performance and carcass data, plus documentation efforts such as becoming the first cow-calf operation certified through USDA's Quality Systems Assessment program, already help San Benito feeder cattle earn premiums at sale time.

SUMMITCREST ANGUS

Sam Johnson is President of Summitcrest Angus, a large seedstock producer headquartered in Summitville, Ohio, with additional ranches in Iowa and Nebraska.

For several years, Johnson says Summitcrest has used MMI's DNA parentage verification on selected animals. It's an accurate and cost-effective way, he says, to double-check and verify pedigree records, or to confirm an animal's pedigree if records are lost or questioned.

Now Summitcrest also uses Bovigen's marbling and tenderness panels, and Johnson says he is especially enthused about the ability to select for beef tenderness. The test, he says, provides an accurate and practical prediction of tenderness and its heritability.

With \$4-corn, Johnson says, "It costs too much to add value by adding fat." Select carcasses guaranteed for tenderness have a value on par with Choice, and animals that can produce tender beef with a short time on feed will earn significant premiums.

Johnson notes that at his company's March 19th bull sale in Broken Bow, Neb., a bull sold for \$35,000 — a new record price for Summitcrest Angus. Its full brother sold for \$11,000 and another bull brought \$9,000. The reason? Johnson says the top bull earned a nine-star rating in the Bovigen DNA test, and all three were homozygous for the three tenderness genes measured. Without those ratings, Johnson says they probably would have been \$3,000 to \$5,000 bulls.

Some Summitcrest customers purchase only bulls that are homozygous for the tenderness genes. These bulls, Johnson says, will introduce one copy of each gene to the first generation of progeny and reduce the incidence of genetically tough carcasses by half. Among the second generation, using replacement heifers with high ratings for tenderness, 45 percent of offspring are homozygous for the genes. By the third generation, the number climbs to 92 percent.

SEEDSTOCK PLUS

Seedstock Plus is a cooperative of 65 independent breeders in 16 states, selling about 1,200 Angus, Red Angus, Gelbvieh and Balancer bulls each year. The group operates several development and testing stations where members send their bulls at weaning.

Seedstock Plus CEO John Burbank says the group initially began using the IGENITY test for coat color, allowing members to market their black Gelbvieh and Balancer bulls as homozygous or heterozygous black. A bull that is homozygous for the trait will pass the dominant black genes to its offspring.

Now, Burbank says, the cooperative takes ear-notch samples of bulls at the test stations for the full IGENITY profile along with BVD testing. The group is using the tenderness and marbling portions of the profile to make genetic progress toward more consistent, higher-value beef. Some customers, he says, particularly those producing for branded-beef programs, focus on those traits in their bull purchases. "We want to get the best information available," he says, "just so we can produce better cattle and provide customers with more information."

pendent of marbling. In IGENITY's genotyping project, researchers found the distribution of genetic tenderness scores was almost identical across the Select and Choice quality grades. About 13 percent of Choice carcasses had IGENITY tenderness scores below 3, with 1 being least tender. Within the Select grade, more than 30 percent had tenderness scores greater than 7, with 10 being the most tender. These results suggest DNA testing could improve consistency and palatability of Choice beef, while production systems targeting a leaner product could benefit by selecting for tenderness.

GETTING STARTED

For producers just getting started with DNA testing, Gunter and DeHaan suggest similar priorities.

- Test the bulls you are using to get a better picture of their genetic merit and begin laying the groundwork to select toward specific goals. Collect birth weights, weaning weights and other data on calves, then use sire verification to identify which bulls sire the best, and worst, of the crop.

- Test donor cows if using embryo transfer.

- Test replacement heifers. A producer who plans to keep 12 heifer calves might use traditional methods to narrow the field down to 15 or 16, and use DNA results to make the final sort. Replacement heifers will be in the breeding herd for years, so producers can think of allocating the cost of the test over the animal's lifetime. In four to six years a producer could have the entire herd profiled.

As with other selection and management issues, Gunter says communication is a key to success. Find out what customers are looking for and make them aware of your focus and the tools you are using. The goal is to get your calves to the right market — the market that recognizes and rewards the value you have created. ✓