



# Genomics, EPDs and their application to beef herds in Florida

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# Outline



- Revisiting some basic genetic concepts
- Beef cattle – traditional selection
- Genomic selection - practical questions
  - Dairy Industry as a genomic selection success story
  - Beef Industry as an “opportunity for improvement”
- What genomic tests are available?
- What do the results mean?
- Current and future status of this technology

# Basic Genetic Concepts



# Types of traits



## Simple (qualitative)

- Coat color (black vs red)

### 1. Number of Genes

- One gene



**BB** or  
**Bb**



**bb**

## Complex (quantitative)

- Growth rate (WW, YW)

### 1. Number of Genes

- Many genes



**450 lb**

AABbccDDeeGg  
FFIijjkkLIMmNN  
OoppRRSStt.....



**480 lb**

AABbCcDDeeGg  
FFIijjkkLIMmNN  
OOppRRSStt.....

# Types of traits



## Simple (qualitative)

- Coat color (black vs red)

### 1. Number of Genes

- One gene

### 2. Environment

- No effect

## Complex (quantitative)

- Growth rate (WW, YW)

### 1. Number of Genes

- Many genes

### 2. Environment

- Has an effect (small – large)

**Nutrition:** (pasture vs pasture+suppl.)



**450 lb vs 480 lb**

# Types of traits



## Simple (qualitative)

- Coat color (black vs red)

### 1. Number of Genes

- One gene

### 2. Environment

- No effect

## Complex (quantitative)

- Growth rate (WW, YW)

### 1. Number of Genes

- Many genes

### 2. Environment

- Has an effect (small – large)

**Climate:** (drought vs rain)



**450 lb vs 480 lb**

# Types of traits



## Simple (qualitative)

- Coat color (black vs red)

### 1. Number of Genes

- One gene

### 2. Environment

- No effect

## Complex (quantitative)

- Growth rate (WW, YW)

### 1. Number of Genes

- Many genes

### 2. Environment

- Has an effect (small – large)

**Disease:** (sick vs healthy)



**450 lb vs 480 lb**



# Types of traits



## Simple (qualitative)

- Coat color (black vs red)

### 1. Number of Genes

- One gene

### 2. Environment

- No effect

## How much of an effect?

**Heritability** - proportion of phenotypic variation caused by genetics

## Complex (quantitative)

- Growth rate (WW, YW)

### 1. Number of Genes

- Many genes

### 2. Environment

- Has an effect (small – large)

<u>traits</u>	<u>h<sup>2</sup></u>	<u>magnitude</u>
Reprod.	<.2	low
Growth	.2-.4	moderate
Carcass	.4-.6	high



# Impact on genomics



- Most – if not all – economically important traits are complex (quantitative) traits

## 1. Controlled by **many genes**

- Genomic tests - subset of these genes (and most times, not the genes themselves)
- Accuracy - associated with how much of the underlying genetics is accounted for by the test

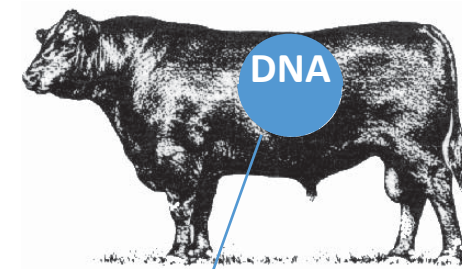
## 2. Under **environmental** influence

- Same genetics will perform differently in different environments
- Accuracy associated with the environmental variation

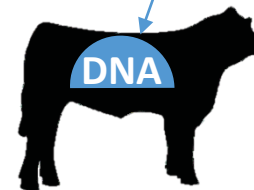
# Inheritance



- Parent – offspring
  - Share **50%** of their DNA



50%



# Inheritance

- Parent – offspring
  - Share **50%** of their DNA
- Two half-sibs:
  - On average, share **25%** of their DNA
  - In reality, that ranges from **0** to **50%**

Implication for selection: even when the genotype of the sire is completely known – offspring could be quite different genetically:

1. Due to half of the DNA coming from the **dam**
2. Due to random segregation of genes from the sire (**Mendelian sampling**)

