

Uncovering the Secrets

Angus Foundation partners with beef checkoff in multi-university effort to investigate factors affecting marbling deposition.

by **KATIE ALLEN,**
Angus Foundation

Tender, flavorful and cooked to a specified degree of doneness to suit your taste. Everyone has their own idea of the perfect steak, and the Angus breed aims to please consumers of all palates.

The Angus Foundation, coupled with the National Beef Checkoff Program, funded a research project to investigate marbling development, an essential component in beef flavor, from 2009 to 2011. The \$50,000 the Angus Foundation contributed to the project was granted to Texas Tech University, Texas A&M University and the University of Idaho for the National Cattlemen's Beef Association (NCBA) Product Enhancement Priority study formally titled, "Regulation of marbling development in beef cattle by specific fatty acids."

Four to five years ago, a lot of emphasis in the industry was given to tenderness in beef, and researchers hadn't put enough emphasis on flavor, explains Larry Corah, vice president of Certified Angus Beef LLC (CAB).

"What was rather interesting is that with all of the meat science research that had been done over the years, we really had a very poor grasp on what created marbling in cattle," Corah says. "We knew genetics was a part of it, but how could you facilitate that? What were the drivers at the cellular level? There was a real need for basic research in marbling formation early on in the animal's life."

In this study, facilitated by multiple universities, researchers aimed to learn more about marbling, or intramuscular fat, in order to improve it without compromising subcutaneous fat, or backfat.

"We've done a series of experiments that clearly have shown that the adipocytes (fat cells) that make up marbling are truly different from the cells that make up subcutaneous or backfat, and in fact they probably more closely match up with muscle cells than they do with backfat cells," says Brad Johnson, Gordon W. Davis Regent's Chair in Meat and Muscle Biology at Texas Tech. "That [finding] allowed us to try to manipulate those cells in different ways."

In the industry, Johnson says, we are taught the hierarchy of fat deposition: Internal fat is deposited first to protect vital organs, followed by backfat and intermuscular, or seam, fat, which is deposited between muscles. Lastly, marbling, or intramuscular fat, is created.

"We're learning that marbling



development actually happens in gestation for that animal," Johnson adds. "We could see, via fetal programming mechanisms, potential marbling in that calf *in utero* and what its outcome is going to be at the end of the feeding period."

Application

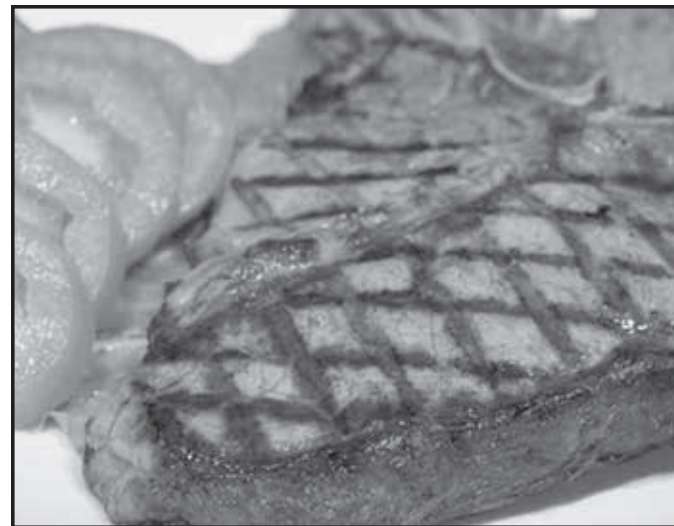
Feedlots can overfeed pens of cattle to ensure adequate marbling, which results in poorer feed efficiencies and higher cost of gains. These research findings begin to unravel the mystery behind key factors regulating marbling development in cattle. Knowing more about marbling development in the early stages of an animal could allow researchers to find ways to intervene to increase marbling development without increasing backfat and help improve feed efficiency.

"We're in a position, by understanding the cellular aspects, to be able to then use that in creating information for producers to use," Corah says. "It may even lead to products being developed to stimulate marbling. Traditionally, most commercial products developed actually reduce marbling, even though they may stimulate growth or other positive attributes as far as the animal is concerned."

As Corah points out, the long-term goal is to develop intervention strategies, like a specific pharmacological agent capable of binding to GPR43, an important membrane-bound receptor that may be critical in regulating marbling, and how that agent can be administered at the optimal time during the feeding period to "turn on" marbling cells and have no effect on subcutaneous cells.

In theory, higher or as high marbling scores could be achieved earlier in the finishing period with lower overall cost of gains.

"Obviously with our increases in commodity prices, feed efficiency is such a huge concern, and as animals get fatter, food conversion tends to worsen," Johnson says. "So if we can use our growth technologies that we have available and maintain really good feed efficiency, but yet get the animals to marble, that's a huge advantage to the cattle feeder."



Better feed efficiency for the feedlot owner and improved flavor for the beef consumer is a win-win.

Importance of collaborative research

Corah says the Angus Foundation's collaboration with the Beef Checkoff in funding this research is just an example of the many collaborative funding efforts that have been extremely important in the beef cattle industry.

"The Angus Foundation dollars led to being able to expand the research, to look at additional aspects of early marbling formation, that without those dollars we would not have been able to collect all of the research data," he says.



Angus Foundation to fund genomic sequencing of Angus sires

At its September 2012 meeting, the Angus Foundation Board of Directors approved funding for a research project at the University of Missouri-Columbia (MU) for genomic sequencing of Angus bulls. This sequencing is meant to enhance the understanding and genetic prediction of Angus cattle performance.

The \$50,500 funding will be awarded to Jerry Taylor, MU's Wurdack chair of animal genomics and curators' professor of genetics and animal sciences.

Taylor says Foundation dollars will be used in tandem with funding provided by the USDA's National Institute of Food and Agriculture (NIFA) to deep-sequence the genomes of high-impact Angus bulls to identify variations in growth, carcass quality, feed intake, disease resistance and early embryonic loss.

"The funding will also support our development of an assay to generate genomic-enhanced EPDs (expected progeny differences; GE-EPDs) and will include up to 6,000 of the variants detected in the sequencing project to test their effects

on fertility in 10,000 genotyped heifers," Taylor adds. "The results will lead to improved EPDs for fertility and production traits in Angus cattle."

The Association will benefit from this research, as it will receive DNA sequence data on the bulls and obtain additional knowledge tied to a large reservoir of sequenced bulls internationally. Sequence data can be used to expand existing high-density 50K (HD 50K) DNA data at MU into whole genome results, which, in turn, creates potential for advanced Angus selection tools at the Association.

Angus breeders currently have access to dependable GE-EPDs on a weekly basis through the Association's national cattle evaluation updates. Sally Northcutt, genetic research director for the Association and Angus Genetics Inc. (AGI), says this research tied to Angus genetics creates new opportunities for improving accuracy in future EPDs and allows for the expansion of selection tools into new traits, particularly in the area of reproduction.

of Marbling



PHOTO BY SHAUNA ROSE HERMEL

“We could see, via fetal programming mechanisms, potential marbling in that calf *in utero* and what its outcome is going to be at the end of the feeding period,” says Brad Johnson, Gordon W. Davis Regent’s Chair in Meat and Muscle Biology at Texas Tech University.

Angus Foundation-supported research projects

RESEARCH PROJECTS IN-PROGRESS

- ▶ Genomic Sequencing of Angus Sires; \$50,500; 2012; University of Missouri
- ▶ Improvement for Beef Cow Biological Efficiency; \$350,000; 2010-2015; University of Illinois and North Carolina State University
- ▶ Development of Genetic Evaluation Methodology for Traits of Economic Importance in American Angus Cattle; \$300,000; 2008-2012; University of Georgia
- ▶ An Assessment of the History of Inbreeding and Relationship in Angus Cattle; \$4,800; 2011-2012; North Dakota State University

COMPLETED RESEARCH PROJECTS

- ▶ Regulation of Marbling Development in Beef Cattle by Specific Fatty Acids; \$50,000; 2009-2011; Texas A&M, Texas Tech and University of Idaho
- ▶ Genomic and Proteomic Markers for Angus Bull Fertility; \$25,000; 2009-2011; Mississippi State University
- ▶ Relationship Between Feed Efficiency Measures During the Heifer Developmental Stage and Measures Taken During First Lactation in Purebred Angus; \$19,000; 2008-2011; Iowa State University
- ▶ Development and Evaluation of Hair Shedding Scores in Angus Cattle; \$21,000; 2008-2010; North Carolina State University and Mississippi State University
- ▶ Enhancing Biological Efficiency in Beef Cattle; \$140,000; 2007-2010; University of Illinois
- ▶ Establishment of a New Research Program to Study Beef Cow Biological Efficiency; \$30,000; North Carolina State University
- ▶ Characterization of Single Nucleotide Polymorphism (SNP) Genetic Markers in Cattle; \$24,000; 2005; USDA-ARS