

Quick Look at Genetics – Questions and Answers

1. Why are the genotypes named the way they are?

- Genes are made up of unique sequences of the DNA building blocks “A-, C-, T-, and G bases” and these sequences can often be over 1000 bases long.
- In the case of the cattle *Leptin gene* sequence, there is one key location where a ‘C’ is present, yet in many cattle it was replaced with a ‘T’ due to a mutation:
 - This key location is referred to as a ***Single Nucleotide Polymorphism*** or a ‘***SNP***’ (pronounced “snip”).
 - Cattle scientists compared animals containing a ‘C’ or a ‘T’ in their Leptin genes, finding that ‘T’ genotypes had increased fat accumulation.
 - Since DNA has two strands attached together, ***TT*** means that both strands have a T allele, ***CT*** means that one strand has a T allele and the other has a C allele, and ***CC*** means that both strands have a C allele at the *Leptin SNP*.

2. What do the results mean?

- Using Leptin genotypes as an example, genotypes are reported as being ‘***Leptin CC***’, ‘***Leptin CT***’, or ‘***Leptin TT***’.
- Since ***Leptin TT*** is the ***preferred*** genotype, TT cattle will show improved carcass traits over CC cattle with CT cattle being somewhere in the middle

3. Are the genes able to be passed on to the calves?

- Cattle inherit one copy of a gene from the ***dam*** and one copy from the ***sire***.
- This means that if you have a TT bull, the calves can only be either CT or TT since he is only able to pass down one T allele.

Leptin

1. What is Leptin?

- Leptin is a mammalian hormone with the primary function of decreasing appetite.

2. What genotype of Leptin is preferred?

- Leptin TT.

3. What are the benefits of Leptin TT cattle?

- Leptin TTs have an overall increased rate of fat accumulation compared to leptin CC.
- For Leptin TTs, this mainly results in:
 - Increased weaning weight
 - Increased cow productive life due to increased body condition score
 - Increased milk production
 - Increased 12th rib backfat
 - Impacts yield grade & marbling (quality grade)

PMCH

1. What is PMCH?

- PMCH (Pro-Melanin Concentrating Hormone) is a mammalian hormone that is involved in feed intake maintenance.

2. What genotype of PMCH is preferable?

- PMCH AA.

3. What are the benefits of PMCH AA cattle?

- PMCH AAs have an overall increased fat deposition compared to PMCH TT.

- For PMCH AAs, this mainly results in:

- Increased tenderness
- Increased marbling fat
- Increased 12th rib backfat

CRH

1. What is CRH?

- CRH (Corticotrophin-Releasing Hormone) is a mammalian hormone that is involved in appetite control and stress response.

2. What genotype of CRH is preferred?

- CRH GG.

3. What are the benefits of CRH GG cattle?

- CRH GGs have an overall increased carcass yield compared to CRH CCs.

- For CRH GGs, this mainly results in:

- Increased hot carcass weight
- Increased rib eye area

IGF2

1. What is IGF2?

- IGF2 (Insulin-like Growth Factor 2) is a mammalian hormone that is involved in lean muscle growth.

2. What genotype of IGF2 is preferred?

- IGF2 CC.

3. What are the benefits of IGF2 CC cattle?

- IGF2 CCs have an overall increased lean growth compared to IGF2 TTs.

- For IGF2 CCs, this mainly results in:

- Increased rib eye area

Impact on Economically Important Traits (2016-09-20)

Table 1: Magnitude differences by trait across genotypes.

LEPTIN	CC	CT	TT
Backfat (mm)	-	0.6	1
Calculated YG	-	0.09	0.15
Quality Grade			
Choice	-	8%	12%
Select	12%	4%	-
HCW (lbs)	-	4	8
DMI (lb/day)	-	0.5	1
Weaning Wt (lbs)	-	12	20
Cow Longevity (years)	-	1.5	2
PMCH	AA	AT	TT
Backfat (mm)	1.5	0.6	-
Calculated YG	0.2	0.1	-
Quality Grade			
Choice	10%	5%	-
Select	-	5%	10%
WBSF (kg)	-	0.15	0.24
IGF2	CC	CT	TT
REA (in2)	0.5	0.2	-
CRH	CC	CG	GG
HCW (lbs)	-	6	15
REA (in2)	-	0.15	0.3

- HCW is hot carcass weight
- DMI is dry matter intake
- WBSF is Warner-Bratzler Shear Force (measure of tenderness)
- REA is rib eye area