

# What do I need to know about Genomically Enhanced EPD Values?

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## Take Home Message

- Genomically enhanced EPD values are used exactly like the EPD values you have been using
  - More information is added to prediction models
  - Accuracy values are increased, thus reducing risk
- Most useful for hard to measure traits
- Also useful in young, potential AI bulls

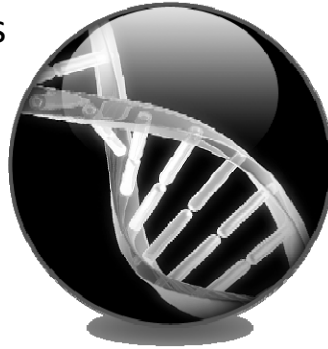
## Why do we use EPD values?

- Genetically change our herds
- For the past 30 years, we knew
  - Heritability of the trait(s)
  - Pedigrees
  - Individual animal measurements of trait(s)
- For the past 30 years we have not known
  - Individual genes controlling traits
  - Still do not know this, but have identified some spots on chromosomes that cause trait variation in the DNA

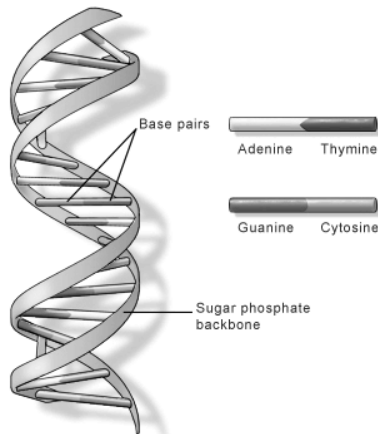
## A small biochemistry lesson

## The Typical Bovine

- Has 30 pair of chromosomes
  - 29 pair of autosomal chromosomes
  - 1 pair of sex chromosomes
- Each chromosome contains
  - Genes
  - Regulatory information
  - Composed of 4 nucleotide bases



## Nucleotide Bases



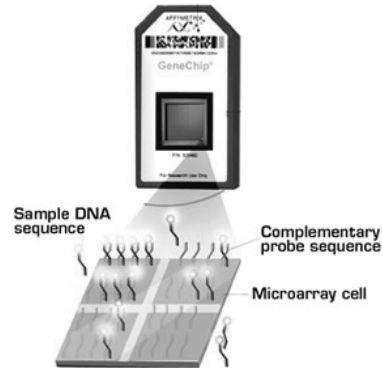
National Library of Medicine

- 5.6 billion base pairs in cattle
- Look for meaningful differences in the base pairs that relate to economically important traits



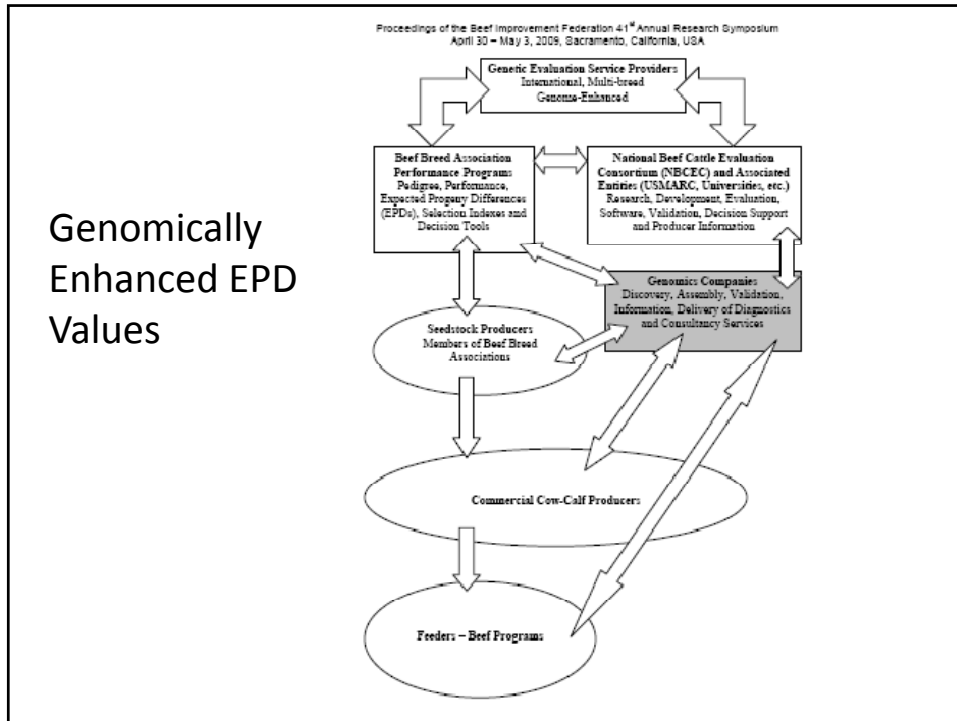
## Single Nucleotide Polymorphisms

- Once identify a group of SNPs that relate to an economically important trait, must be able to rapidly test for these in an individual or population
  - 50K SNP Chip
- Now must turn this information into something useful



## Molecular Breeding Values

- SNP information can be transformed into molecular breeding values (MBV)
  - Must remember, no one has identified all the SNPs for an multi-gene economically important trait
  - Have identified from a few SNPs to low hundreds SNPs for a particular trait
  - So a molecular breeding values are just another piece of the pie to determine the genetic worth of an individual
  - MBVs are owned by the DNA companies



## Genomically Enhanced EPD Values

- Increase accuracy values of young animals
- Shorten generation interval
- Predict EPD values for hard traits
  - Efficiency
  - End-product healthfulness
  - Disease susceptibility
  - Reproductive traits

Figure 1. Increase in accuracy from integrating genomic information that explains 10% of the genetic variation into Estimated Breeding Values (EBV).

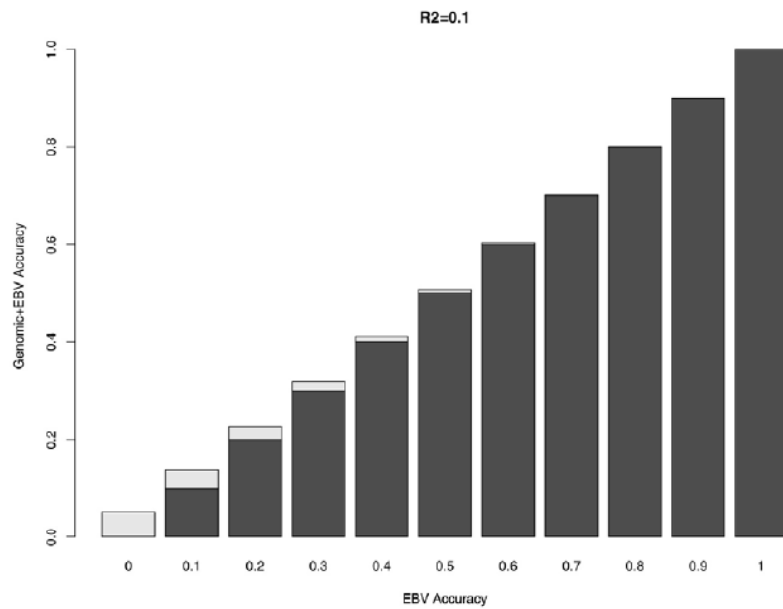


Figure 2. Increase in accuracy from integrating genomic information that explains 20% of the genetic variation into Estimated Breeding Values (EBV).

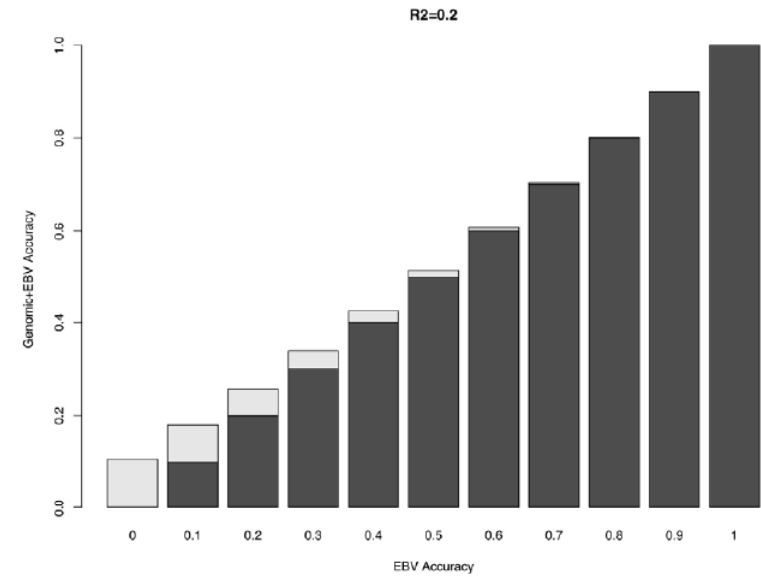


Figure 3. Increase in accuracy from integrating genomic information that explains 30% of the genetic variation into Estimated Breeding Values (EBV).

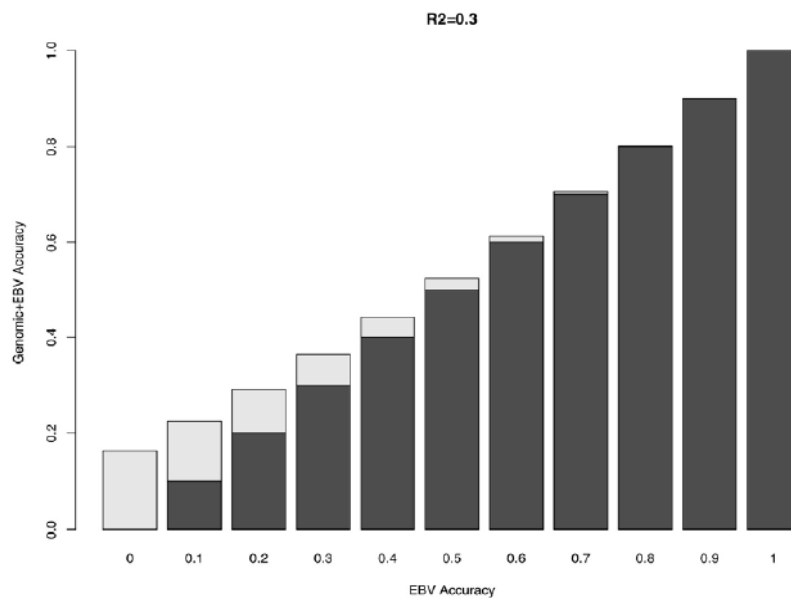
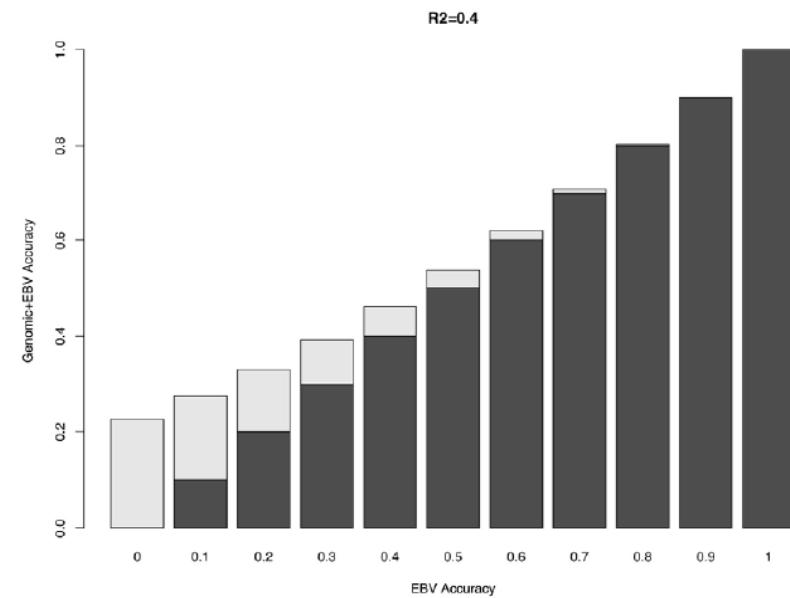


Figure 4. Increase in accuracy from integrating genomic information that explains 40% of the genetic variation into Estimated Breeding Values (EBV).



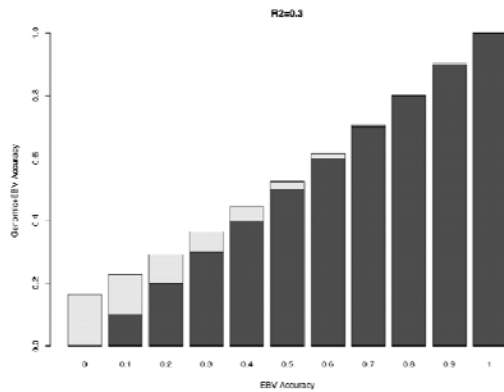
### Approximate number of progeny needed to reach sire summary accuracy levels

Sire Summary Acc.	Heritability (h <sup>2</sup> )		
	0.10	0.30	0.50
0.01	1	1	1
0.05	4	2	1
0.08	8	3	2
0.13	13	5	3
0.20	22	7	4
0.29	38	12	7
0.40	70	22	13
0.56	167	53	30
0.99	3800	1225	700

Adapted from Spangler, 2011. Table 1.

### Adding MBV Data

Figure 3. Increase in accuracy from integrating genomic information that explains 30% of the genetic variation into Estimated Breeding Values (EBV).



Sire Summary Acc.	No. Progeny
<b>h<sup>2</sup> = 0.30</b>	
0.01	1
0.05	2
0.08	3
0.13	5
0.20	7
0.29	12
0.40	22
0.56	53
0.99	1225

Example: No individual or progeny data, heritability of trait = 0.30 and SNP panel explains 13.7% of the variation of the trait. Will move accuracy of EPD from 0.07 to 0.13

## Which Animals?

- Young animals with an exciting, promising genetic background
  - Primarily bull calves
- Perhaps some ET calves
- Can biopsy embryos

## Which Animals?

- Right now, American Angus only beef breed publishing genomically enhanced EPDs

Figure 1. Weekly evaluation traits with genomic data

	Igenity	Pfizer
Calving ease (CED)	✓	✓
Growth (BW WW YW Milk)	✓	✓
Residual Average Daily Gain (RADG)	✓	✓
Docility (DOC)	✓	
Carcass (CWT MARB RIB FAT)	✓	✓

Taken from American Angus Association Website

## How to Collect DNA Samples

- Tail Hair
  - <http://www.youtube.com/watch?v=yPpATa8a1dM>
- FTA Blood Collector card
  - <http://www.youtube.com/watch?v=8VXrF73eJXs&feature=related>
- Tissue Samples
- Semen Samples



## Labs

- Right now, Igenity and Pfizer are the only labs working with genomically enhanced EPD data.
  - **AgriGenomics** - AM, CA, NH, PHA, TH, OS  
**Phone: 1.217.762.9808**  
<http://www.agrigenomicsinc.com/cattle.html>
  - **Genex Cooperative Inc.** - AM & NH  
**Phone: 888.333.1783**  
<http://genex.crinet.com>
  - **MMI Genomics, Inc.** - AM, NH, & OS  
**Phone: 800.311.8808**  
<http://mmigenomics.com>
  - **Pfizer** – AM, CA, NH, OS, PHA, TH, & IE  
**Phone: 1.877.233.3362**  
[http://www.pfizeranimalgenetics.com/sites/PAG/Pages/Testing\\_and\\_Results.aspx](http://www.pfizeranimalgenetics.com/sites/PAG/Pages/Testing_and_Results.aspx)
  - **Igenity** – AM, CA, NH, PHA, TH, OS, DI, IE  
**Phone: 1.877.IGENITY**  
<http://www.igenity.com/resources/KnowledgeCenter.aspx?ref>

## Summary

- Genomically enhanced EPDs are just the next improvement in more accurately predicting genotypes
- Each breed must develop their own SNP panels
- Main improvement is increased accuracy in young animals or animals with no records
- Additional cost that must be recaptured in marketing