



## DNA TECHNOLOGY IN THE BEEF CATTLE INDUSTRY

Tim Page, LSU AgCenter

### INTRODUCTION

Beef industry innovators are looking at DNA technology as another selection tool for decisions that give them a marketing advantage. The most important thing for producers to consider is the cost of the DNA technology and what they will get out of it. Like EPDs, it's what people take from it. It may or may not be useful to you, depending on your management, marketing and production plan. Genetic markers are an inheritable piece of DNA taken from a specific site on a known gene. They can provide information about traits such as tenderness, marbling, feed efficiency and disease resistance. Research has identified 50 to 60 DNA markers in beef cattle for economically important traits such as tenderness and marbling. There are several DNA tests commercially available to producers. Experts caution that beef cattle producers should keep in mind that cattle phenotype or physical appearance and performance are imparted by genes, environment and management practices.

### CHROMOSOMES AND GENES

Chromosomes are structures in the cell nucleus that store and transmit genetic information in the form of DNA. Genes are sequences of DNA bases on a chromosome that cause a certain characteristic. All chromosomes contain many genes. The precise location of most genes is unknown at this time. There are approximately 30,000 genes in cattle. Chromosomes are arranged into pairs of similar size and structure that contain genes for the same traits. Cattle have 60 chromosomes or 30 pairs. Each parent contributes one randomly chosen

chromosome from each pair to its offspring. Alleles are the various possible forms of a gene. When an individual has two identical alleles for the same trait, they are homozygous (AA, BB, etc.). When an individual has two contrasting alleles for the same trait, they are heterozygous (Aa, Bb, etc.). There are two basic types of traits, qualitative and quantitative. Qualitative traits fall into a few distinct classes such as red or black, horned or polled, double muscled or normal. Qualitative traits are normally determined by one gene or only a few genes. These genes usually affect only one trait. Quantitative traits are those that show a continuous distribution such as performance traits. Quantitative traits are influenced by many genes and each gene usually has a small effect. Quantitative traits are the result of genes for proteins that control growth, reproduction, fat deposition, muscling and many others. These proteins can be hormones, enzymes, and growth factors. Nearly every gene will have an effect on more than one trait. Some effects associated with a favorable trait will be unfavorable for other traits.

### GENETIC MARKERS

Meat tenderness is a major issue facing today's beef cattle industry. It is a trait that producers cannot select for by visually appraising an animal. Also, it cannot be accurately measured until the animal is harvested. Genetic marker assisted selection allows for the accurate selection of specific DNA variations that have been associated with a measurable difference or effect on quantitative traits.

### DNA TESTS EXAMPLES

Igenity TenderGENE (Merial) is actually two single nucleotide

polymorphism markers (SNP 316 "C" and SNP 530 "G") in the calpain gene associated with increased tenderness. The DNA variations are located at two different places in the coding region of the calpain gene. This gene produces an enzyme that weakens muscle fibers, thus increasing tenderness during the aging process. The results from the TenderGENE test are presented on a 1-5 scale with 5 being the most tender. GeneSTAR Tenderness (Bovigen) reports on two SNP markers, one SNP associated with the calpastatin gene which produces an enzyme that regulates calpain, and the SNP 316 of calpain. The results from the GeneSTAR Tenderness test are presented as 0-4 stars with 4 stars being the most tender. More DNA gene marker tests are being developed for such traits as feed efficiency.

### SUMMARY

Remember, genetic markers for quantitative traits in beef cattle, such as tenderness or marbling, are associated with only one of the many genes that contribute towards that trait. The presence or absence of numerous other genetic markers and production environment, determine whether an animal displays the desired phenotype, such as increased tenderness or marbling. When making selection decisions, EPDs should be considered, even in the presence of marker data, to estimate the breeding value of all unmarked genetic markers contributing to a given trait. Genetic marker assisted selection should be seen as an assistance tool, not as a replacement for traditional selection techniques.

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