Genetic Evaluations

Stephen Scott
Canadian Hereford Association

Hereford

Canadian Hereford Association

- Herefords were first imported into Canada in 1860
- The CHA was incorporated in 1902 under the Government of Canada Animal Pedigree Act
- The Canadian Hereford Association currently has 1500 members servicing thousands of commercial cattlemen across Canada
- Manage the registry, involved in marketing Canadian genetics world wide, Scientific Development and National Show program
- Work on a team that produces an pedigree evaluation on over 6 million records across 4 countries
- Part of the World Hereford Council

Genetic Evaluations

Expected progeny differences (EPDs) provide an estimate of an animal's genetic worth as a parent. These values make use of known pedigree and performance information about an animal, its progeny and other relatives

GE-EPDs are the best estimate of an animal's genetic worth as a parent. These values make use of known pedigree, performance **and genomic** information about an animal, its progeny and other relatives.

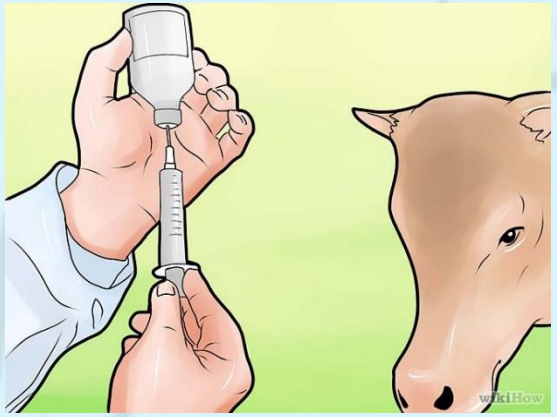
Genomics – branch of molecular biology concerned with the structure, function, evolution, and mapping of genomes

Genetics creates potential, management delivers

What are Your Goals

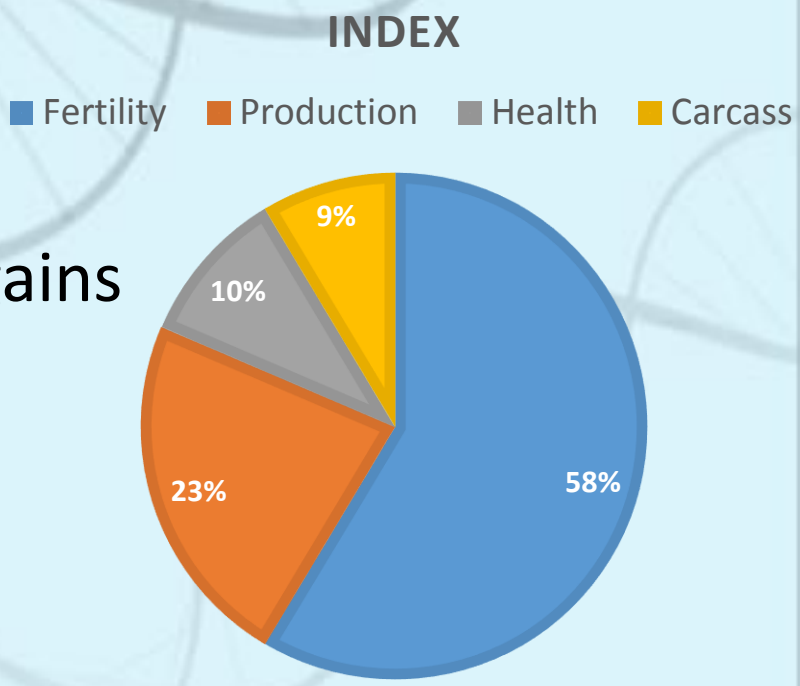
- How do you choose your cows and bulls?
- Increase my bottom line without a lot of extra time and labour
- Create Efficiencies
- Benefit the Environment
- Animal Welfare
- Low Maintenance Cattle
- World leader in cattle production

Phenotypes + Pedigree



Improving Genetic Merit

- Expected Progeny Difference (EPD)
  - Phenotype and pedigree
  - GxE=P
- Multi-trait selection indices
  - Economics and/or desired gains
  - Overcomes unfavourable correlations



Understanding EPDs

EPDs	Hrds Prog DIP	CE Acc %	BW Acc %	WW Acc %	YW Acc %	Milk Acc %	TMAT Acc %	SC Acc %	CWT Acc %	REA Acc %	FAT Acc %	LY Acc %	MARB Acc %
	0	46	1.5	40	76	17.9	38	N/A	15	0.47	-0.11	1.16	0.09
	0	0.17	0.39	0.27	0.24	0.15	0.19		0.10	0.06	0.08	0.00	0.05
							85		65	30	20	15	50

13 **AGA 2U BRITISHER 13A**

C02986647 ALNK 13A MARCH 20 2013

BW:	81
205:	558
'15 EPDs	
CE:	+0.3
BW:	+3.2
WW:	+38.1
YW:	+62.4
MCE:	-0.2
Milk:	+14.7
TM:	+33.8

DP BRITISHER AGA 46E
AGA 46E BRITISHER ET 2U
AGA 22B MISS BRIGADER 511E

DOMINO STANDARD DP LAD 45
BRITISHER WETMORE LADY AGA
CTY BRIGADER 22B
AGA MISS 42X STANMORE 94Z

CC 77J JARROD 26T
AGA 26T MISS JARROD EXCITE 13X
AGA 53L MISS RED DOMINO 80S

CC 129D SUPERMAN 77J
CC 14N JOCELYN 33R
AGA 22B BRIGADER 53L
AGA 277D MISS STANDARD 810H

Ranked 121 / 918 published RFI EPDs

Long & solid marked with a woolly, yellow haircoat with a great top, thick quarters and great pants, this 2U son placed far above average on the RFI EPD report. The ultrasound scanner revealed a REA of 1.25/100 lbs. Retaining semen interest

Where do I start?

281 **LLB 9188 KODIAK 341A**

April 17 2013 #1749747 LLB 341A

HF KODIAK 5R AMF CAF NHF MAF DDF
SOO LINE KODIAK 9188
LLB EULIMA 283R

SANDY BAR ADVANTAGE 43M
WILBAR RUBY 955N
K G POWER DESIGN DDF
LLB EULIMA 104K

WOODHILL ADMIRAL 77K AMF CAF NHF DDF
SANE ADM BLACK KERRIE 103W
KLT BLACKBIRD MINNIE 24M AMF NHF

S A F FOCUS OF E R AMF CAF NHF DDF
WOODHILL LASS 344-1178
C A FUTURE DIRECTION 5321 AMC
KLT BLACKBIRD'S KERRI 12K

BWT **85** lbs. Adj 205D **787** lbs. Adj. 365D **1436** lbs. Dams Age **4** Calving Ease **2**

BW +4.1 35% WW +55 25% YW +84 14% MILK +19 14% TM +47 205 Index 108

A bull with top weaning and yearling weight records. Note his grand dam LLB Eulima 104K is the mother of the Lot 1.

EPDS	CE Acc %RK	BWT Acc %RK	WWT Acc %RK	YWT Acc %RK	MCE Acc %RK	MWWT Acc %RK					
	-0.8	3.5	46.8	52.0	-6.0	48.7	25.4		5.2	0.22	-0.050	-0.26
	0.30	0.31	0.27	0.27	0.26	0.26	0.26		0.23	0.16	0.16	0.16
	80	60	55	60	100	50	15		60	70	80	100

EPDS Spring 2015

- **Understand EPD**
- **Breed Average EPD**

	Birth Weight	Weaning Weight	Yearling Weight	Milk	Total Maternal	Scrotal Circ.	Calving Ease	Mat Calving Ease	Yield Grade	REA	Carcass Weight	Marbling	Fat	Stay	HPG
EPD	+4.3	+52	+93	+19	+45	-	+2.0	+9.0	-	+0.41	+33	+0.19	-0.013	-	-
Acc	72	61	18	24	-	-	35	17	-	13	9	12	11	-	-
TOP %	85	20	15	45	30	-	55	20	-	25	10	75	8	-	-

Understanding EPDs

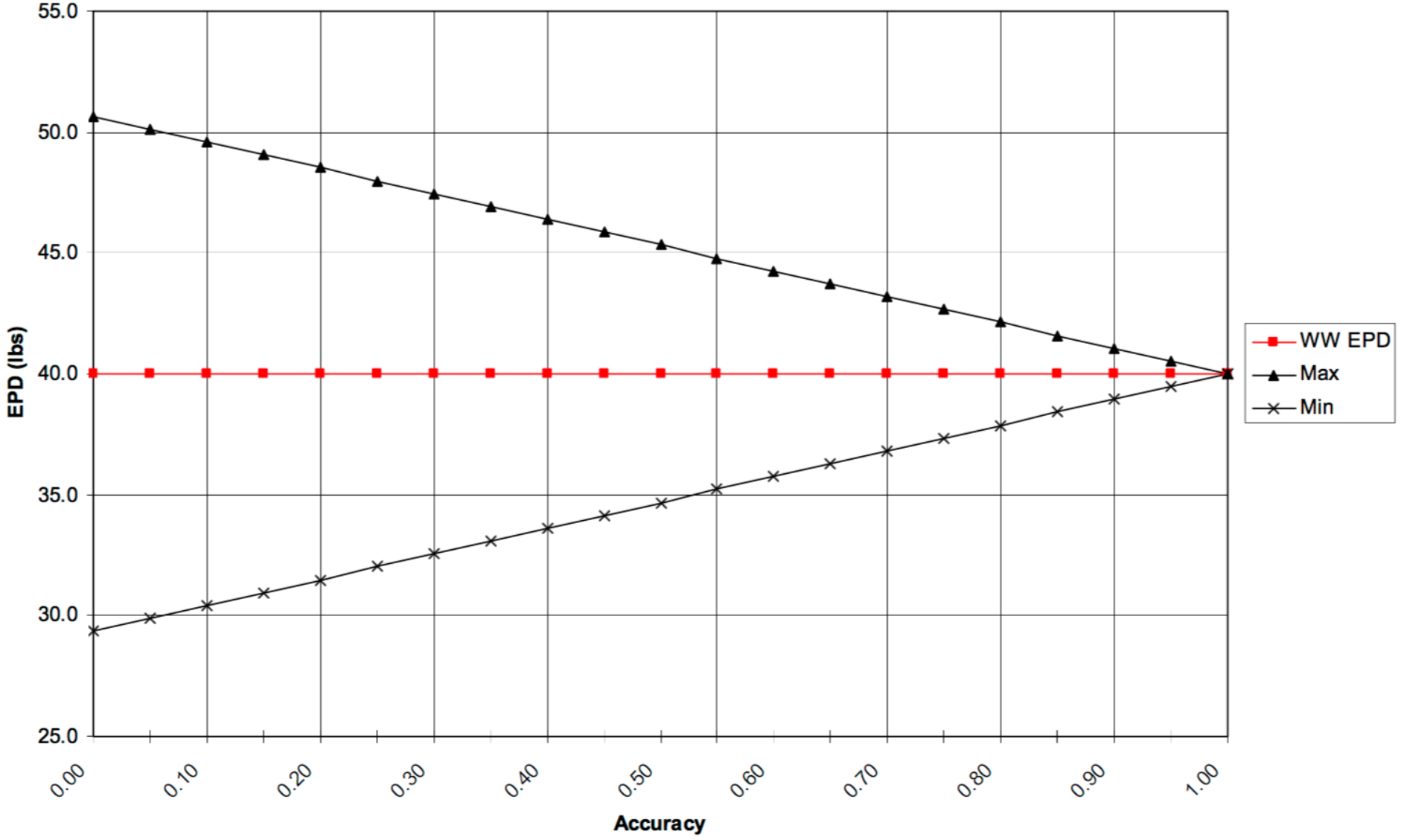
Accuracies; quickly tells you the status of a bull

	Birth Weight	Weaning Weight	Yearling Weight	Milk	Total Maternal	Scrotal Circ.	Calving Ease	Mat Calving Ease	Yield Grade	REA	Carcass Weight	Marbling	Fat	Stay	HPG
EPD	+4.3	+52	+93	+19	+45		+2.0	+9.0		+0.41	+33	+0.19	0.013		
Acc	72	61	18	24	-	-	35	17	-	13	9	12	11	-	-
TOP %	85	20	15	45	30	-	55	20	-	25	10	75	8	-	-

Possible EPD changes

Accuracy %	Birth Wt	Wean Wt	Milk
10	±2.4	±10.4	±8.7
30	±1.8	±8.1	±6.8
50	±1.3	±5.8	±4.9
75	±0.8	±2.9	±2.4
90	±0.3	±1.2	±1.0

Possible Change Value of WW EPD



Understanding EPDs

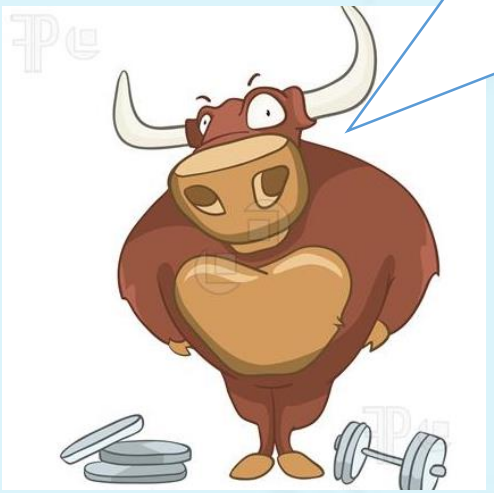
JOE

- **Joe is the bull that all bulls are compared to**
- **He is just a very average bull**
- **All of Joe's trait figures are zero**
- **Joe is what is called the base bull and doesn't actually exist**

	BWT	CE	WWT	YWT	MLK	CWT	FAT	REA
EPD	0	0	0	0	0	0	0	0

Understanding EPDs

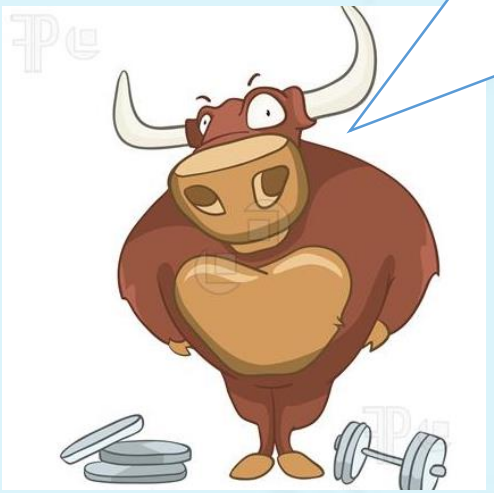
- His progeny will be 40lb heavier at weaning than my progeny
- In the top 70% of his breed



WW Acc %	
40	
0.27 70	

Understanding EPDs

- His daughters will have more milk than mine
- Their calves are 17.9 lbs heavier at weaning
- A lot better than him in his breed though



Milk Acc %
17.9
0.15 85

Rankings

Percentile Band	Birth Weight	Weaning Weight	Yearling Weight	Milk	Total Maternal	Scrotal Circ.	Calving Ease	Mat Calving Ease	REA	Carcass Weight	Marbling	Fat
Top Value	-6.600	87.000	141.000	36.000	77.000	1.825	21.183	21.034	1.425	62.334	2.346	-0.106
Top 5%	-0.600	60.000	106.000	27.000	54.500	1.315	10.500	11.500	0.740	38.290	0.865	-0.021
Top 10%	0.100	57.000	101.000	25.000	51.500	1.170	9.000	10.000	0.625	34.747	0.720	-0.015
Top 15%	0.550	54.000	97.000	24.000	49.750	1.085	8.000	10.000	0.555	32.272	0.630	-0.010
Top 20%	0.900	52.500	93.500	23.000	48.000	1.025	7.000	9.000	0.505	30.300	0.560	-0.006
Top 25%	1.200	51.000	91.000	22.000	47.000	0.965	6.000	8.500	0.460	28.595	0.510	-0.002
Top 30%	1.450	50.000	88.500	22.000	45.500	0.910	6.000	8.000	0.420	27.161	0.465	0.002

Finding that bull

Black Percentile Bands for all Calves born in 2015

Home Animal Inquiry EPD Inquiry Mating Predictor Member Inquiry Sale Catalogs Semen Catalogs Download Files Online Transactions

Percentile Band	Birth Weight	Weaning Weight	Yearling Weight	Milk	Total Maternal	Scrotal Circ.	Calving Ease	Mat Calving Ease	REA	Carcass Weight	Marbling	Fat
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Top 15%	0.550	54.000	97.000	24.000	49.750	1.085	8.000	10.000	0.555	32.272	0.630	-0.010
Top 20%	0.900	52.500	93.500	23.000	48.000	1.025	7.000	9.000	0.505	30.300	0.560	-0.006
Top 25%	1.200	51.000	91.000	22.000	47.000	0.965	6.000	8.500	0.460	28.595	0.510	-0.002
Top 30%	1.450	50.000	88.500	22.000	45.500	0.910	6.000	8.000	0.420	27.161	0.465	0.002
Top 35%	1.700	48.000	86.000	21.000	44.500	0.865	5.000	7.500	0.385	25.784	0.425	0.005
Top 40%	1.900	47.000	84.000	20.000	43.500	0.825	4.000	7.000	0.360	24.495	0.400	0.008
Top 45%	2.100	46.000	82.000	20.000	42.500	0.780	4.000	7.000	0.335	23.249	0.375	0.011
Top 50%	2.300	45.000	80.000	19.000	41.500	0.740	3.000	6.000	0.305	21.954	0.345	0.014
Top 55%	2.500	43.000	78.000	18.500	40.500	0.705	3.000	6.000	0.280	20.763	0.325	0.017
Top 60%	2.700	42.000	76.000	18.000	39.500	0.660	2.000	5.500	0.250	19.449	0.305	0.020
Top 65%	2.900	41.000	74.000	17.000	38.500	0.610	2.000	5.000	0.225	18.148	0.275	0.023
Top 70%	3.100	39.500	71.500	16.500	37.000	0.560	1.000	5.000	0.200	16.780	0.250	0.027
Top 75%	3.300	38.000	69.000	16.000	36.000	0.505	0.000	4.000	0.170	15.206	0.225	0.030
Top 80%	3.600	36.000	66.000	15.000	34.500	0.435	-0.500	4.000	0.140	13.460	0.200	0.035
Top 85%	3.900	34.500	63.000	14.000	32.750	0.350	-1.000	3.000	0.105	11.423	0.165	0.041
Top 90%	4.300	32.000	59.000	12.500	30.500	0.255	-2.500	2.000	0.060	8.805	0.125	0.047
Top 95%	4.900	29.000	53.000	10.500	27.000	0.120	-4.000	1.000	-0.010	5.130	0.065	0.057
Low Value	12.500	6.000	6.000	-2.000	3.000	-0.440	-20.000	-10.000	-0.295	-26.208	-0.494	0.108

+

Trait Description	Min	Max	Min. Accuracy (Enter as whole number, not decimal)	Breed Avg *
Birth Weight				+2.2 -0.1
Weaning Weight				+45 +52
Yearling Weight				+80 +78
Milk				+19 +17
Total Maternal				+41 +43
Scrotal Circ.				+0.73 n/a
Calving Ease				+3.2 +3.6
Mat Calving Ease				+6.3 +3.6
Yield Grade				n/a -0.03
REA				+0.33 +0.07
Carcass Weight				+22 +16
Marbling				+0.39 +0.28
Fat				+0.015 -0.017
Stay				n/a +12
HPG				n/a +9

Sort By Animal Name ▾ ◉ Default ○ Ascending ○ Descending

On EPD Listing Display ◉ Name ○ Regn.#

* Black Percentile Bands for all Calves born in 2015 (Click for Percentiles)
Red Percentile Bands for all Calves born in 2015 (Click for Percentiles)

Clear Search

Genomic EPDs

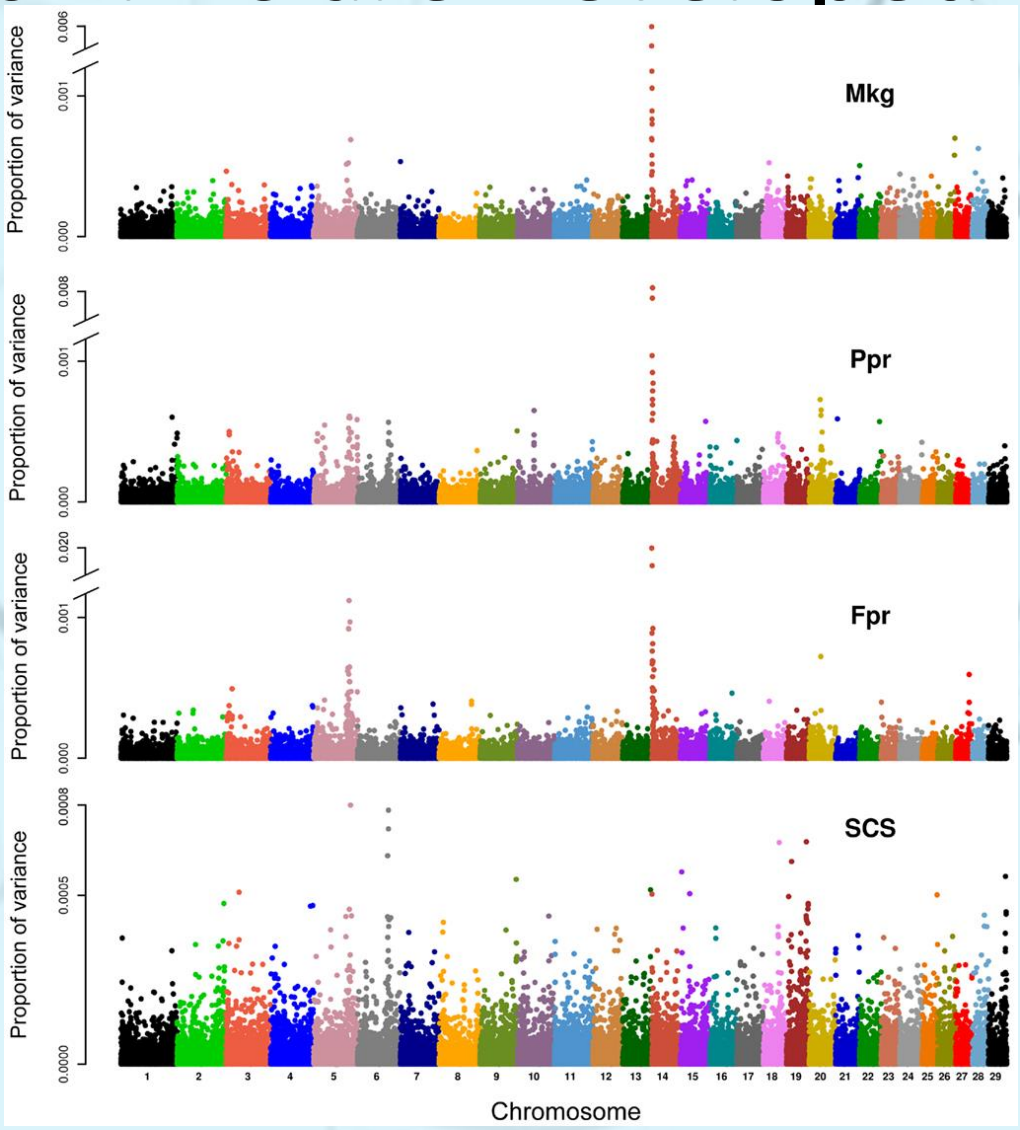
- What is a Genomically Enhanced EPD:
  - EPD that is enhanced by using the information provided by the genome of the Animal
- How?:
  - A Genomic test tells us a lot of information about the genome of an animal, and increases the accuracy of most animals EPDs
  - It measures small points of variation in the genetic code called single nucleotide polymorphisms (SNP)

How Genomic EPDs are Developed

1 . Group of High Reliability Sires
-Hundreds of progeny per sire
-Highly Acc EPD based on real progeny performance

2 . Genomic Test the High Reliability Sires
-Samples thousands (~77K) of areas in each animals the genome
-Compare the variation in the genome at those 77K spots to the difference in each bulls progeny for each trait

How Genomic EPDs are Developed



How Genomic EPDs are Developed

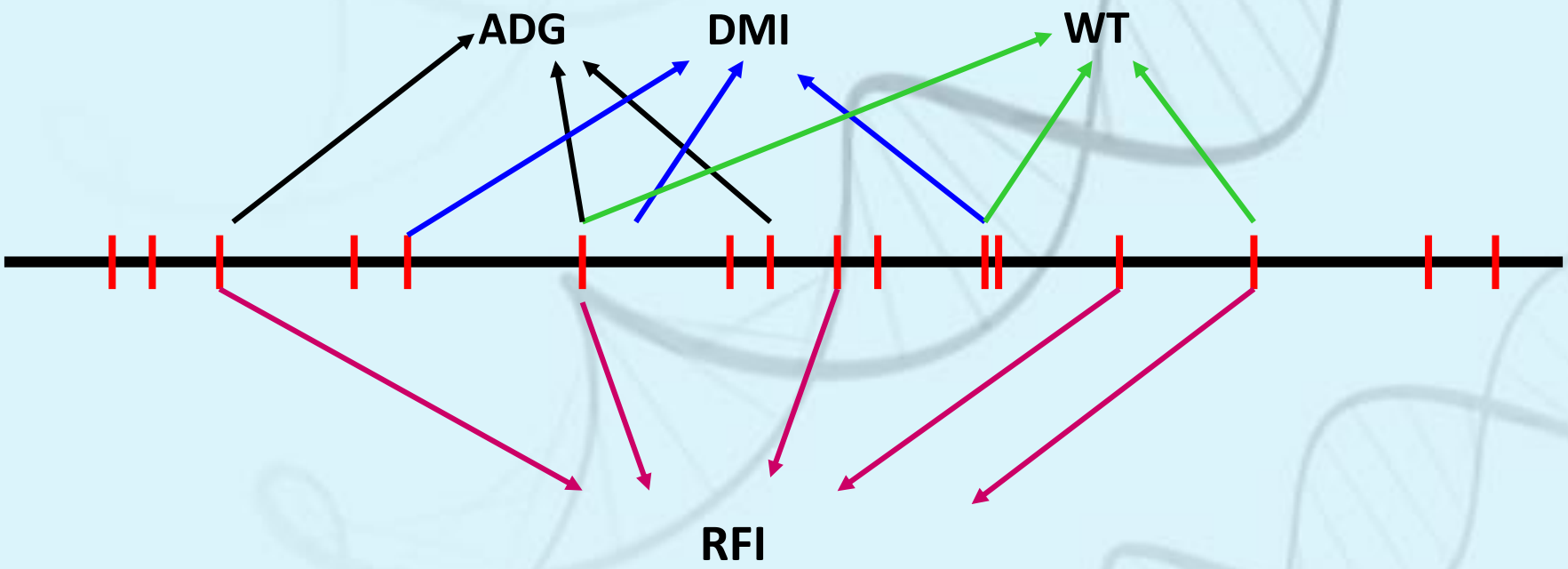
3. Use the variation in the genome of the parents to explain the difference in the progeny's performance through statistical relationships

4. Test these statistical relationships by using another set of high reliability bulls, and their progeny's information to make sure the equations fit the whole population

Using it: test young, or cattle with low reliability to increase the reliability of their EPDs – this produces a GE-EPDs

Genomics, DNA, and Markers

- Generate or increase accuracies of predictions
- Densities….400 (ca.), 6K, 50K, 770K (genome ~3bn)



Genomics' Influence

Also

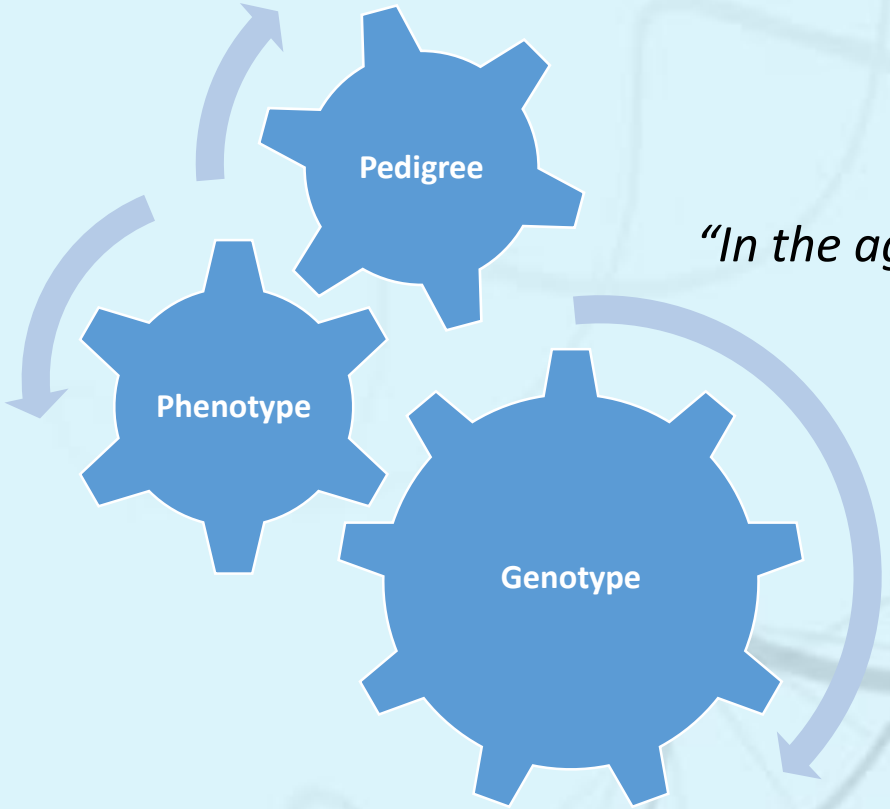
- Difficult to measure traits
- Sex limited traits
- Expensive to measure traits
- Terminal traits

Potential uses of Genomics

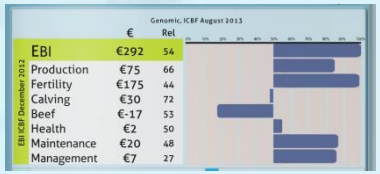
Use	Seedstock	Commercial	Feedlot	Packer
DNA Assisted Selection	✓	✓		
Parentage	✓	✓		
Recessive Allele Testing	✓	✓		
Control of Inbreeding	✓	✓		
Mate Selection	✓	✓		
DNA-based Management	✓	✓	✓	
DNA-based Purchasing			✓	✓
Product Differentiation				✓
Traceability				✓

Source: Van Eenennaam, 2012

Phenotypes…they're important!



"In the age of the genotype, phenotype is king"
Mike Coffey, SRUC



Hereford

Questions