Pfizer Animal Health
Animal Genetics

The Genetic Selection Toolbox – Feed Efficiency

Mark Allan
Ronnie D. Green

NCBA Cattlemens College
Phoenix, AZ
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Animal Genetics

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Presentation Road Map

- **Historical Overview of Genetic Selection**
- **Genomics Technology Coming of Age**
- **Technology – Additions to the Breeder's Toolbox**

Quantitative Genetics
Reduced Animal Model

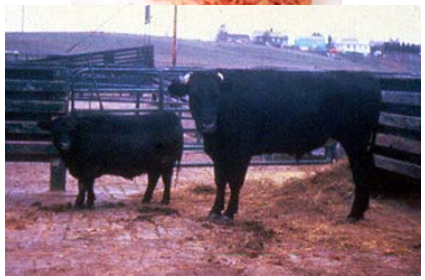
Phenotypic data

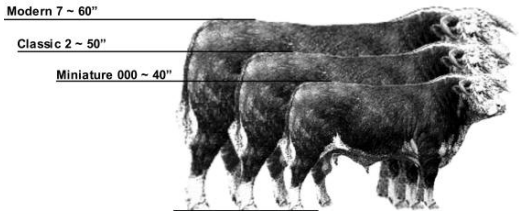
"Breeding Value" for unknown polygenes

Unknown Genes

EPDs Within Breeds

Traditional Selection Works Well





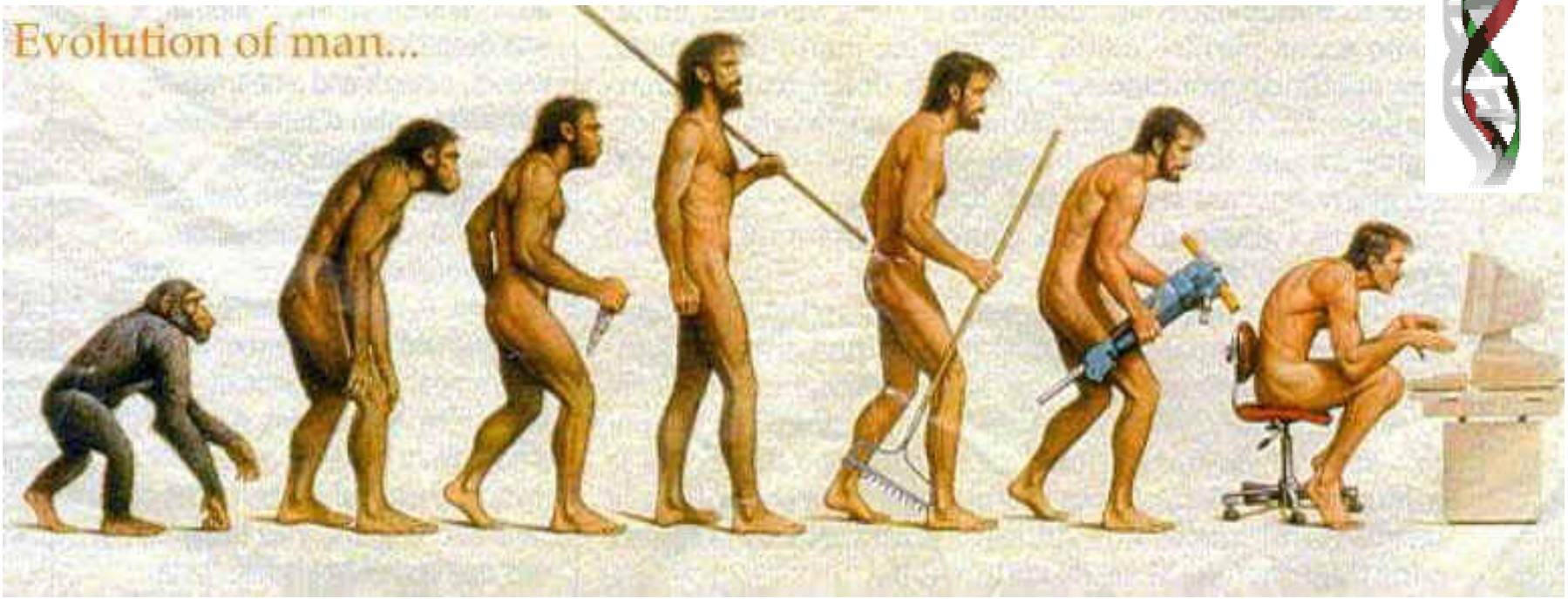
- Visual
- Performance Data **
- EPDs**** AI use
- Pedigree
- *DNA Marker Information*
- Economic Indexes

Production						Maternal					
CED Acc	BW Acc	WW Acc	YW Acc	YH Acc	SC Acc	CEM Acc	Milk Acc	MkH MkD	MW Acc	MH Acc	$EN
+11 .65	+1.0 .85	+48 .85	+82 .78	-.5 .53	-.76 .66	+6 .22	+13 .48	2 3			+10.31

Carcass					Ultrasound			
Cwt Acc	Mrb Acc	RE Acc	Fat Acc	Grp Prog	%IMF Acc	RE Acc	Fat Acc	Grp Prog
+1 .10	+.09 .11	+.29 .10	-.009 .09	1 1	-.05 .74	+.09 .75	+.018 .75	36 117

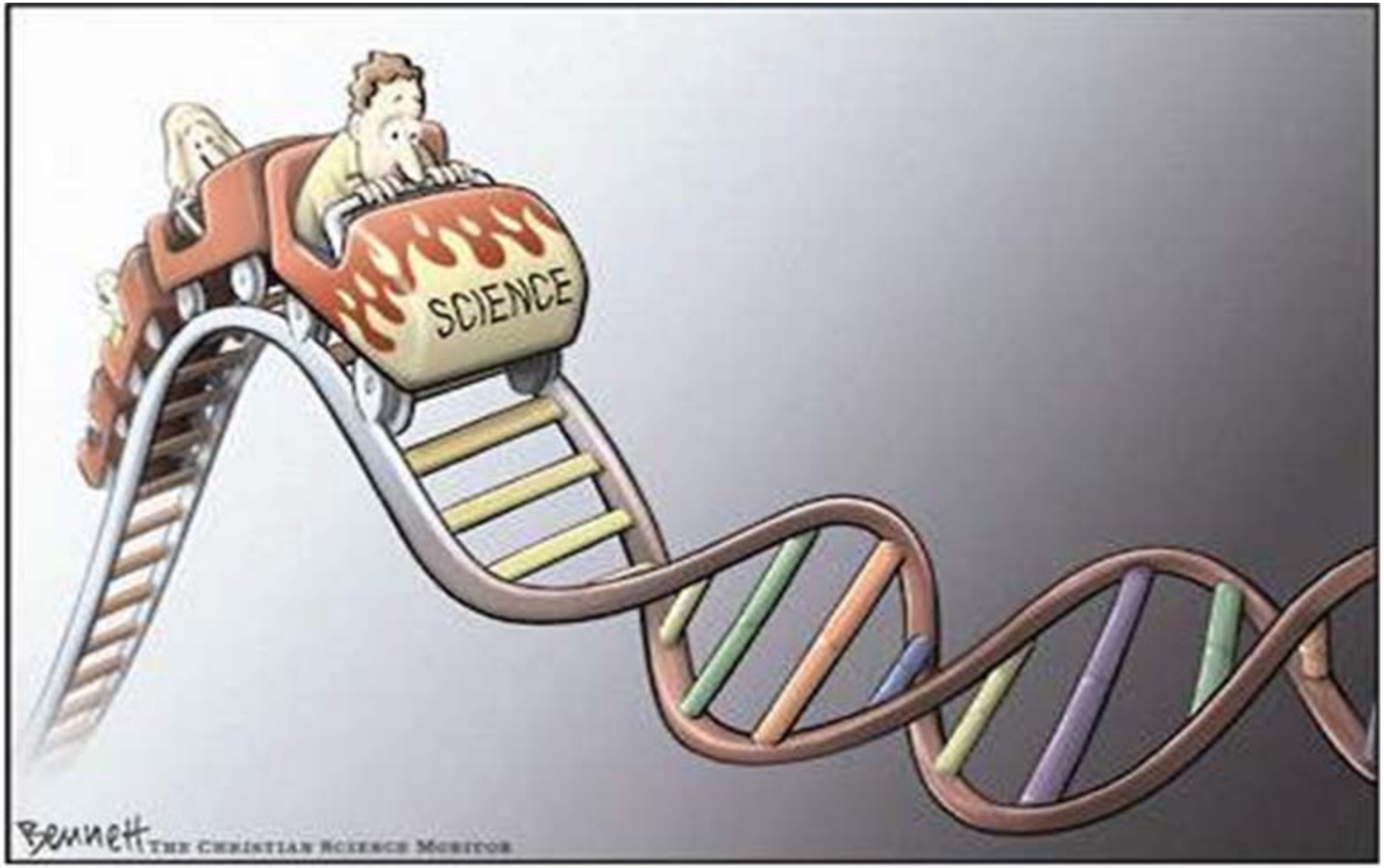
$Values					
$W	$F	$G	$QG	$YG	$B
+27.96	+22.58	+6.25	+3.73	+2.52	+26.07

We Are Entering Major Transition

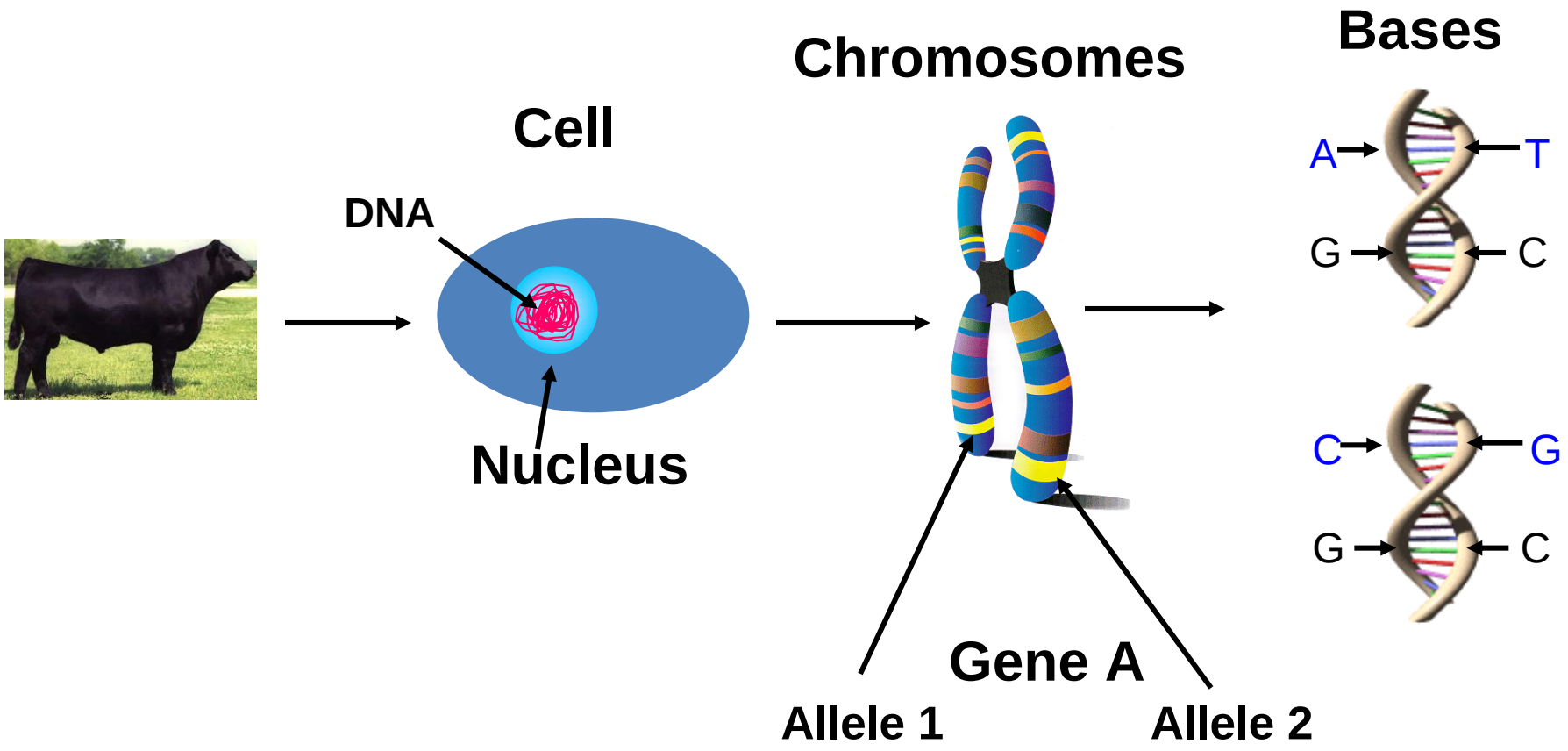


http://www.naute.com/images/evolutionofman.jpg

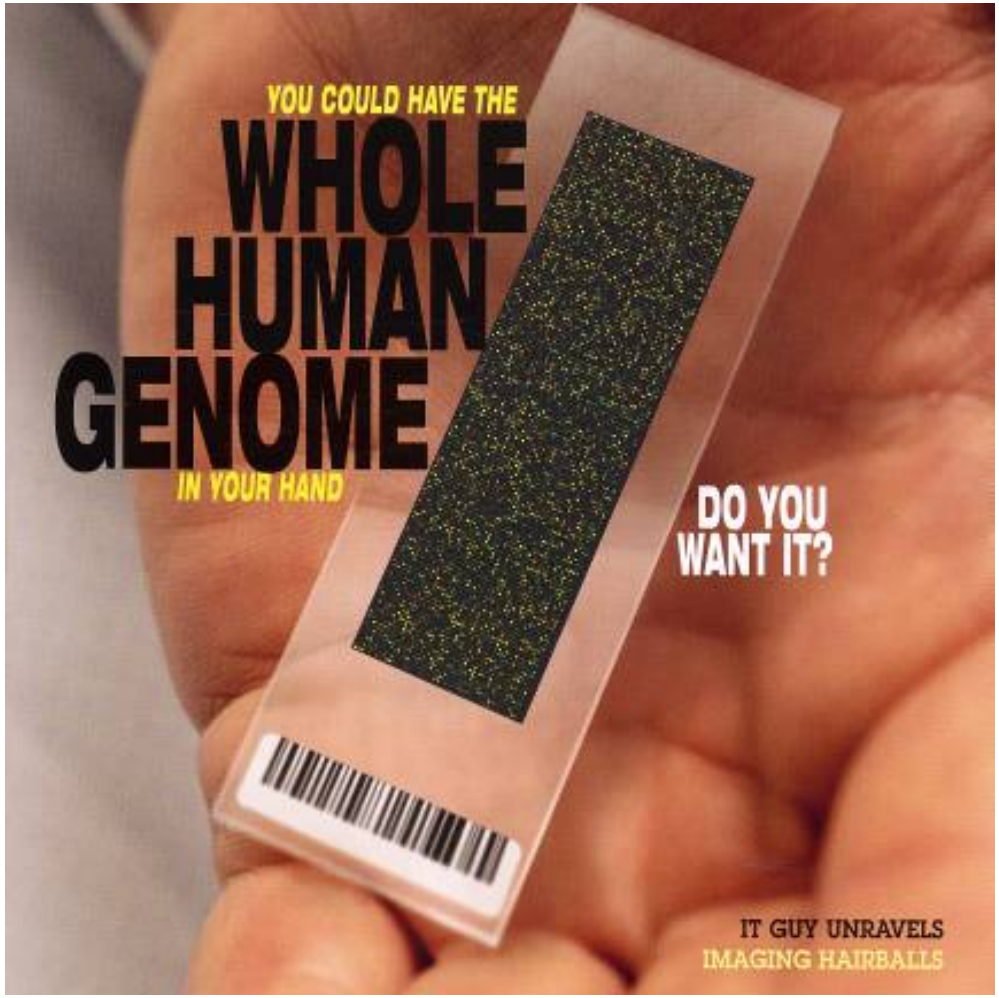
We are on an exciting ride....



DNA - Technology



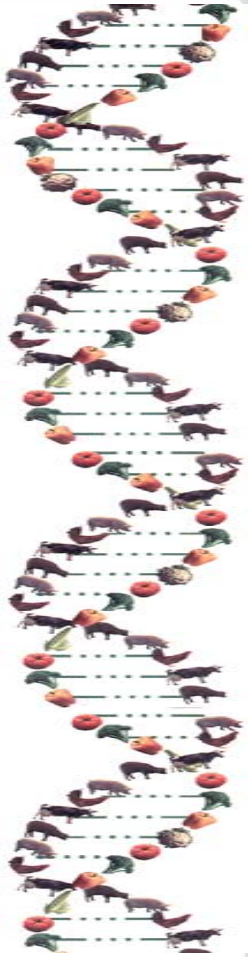
Driving Force…….



Genome Sequence Assemblies

2004

2005



2007

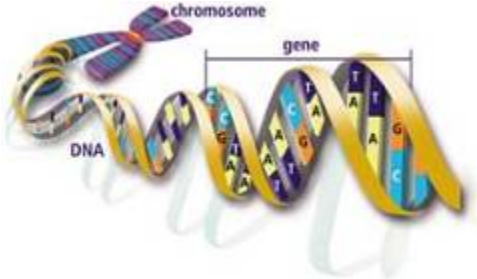
2007

2008-9

2010

International Bovine Genome Sequencing Project

- *NIH / NHGRI -- $25M*
- *USDA -- $11M*
- *State of Texas – $6M*
- *Genome Canada -- $5M*
- *U.S. Beef Councils -- $1.2M*
- *Australia -- $1M*
- *New Zealand -- $1M*



Project Total ~ $50M

Advancements In Technology -- SNPs

Single Nucleotide Polymorphism

- **Advantages**
  - **Stable (low mutation rates)**
  - **Frequent (1 every 300 - 1,000 bases)**
  - **Relatively uniformly distributed**
  - **Amenable to automation and high-throughput**
  - **Costs dropping**

ATGCAATTGC**C**ACGTTGCAAT

ATGCAATTGC**T**ACGTTGCAAT

ATGCAATTGC**C/T**ACGTTGCAAT

“50K” Bovine BeadChip - Discovery

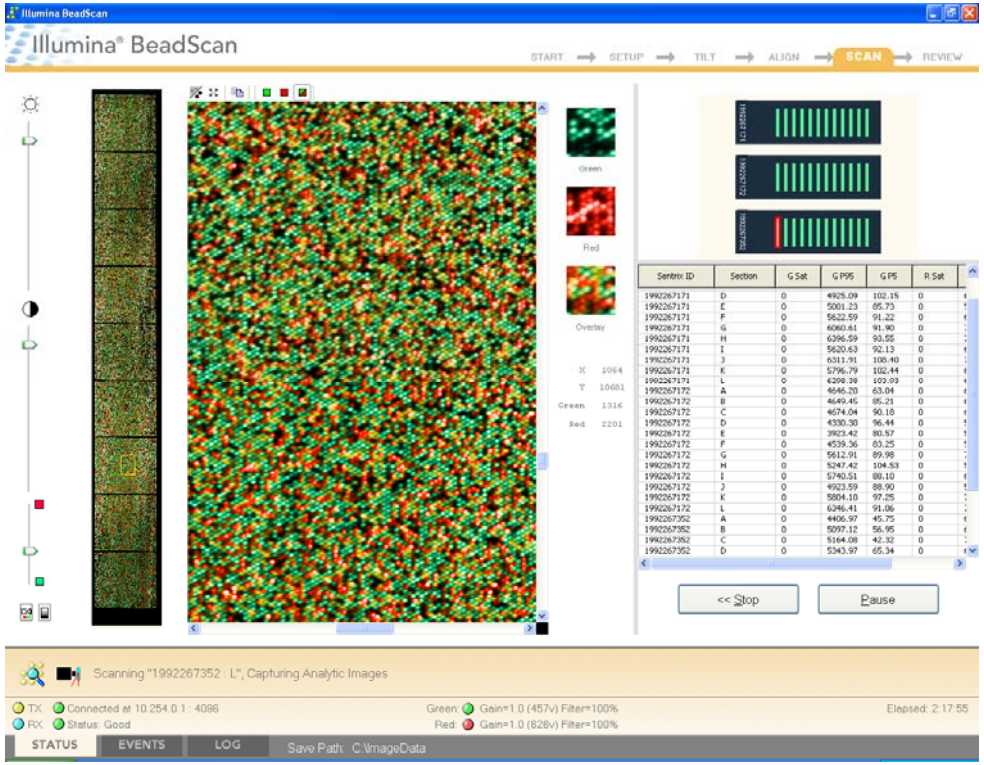
~ 54,008 SNP markers across the bovine genome

- On average SNP every <67,000 base pair

- Discovery SNP includes many breeds

USDA - BARC
US MARC
University of Missouri
University of Alberta

(Van Tassell et al., 2008 Nature Methods)



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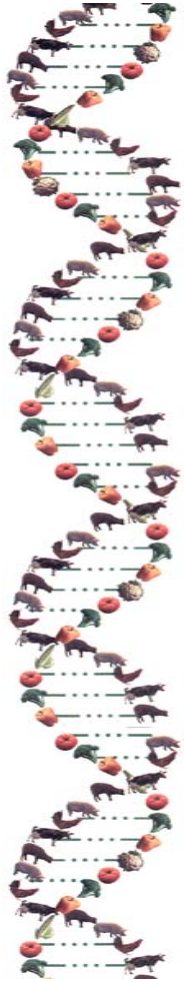
Real-world applications…..

- *Trait Prediction – Genetic*
- *M-Inverse Enhancement*
- *Parentage / Com Ranch GE*
- *Precision Management*
- *Supply Chain Management*



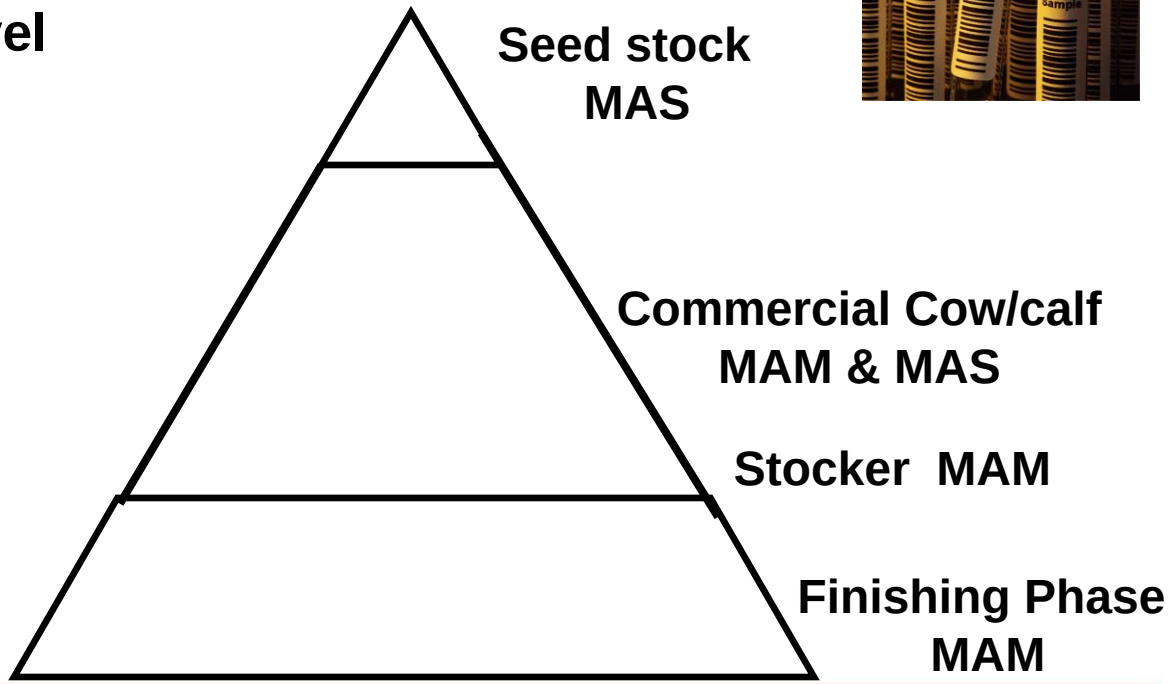
Reach of Marker Technology

Mark-Assisted Selection (MAS)

- At the seed stock/multiplier level

Marker-Assisted Management (MAM)

- At the commercial level



Current Products

GeneSTAR®

Feed Efficiency

Marbling

Tenderness

.....Evolving Products.....

- Moving away from individual markers toward panels
- Predictions for genetic improvement or phenotype – *"**M**olecular **V**alue **P**redictions" with Reliabilities*
- Economic value needs to be demonstrated
- Combining different sources of information (EPD + markers + herd /market analysis)
- Decision support in the production system

"Solutions Beyond Data"

Molecular Value Predictions

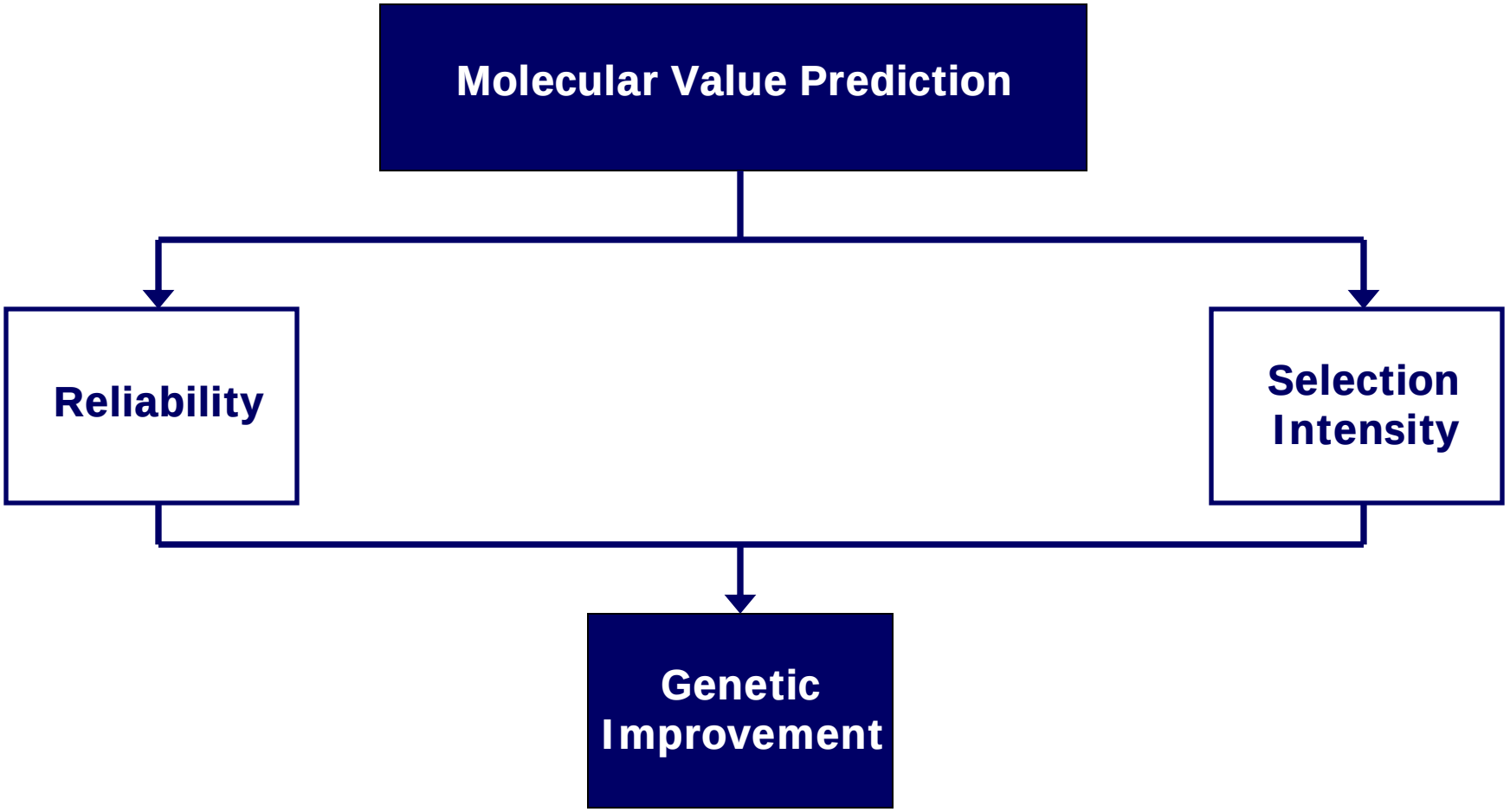
MVP → *the sum of individual molecular breeding values for the genotypes of an animal across all marker loci evaluated (N=56).*

- Individual marker effects assumed to be additive, but not necessarily equal
- Reliability maximized by fitting marker additive effects as a regression on the number of favorable alleles

Stars to MVPs

11 individual markers	56-marker panel
Number of stars	Greater selection opportunity
Number of favorable alleles	Collective effects of markers into a trait prediction
Equal effects of each marker	Accounts for individual marker effects
No calculated reliability	% reliability described 26 – 49%
Not benchmarked against breed	Breed average and percentile ranks provided
Good selection tool	**A new era in genetic improvement**

Driving Genetic Improvement




MVP Range
% Reliability
Feed Efficiency
(lbs.)
5.55
30%
PIONEER
33B51
PIONEER
33H68
33P67

Real world example – two bulls

Feed efficiency of two bulls in a commercial cow herd:

- Two Bulls – Genetic Difference
  - Bull A: -0.73 lbs. (30% rank)
  - Bull B: 0.60 lbs. (80% rank)

  } **1.33 lb/day**

- Feeding Period: 150 DOF x 1.33 lbs. = 199.5 lbs. feed
- Feed Cost: $200/ton x 199.5 lbs. = $19.95/hd

Real world example – two bulls

Difference between a low and a high MVP:

- Average lifetime of 5 years
- 25 calves per year from average dams
- 90% survival rate on calves

} **112 feeder calves**

- Value Difference = $19.95 ÷ 2* x 112 = **$1117**

*Divided by two to account for sire influence only in the calf

Example MAM - Quality Grade

PAG

5 to 7 days

MVP

Precision Management

Supermarkets

Branded Market - Choice

Quantitative Genetics- "New" Reduced Animal Model

Phenotypic data

"Breeding Value" for unknown and known polygenes

Unknown genes

DNA Marker info
Genetic effects

EPDs including DNA marker information

Feed Efficiency EPD
-1.9
.45 acc.

“Common Sense Interdependencies”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