

## The comprehensive IGENITY profile analyses horned/polled status. And much more.

Only IGENITY offers the most powerful profiling technologies with user-friendly applications and consultation. The comprehensive IGENITY profile empowers producers to make more confident real-time decisions and higher-quality, more profitable products.

IGENITY works with research partners around the globe to continue to discover and integrate innovative technologies, and enhance the value of the IGENITY profile. At press time, IGENITY offered analyses related to the following economically significant traits:

- **Tenderness**
- **Marbling**
- **Retail Meat Yield**
- **Fat thickness**
- **Ribeye area**
- **Heifer pregnancy rate**
- **Longevity**
- **Calving ease**
- **Docility**
- **Residual feed intake**
- **Average daily gain**
- **Parentage verification**
- **Coat colour**
- **BVD-PI diagnostic test**
- **Myostatin**
- **Breed-specific horned/polled**
- **Arthrogyposis Multiplex (Curly Calf Syndrome)**

**As IGENITY advances the science of DNA technology, more analyses will be added. For the latest information about the IGENITY profile, visit: [www.igenity.com](http://www.igenity.com) or call: 0845 603 8895**

### References

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## Genetic Profiling Helps Select for Polled Cattle.

Horned cattle still represent a significant cost to the beef industry due primarily to these animals' impact on bruising in the rib, loin and round areas of the beef carcass.<sup>1</sup>

### Why Do I Still Have To De-Horn?

Disbudding/dehorning is:

- time consuming at what is already a busy period;
- potentially dangerous, separating young calves from their mothers;
- stressful and a frightening early experience of human contact for the calf;
- completely non productive, simply rectifying a [point] in the breeding of the animal.

Perhaps the most important reason is that it is completely unnecessary, particularly as "poll" is the dominant gene and horned the recessive. Hence the majority of beef producing countries in the world no longer have horned cattle. The best we can say in the UK is that most breeds have a small proportion of polled animals.

What emphasises the futility of disbudding cattle is in herds using a two breed criss-cross system for breeding replacements where one of the breeds is naturally polled e.g. Aberdeen Angus and the other horned. All calves sired by the polled breed will not require de-horning. Interestingly only one third of calves sired by the horned breed will need de-horning, due to the dominance of the poll gene.

Overall with polled and horned breeds of bull being used each year, on average 82% of calves born will not need to be de-horned.

This figure could rise to 100% every year if the horned breeds in the UK began to take polling seriously to meet the needs of their main customers, commercial beef producers. To help incorporate polling into our horned breeds Merial have produced a "polled v horned" gene marker test in their IGENITY package.

*Basil Lowman, SAC Beef Specialist.  
With acknowledgements to Tim Roughsedge.*

### Phenotypic and Genotypic Options for Eliminating Horns

The cost of removing horns from cattle can vary significantly depending on animal age and whether or not the practice is incorporated into other

management activities. Additionally, several countries have implemented maximum age restrictions (ranging from a few weeks to a few months) for dehorning without the animals being under anesthesia/sedation.<sup>4</sup>

Genetic analysis is now available for horned/polled traits in many breeds of cattle as an option from IGENITY®. See inside.

### Polling – Why Homozygous Is Important

An animal can have three different combinations of genes determining whether it will be polled (P) or horned (H). These are –

- PP – a polled animal (homozygous)
- PH – a polled animal (heterozygous)
- HH – a horned animal (homozygous)

The reason a PH animal will not have horns is because polling is the dominant gene and horned the recessive gene.

The importance of knowing whether a polled bull is homozygous (PP) or heterozygous (PH) is because if they are mated to horned (HH) cows then all of the progeny from the homozygous (PP) bull will carry PH genes and be polled.

In comparison mating a heterozygous polled bull (PH) to horned (HH) cows will result in only half of the calves carrying PH genes and hence being polled with the other half carrying HH genes and being horned.

This is why using a bull from a polled breed (which carries no H genes) such as the Aberdeen Angus means that none of the calves will require dehorning. In comparison using a heterozygous (PH) polled bull on horned and heterozygous polled cows will mean that all calves still have to be handled to find those which require disbudding. Hence the much greater premium of around £300 – 400 which can be paid for a homozygous polled bull compared with a heterozygous bull (or £500 – 600 for a polled bull compared with a horned bull). This premium makes the cost of an IGENITY polling test a good investment for pedigree breeders starting to introduce polling into their herd.

*Basil Lowman, SAC Beef Specialist*

## Genetic Profiling Helps Select for Polled Cattle.

### Inheritance of Polledness

In beef cattle of European ancestry (*Bos taurus* cattle), the trait of being polled or having horns is believed to be determined by one pair of genes. The polled form (P) is dominant to the horned form (H).<sup>6</sup> The only situation when an animal will be horned is when it possesses two recessive horned genes (HH or homozygous horned).<sup>7</sup>

Inheritance of horns in zebu-type cattle may be different from that observed in British and Continental breeds, and is believed to be influenced by the African horn gene, which has its own unique mode of inheritance.

### A Closer Look at the Horn

The horned condition in cattle is defined by a bony outgrowth from the skull and the extension of the sinus cavity into the horn (see Figure 1). A related condition to horns in cattle is scurs. Scurs do not have the bony outgrowth from the skull and the extension of the sinus cavity into the horn (see Figure 2). They can range in size from tiny scablike growths to large protrusions, almost as large as horns. Scurs are generally loose and movable beneath the skin, and not attached to the skull.

It is believed that there is a separate gene for scurs, transmitted independently of the horn gene and that only cattle that are heterozygous for the polled/horned genes can express the scurred trait.<sup>8</sup> In males, the scur gene is dominant, meaning that if only one of the two genes is for scurs, the bull will be scurred. In females, the scur gene is recessive, meaning that she must possess both genes for scurs in order for the female to be affected.<sup>6</sup>



Figure 1. True horns are bony outgrowths from the skull and sinus.



Figure 2. Scurs are scablike growths, neither bony nor attached to the skull.

### horned/polled analysis from IGENITY

The horned/polled analysis available from IGENITY uses technology developed at Texas A&M University and identifies variation at the polled locus in *Bos taurus* cattle.

Using a comprehensive set of markers across the polled genome region, the analysis is derived by examining the DNA from animals of known status for the horned/polled genes, based on breeding records. Development typically involves up to 200 bulls per breed, which allows evaluation of records on well over 50,000 progeny.

The analysis is breed-specific, to reflect how the polled condition was introduced and subjected to recombination within each breed. The horned/polled analysis is currently available from IGENITY for the following breeds, as well as any of these breeds crossed with Angus, since Angus carries only polled haplotypes:

- Charolais
- Shorthorn
- Gelbvieh
- Simmental
- Hereford
- Jersey
- Limousin

**NOTE:** Recombination events may occur within any of these breeds — as well as breeds added to the analysis in the future. In these cases an “indeterminate” result will be reported in the analysis (see Table 1).

### Validation Process for the Horned/Polled Analysis from IGENITY

IGENITY is an industry leader in validation of its analyses using a variety of populations. The validation process for the horned/polled analysis includes three phases:

1. The first phase involves internal blind testing in which results are reported without knowing the animals’ phenotypes.
2. In the second phase, extensive pedigree information provided by breed associations is compared with the genotypes on homozygous polled, heterozygous polled and horned bulls per breed. These bulls often have progeny resulting from mating to at least 25 different horned and polled females.
3. The third phase includes blind testing in which animals are submitted for testing without animal identification and results are compared with animal breeding records.

### Results

While additional breeds continue to be added to the IGENITY profile, the analysis was first developed in Angus, Hereford and Limousin cattle (see Table 1). More than 2,000 animals were evaluated, representing more than 200 different chromosomes. Within each breed a number of unique genotype combinations, referred to as haplotypes, were identified and related to horned or polled status based on breed records. The number of haplotypes found within a breed can be as little as 8 or number over 300 possible haplotypes.

	Angus	Charolais	Gelbvieh	Hereford	Holstein	Jersey	Limousin	Shorthorn	Simmental
Number of animals tested	455	254	322	274	180	81	342	118	137
Percent indeterminate	0	7	0.1	3	0.01	0.1	0.5	2	0*
Percent error	0	0	0.6	0	0	0	0	2	6

<sup>a</sup>The percent indeterminate for commercial Simmental horned/polled results may be somewhat higher, due to the large amount of variation within the breed and limited breeding records with bulls mated to horned cows.

For each breed, the percent indeterminate and percent error rate can be calculated. Indeterminate results occur when there are not enough animals from the breed with the haplotype and good breeding records to establish the horned/polled status for that haplotype. The percent indeterminate in Table 1 is calculated based on the number of animals tested for each breed in the discovery and validation populations. If an animal receives an indeterminate result for a breed which has a 0 percent indeterminate in Table 1, it means that particular haplotype was not seen in the discovery or validation population. The percent error rate in Table 1 represents the number of animals tested where the breeding record did not match the haplotype in the discovery or validation population. This could be due to errors in the genotypes, the breeding record or the calculation of the haplotype result.

### Horned/Polled Analysis Terms

**Recombination** — The process by which a strand of genetic material (usually DNA) is broken and then re-joined (recombined) to a different DNA molecule. Recombination commonly occurs during meiosis as chromosomal crossover between paired chromosomes. A recombination event results in offspring having different combinations of genes than their parents.

**Haplotype** — The term is a combination of the two words “haploid genotype.” A haplotype is a genetic combination of alleles at multiple loci that are transmitted together on the same chromosome. It may refer to as few as two loci, or to an entire chromosome, depending on the number of recombination events that have occurred.

**Homozygous** — Describes the presence of two identical alleles or DNA sequences at one locus.

**Heterozygous** — Describes the presence of only a single copy of the gene in an otherwise diploid organism.

For the latest information on breeds included in the IGENITY profile, or additional technical information about the horned/polled analysis, visit [www.igenity.com](http://www.igenity.com) or call 0845 603 8895.