

### Genetic Markers and Tests Currently Available:

What They Cost, How to Get Them Done and What Do They Tell Us

**Kevin Milliner, Director of Sales** 







### Bovigen, LLC

- US founded company
  - Vic Castellon CEO/Founder
  - Founded in 2003
  - In April of 2004 Bought the rights from Australia to:
    - GeneSTAR, SureTRAK & SireTRACE
  - Harahan, LA Office
  - Privately Owned
- GenVis Labs, LLC
  - Share Offices with Bovigen
  - Shared Ownership
  - Production Testing began in April 2005



### Interpreting GeneSTAR Results

#### Alleles

Each Animal has two alleles

- -CC
- -CT
- -TC
- -TT

• If the T allele is Good & the C allele is bad:

- -CC = 0 Stars
- CT & TC = 1 Stars
- -TT = 2 Stars



#### GeneSTAR Results

- A particular marker would have three possible results:
  - 0 Stars
  - 1 Stars
  - -2 Stars



### Genetic Inheritance

Sire	Dam	0	*	<b>*</b>
0	0	100%		
0	*	50%	50%	
0	<b>*</b>		100%	
*	0	50%	50%	
*	*	25%	50%	25%
*	<b>*</b>		50%	50%
太太	0		100%	
<b>*</b>	*		50%	50%
<b>太太</b>	太太			100%





### Bovigen, LLC Products





# GeneStar Quality Grade

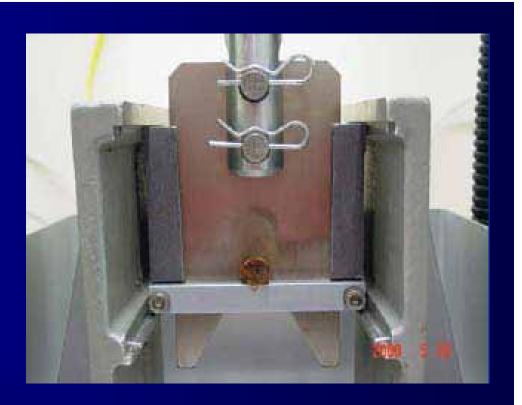










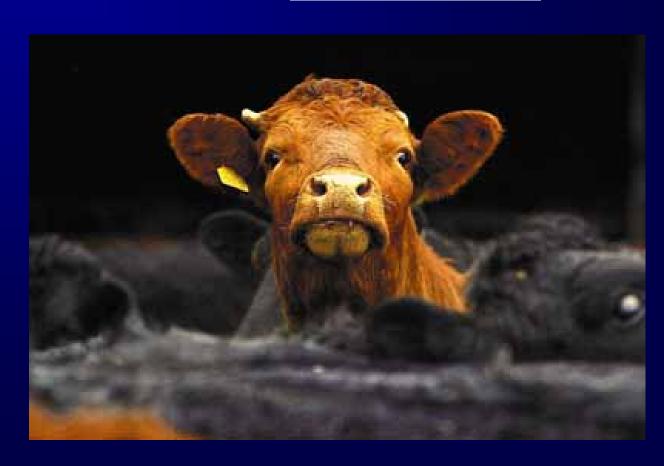


### GeneStar

Tenderness











### SireTrace







### Industry's Largest Portfolio of Validated Products

### What is Validated???

- Independent Third Party
- Anonymous Data Sources
- Independent Analysis
- Up Front Commitment to make results public
- Transparency of the process



## Rational Colorado State University-Cornell University of Georgia Beef Cattle Evaluation Consortium

The purpose of the NBCEC commercial DNA test validation is to independently verify associations between genetic tests and traits as claimed by the commercial genotyping company using phenotypes and DNA from reference cattle populations. The validation process is a partnership of the owners of DNA and phenotypes (e.g., breed associations) and genomics companies, facilitated by the NBCEC









# GeneStar Quality Grade





A quality grade is a composite evaluation of factors that affect palatability of meat (tenderness, juiciness, and flavor). These factors include carcass maturity, firmness, texture, and color of lean, and the amount and distribution of marbling within the lean.







### GeneStar

### Quality Grade

QG1 QG2





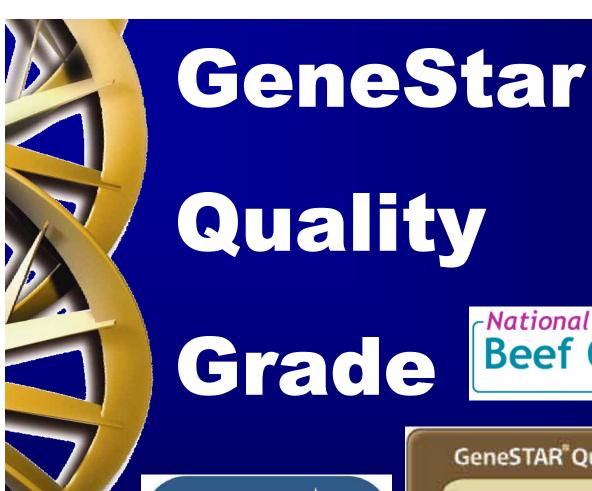


Grace Beef Cattle Evaluation -Consortium <sup>J</sup>

		No.			Sample	Effect of	Standard
Population	Trait	Head	Gene	Allele	Frequency	1 star	Error
			GSQ** (TG5 & M2)	"★"		6.2	3.2
Charolais				0		0	
X	% Choice	387	TG5*	"★"	0.22	8.6	4.5
Angus	and Prime			0	0.78	0	
Aligus		M2*	"★"	0.21	2.9	5.2	
				0	0.79	0	



Reference	Trait	no.		ele	Sample	Estimated
Population	Irait	Head	TG5	M2	Frequency	Effect
		387		2	0.01	22.9
			2	1	0.02	20.0
	% Choice and Prime			0	0.02	17.1
Charolais x Angus			1	2	0.01	14.4
				1	0.12	11.5
				0	0.21	8.6
				2	0.03	5.8
			0	1	0.20	2.9
				0	0.38	0





National Colorado State University-Cornell University-University of Georgia

### Beef Cattle Evaluation

Consortium



#### GeneSTAR Quality Grade Results (% Choice)

	0	*	态态	(基) (基)(基)	(本) (本)	Difference
Charolais/ Angus Trial*	49%	54%	55%	65%	100%	51%
Commercial Angus Cross Trial	59%	67%	69%	71%	100%	41%

<sup>\*</sup> Independent 3rd party study



### **Quality Grade**

A quality grade is a composite evaluation of factors that affect palatability of meat (tenderness, juiciness, and flavor). These factors include carcass maturity, firmness, texture, and color of lean, and the amount and distribution of marbling within the lean.

- GeneStar DNA Markers are proven to Increase Quality Grade.
- Marbling is a component of Quality Grade.
- Ultrasound IMF is an adequate, indicator of Marbling,
- But neither Marbling or Ultrasound IMF measure maturity, firmness, texture, color or distribution of marbling.







### **GeneStar Tenderness**

### WE WANT TENDER BEEF! WE WANT TENDER BEEF!







# Warner/Bratzler Shear Force











### **GeneStar Tenderness**

<b>T1</b>	<b>T2</b>	<b>T3</b>
**	*	**





# GeneStar Tenderness

	GENOTYPE			Standard	Number	%
CAST-T1	CAPN1 316-T2   CAPN1 4751-T3		(lbs.)	Error	Obs.	/0
		2 (CC)	-2.2	0.4	11	0.8
	2 (CC)	1 (CT)	-1.8	0.5	9	0.7
		0 (TT)	-1.4	0.8	0	0.0
		2 (CC)	-1.8	0.3	71	5.5
2 (TT)	1 (CG)	1 (CT)	-1.4	0.3	80	6.1
		0 (TT)	-1.0	0.4	13	1.0
		2 (CC)	-1.5	0.4	54	4.2
	0 (GG)	1 (CT)	-1.1	0.3	143	11.0
		0 (TT)	-0.7	0.2	321	24.7
		2 (CC)	-1.8	0.4	5	0.4
	2 (CC)	1 (CT)	-1.4	0.4	3	0.2
		0 (TT)	-1.0	0.8	0	0.0
	1 (CG)	2 (CC)	-1.5	0.3	38	2.9
1 (TC)		1 (CT)	-1.1	0.2	25	1.9
		0 (TT)	-0.7	0.4	7	0.5
		2 (CC)	-1.1	0.3	62	4.8
	0 (GG)	1 (CT)	-0.7	0.2	53	4.1
		0 (TT)	-0.3	0.1	285	21.9
		2 (CC)	-1.5	0.3	0	0.0
	2 (CC)	1 (CT)	-1.1	0.4	1	0.1
		0 (TT)	-0.7	0.8	0	0.0
	1 (CG)	2 (CC)	-1.2	0.3	9	0.7
0 (CC)		1 (CT)	-0.8	0.2	7	0.5
		0 (TT)	-0.3	0.4	6	0.5
		2 (CC)	-0.8	0.3	17	1.3
	0 (GG)	1 (CT)	-0.4	0.1	15	1.2
		0 (TT)	0.0	•	67	5.2



### **Target Tenderness**

"Involvement in alliances allows beef supply-chain focus upon today's and tomorrow's targets:"

- (a) A safe beef supply.
- (b) Electronic IAID with age records.
- (c) Balance in production performance and carcass merit.
- (d) Management based upon individuals rather than on pen/lot averages.
- (e) Avoidance of 'out cattle' (dark cutters, advanced maturity, etc.).
- (f) Control of carcass weight (target = 600 to 949 lb).
- (g) Production of High Select or better, and Yield Grade 2 or better, carcasses with ribeye areas of 10.0 to 15.9 sq. in.
- (h) Adoption of instrument grading.
- (i) Tenderness testing to avoid tough beef."

Glen Dolezal (Cargill Meat Solutions) (2005 National Beef Quality Audit)





### **Quality Challenges**

Responses To Questionnaires -- Seedstock Generators, Cow/Calf Producers, Stockers/Backgrounders and Cattle Feeders (Combined)

#### **Greatest Quality Challenges**

7.43		
/1\		Marallaa
(1)	Insufficient	
('/		

(2) Lack of Uniformity

(3) **Inadequate Tenderness** 

(4) Too High Yield Grades

(5 tie) Low Cutability

(5 tie) Too Heavy Carcasses

(7) Injection-Site Lesions

(8) Inadequate Flavor

(9) Inadequate Muscling

(10) Excess Fat Cover



SOURCE: Strategy Workshop of the NBQA -- 2005 (Oklahoma City, OK) October 2005.







### GeneStar Black





### GeneStar Black



The alleles for this gene can have three possible forms: ED=Black e=Red E+=Wild Type



EDED = Homozygous Black
EDe = Black Hided Animal, Red Carrier
ee = Red Hided Animal, Double Red Carrier
E+ED = Most Likely Black Hided Animal, Wild Type Carrier
E+e = Most Likely a Red Hided Animal, Wild Type Carrier
E+E+ = Wild Type Carrier, Any Color Possible







### SireTrace



Micro-Satellite based Parentage Verification Tool





### SireTrace



Large multi-sire breeding pastures.

E.T. and A.I. inconclusive birth dates.

Multiple calves born same time.

 Breed Association Parentage Verification.



### **GPD**

"Genetic Progeny Difference"

Patented Process & Trade Marked term explaining the estimated difference in the effect of a particular trait given the animals actual known genetic makeup.

### Tenderness GPD

А



- 1.8

B

T1	T2	T3
*	0	0

**- 0.3** 



Difference of

-1.5

### Quality Grade GPD

A



**=** +20

B



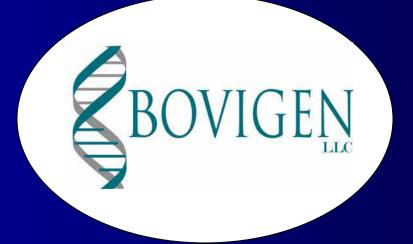
= +2.9



Difference of

+17.1





## Bovigen, LLC Logistics





### **DNA Samples**

In what forms do we accept DNA?

- Hair
- Semen
- Blood



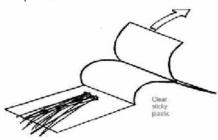


#### Information Sheet Hair Root Sample Collection

Bovigen Solutions, LLC 250 Plauche St. Harahan, LA 70123 Toll Free: 877 BEEF DNA Ph: 504 733 8182 Fax: 504 733 0224



 Verify and write the eartag number on the Hair Sample Collector in the space provided.

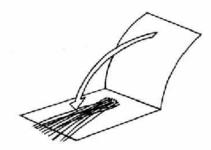


3. Open the Hair sample collector fully, as you would to bend back the spine of a book. Place the hair on the back of the printed flap of the collector as shown above, with roots close to the joined end. Peel off the backing paper, starting from the joined end, to expose the sticky backing of the other flap.





While holding the end of the tail switch, pull a pencil thickness tuft of hair (15 – 20 hairs) from the switch making sure the hair roots are attached. Pull the hair "up and away" to get as many roots as possible.



- Press the sticky plastic side down on top of the hair. Make sure the edges of the plastic are sealed around the collector.
- 5. Trim the excess hair to the edges of the sample collector. Place the collectors in bundles of 10-15 in a Ziploc bag. Complete the Sample Information Sheet with animal information and collector barcode number.

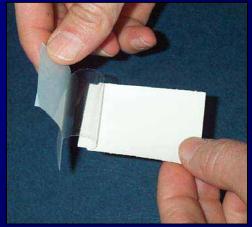
www.bovigen.com

USA Hair Instruction Sheet - 102005

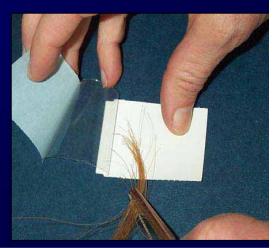








Hair sample collection







### Hair sample collection

#### GeneSE☆R

Peel blue backing paper off from clear adhesive plastic, place hair roots onto clear adhesive plastic and seal onto attached paper.

Centre hair roots under this square.

Patent Pending



Barcode No: 1602417

Eartag No:







# Semen Sample







# **Blood Sample**







250 Plauche Street Harahan, LA 70123 (504)733-8182 Corp. (877) BEEF-DNA Toll Free www.bovigen.com

### **BLOOD SAMPLES ON FTA CARDS**

When collecting blood make sure that new collections devices (needles/syringes or pin pricks devices) are used between animals. When submitting samples for DNA testing it is critical that the potential for cross contamination is eliminated. Rinsing needles is not enough to eliminate any possible DNA residue. New collection devices must be used for each animal to insure integrity of the sample.

- 1) Mark front of FTA Card with Animal ID.
- 2) Note FTA Card barcode number on Sample Information sheet as well as other animal information.
- 3) Open FTA card and bend top flap up so once sample is placed on the card it can dry in an open position.
- 4) Place drops of blood from syringe, tube or pin prick on FTA card.
- 5) Saturate the card with enough blood to fill the circle outlined on the card but not so much that the card is soggy.
- 6) Set the FTA card aside to dry overnight with top flap open. Make sure that FTA Cards do not touch. This is a possible source of DNA cross contamination.
- 7) Once dry, rubber band the FTA cards together in batches of 10-15 and place several batches together into a Ziploc bag.
- 8) Ship FTA cards and other samples to Bovigen.







Test Request Form Effective 08/22/05



Bowgen, LLC 250 Plauche St. Harahan, LA 70123 Tol Free: 877.BEEF.DNA Phone: 504.733.8182 Fax 504.733.0224 Emai: sales@bowgen.com Web: www.bowgen.com



	Company Name:			Date:			
Contact Pe	erson:	33	Address:				
Phone:			City, ST, Zip:				
Fax		540					
Email:			No. of sample	es enclosed:			
Notes:							
Owner of Signature	sign below to confirm your a of test results:	Name/Co	mpany:	50(-0.04-14)	n ver- brosener		
	a member in good standing.						
£5	Order Samples to be tested	Pricing Test	g Worksh Price per	Number of	Total Price		
	Order Samples to be tested Grouped by Test Code	Pricing	1:00 to 00 t	Number of	Total Price		
	Order Samples to be tested	Pricing Test	Price per	Number of			
-	Order Samples to be tested Grouped by Test Code Group 1	Pricing Test	Price per	Number of			
- - -	Order  Samples to be tested Grouped by Test Code  Group 1  Group 2	Pricing Test	Price per	Number of			



### BOVIGEN PRICING GUIDE Effective August 22, 2005

Test Description	Test Code		Quantity Pricing for Samples Submitted per Order per Test Code				
		1-25 26-49 50-99 100-249				250+	
GeneSTAR® Quality Grade Panel (Includes TG5 and M2 Markers)	Q	\$45	\$40	\$35	\$35	\$35	
GeneSTAR® Tenderness Panel (Includes T1, T2 & T3 Markers)	т	\$45	\$40	\$35	\$35	\$35	
Combined Panel (Includes Quality Grade & Tendemess Panels)	QΤ	\$65	\$80	\$55	\$55	\$50	
GeneSTAR® Black Panel (Testing for Homozygous Black)	В	\$32	\$32	\$32	\$30	\$30	
Parentage Panel (SireTRACE® DNA Fingerprinting)	P	\$25	\$25	\$25	\$20	\$20	
Black Combined (with Quality Grade & Tenderness)	QTB	\$95	\$90	\$85	\$85	\$80	
Parentage Combined (with Quality Grade & Tenderness)	QTP	\$85	\$80	\$75	\$75	\$70	
Black & Parentage Combined (with Quality Grade & Tenderness)	QTBP	\$115	\$110	\$105	\$105	\$100	

To determine the price of test combinations not specifically listed above, add the price of each test together.

Credit Card Authorization Form	
Name on Card	
Billing Address	VisaMasterCard
	Expiration Date/
Card Number	CVV2
	Last 3 digits of the number printed on the back of the card.
Signature	
I authorize Bovigen, LLC to charge my credit card for:	
This order	
This order and all future orders until further notice.	
All information must be complete in order to bill to a cre	edit card.







### Sample Information Form

Contact Name:	Company Name:	Date:	Total Samples Enclosed:

Write the animal ear tag or identification number, sex and bar code from the sample collector. If the animal is registered with a breed association write the association registration number and full registered name as illustrated in the example below. For non-registered stock give a unique permanent identification number.

			Sample		Breed		TEST REQUESTED
	Animal Identifier	Sex M/F	Collector Barcode Number	Breed	Registration Number	Full Registered Name	Test Code (From Pricing Guide on Test Request From)
Ex.	U25	М	1987621	Angus	1538843	GS Double Star U25	QT
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							





delayed.

Bovigen, LLC 250 Plauche Street Harahan, LA 70123 Toll Free: 877-BEEF-DNA Ph: 720 890 2832

Ph: 720 890 2832 Fax: 720 890 2834 www.bovigen.com sales@bovigen.com

Please complete the following in order to ensure timely processing of your samples. Processing of samples shipped without proper paperwork may be

Shipping Procedures

- ✓ The GeneSTAR Sample Information form(s), correctly filled out detailing the animals' identification, breed and sex. Registration Number and Name, if available, should be listed on this form.
- Check that the number of animals listed agrees with the total number of samples to be sent.
- √ The Test Request form is completed and signed.
- Payment for the total listed on the Test Request Form is included and the check is made out to Bovigen, LLC.

Place the samples, the GeneSTAR® Sample Information and Test Request form(s) and payment in the Postage Paid Reply envelope and send to:

Bovigen, LLC 250 Plauche Street Harahan, LA 70123

#### Semen Samples Procedure

- Record the complete animal ID on the Sample Information Form, Bovigen will assign a barcode upon processing.
- 2. Cover the ends of the semen straws with scotch tape to prevent leakage.
- Place each straw/collector into an individual plastic bag e.g. ziplock.
- Mail semen straws in a padded envelope inside the Post Paid Envelope to prevent damage during shipment.

#### Hair Samples Procedure

- Place Hair Samples in the GeneSTAR® sample collectors as shown in the Hair Collection Instruction sheet.
- Excess hair is trimmed and samples are placed in a Ziploc bag. Samples can be rubber banded together in groups of 10-15.
- List samples on Sample Information Form with barcodes from collectors.

For large GeneSTAR testing jobs we recommend you send your samples via a carrier company (e.g. FedEx, UPS).







### **Pricing**

- Per Bovigen Published Retail Pricing
- Published Pricing Includes:
  - Volume Breaks
  - Combining Products

Toot Description			Submitted p	per Orderpe	r Test Code		
Test Description	1- 25	26-49	50-99	100- 249	250 – 499	500 – 999	1000+
Quality Grade Panel	\$45	\$40	\$35	\$35	\$35	\$32.50	\$30.50
Tenderness Panel	\$45	\$40	\$35	\$35	\$35	\$32.50	\$30.50
Combined Panel	\$65	\$60	\$55	\$55	\$50	\$45.50	\$39.50
Black Panel	\$32	\$32	\$32	\$30	\$30	\$30	\$30
Parentage Panel	\$25	\$25	\$25	\$20	\$20	\$20	\$20
Black Combined w/ Q&T	\$95	\$90	\$85	\$85	\$80	\$75.50	\$69.50
Parentage Combined w/ Q&T	\$85	\$80	\$75	\$75	\$70	\$65.50	\$59.50
Black & Parentage Combined w/ Q&T	\$115	\$110	\$105	\$105	\$100	\$95.50	\$89.50

**Quantity Pricing for Samples** 







#### Test Request Form GeneSTAR® Tenderness PROMO





				WED. WW	w.bovigen.com		
Company Name:		Date:					
Contact Person:		Address:	Address:				
Phone:	Phone: City, ST, Zip :						
Fax:							
Email:		No. of sar	mples enclosed:				
Notes:							
and the of Please sign b Owner of test no Signature:	ted material is the Individual an realed material owner is given by elow to confirm your a esults:	y the owner details.  acceptance of the at  _Name/Company:	ttached terms	and conditio	ns. 		
	he release of these results er in good standing.		Association,				
	rent Client Specia Valid until February 1st,		Price per Sample	No. of Samples	Total Price (\$)		
<u>Tendemess PR</u> samples previou	OMO – Test for 3 <sup>rd</sup> Tende usly submitted for GeneST/	erness Marker (T3) on AR® Tenderness test.	\$25.00				
effective November	2 <sup>nd</sup> , 2005 To	otal Amount Due, P	ayable to Bo	vigen, LLC <sub>-</sub>			
		ethod) Bill my		lams	ending a che		
Job# Lab# Rovd Chk#	Billing Address						
Amt \$				-			
	Signature						
				o a credit card.			

Analysis and reporting will not proceed unless payment has been received. Results will be reported within 30 days after receipt of samples, signed Test Request Form and payment.

5.1/09.02.05





## Results

### -Timing

- Wednesday to Wednesday Turnaround 90%
- 2<sup>nd</sup> Wednesday 8%
- 3<sup>rd</sup> Wednesday Finalize

### – Final Job Report

- e-mail
- Fax
- Mail



# Results





weekstern own





#### Genex Cooperative, Inc. ler F Soprette Parlung Introdi-ente ortel colf mi, 95+7hank 888301790

#### GeneSTAR Customer Job Results

Control	Jane Ras	e ber	Final Report		Date Rose	ested 02-lim 06
Contouer Plane Fax Address	254 456 E 254 123 4	SS7 Best Lane	Job No: 4805 Date Con-		Becipeo	
Arient D	Gende	Har Code	Breed	Text:	Result:	the will be
AC45 Reg Rec	) Selemento	36,80000	Aegen	Quality Grade	M1-2M2-2	Internation
CONTRACTOR AND ADDRESS OF THE PARTY OF THE P	Sage Mone	200.000	Pathodiss'	Tenderness	11-212-113-2	*****
AC78	sequences	4057082	Manay Cary	Quality Grade	M1-0 M2 = 0	.0.
	Sizie Q &		l'ebbolice'	Tenderness	11-712-113-1	* * * *
AC200	( *)	61.00010200	Red Augen	Ossalfy Grade	M1-1M2-2	***
			Peblication*	Tendeness	11-2 12-1 13-2	1.1.1.1.1
AD445		900007780	/eps	Quality Grade	M1-2 M2-1	****
Reg No. Desp Warres	OK Sade 45		Publication*	Tendemess	11-212-213-2	111111
AD887	i i	10 0000////	Red Augus	Quality Grade	M1-0M2-2	*.*
Roy Nor Roy Name	Of Bridge 8		Petriodice*	Tendeniess	11-212-213-2	****
AC448	SOMETHINES.	(AppelDelh	Manay Gary	Quality Grade	M1-1 M2-2	***
Reg No. Reg Name:	Generalisasses		Petitodos*	Tendencess	11-212-213-2	*****
AD 889	99.90/0/2000		Many Cay	Quality Grade	M1-1 M2-0	1663
	Mind may 5		Petriotics*	lendamess	T1-112-013-1	**
L.	a de judice	led abases to b	e disabeted as the		refer the publication	of theresalts of
		and the last		period research period	and a last of thinks.	
Signed:				Date		

purpose.



### **Future of DNA Testing**

- Seedstock Sector
  - Marker Assisted Selection in an EPD format (GPD)
  - "Fixing" of Genes in a Population
  - Elimination of Genes from a Population
  - DNA Parentage on all Registered Animals
  - Breeding for desired genetic profile as defined by Commercial Industry

### Commercial Cow/Calf

- Much Greater Use of Genetic Information
  - DNA is lower cost
  - · Easier to use
  - Works for 1 Animal or 100 Animals
  - Equally Informative for Purebred or Crossbred
- "Fixing" of Genes in a Population
- Elimination of Genes from a Population
- Drug Prevention & Treatment based on Genetic Profiles
- More Accurate Matching of Genetics & Environment
- Coordination of Nutrition, Drug & Implant Regimens to Genetic Profile of Animals



# Current & Future Research Areas

- Product Quality
  - Quality Grade
  - Tenderness
  - Ribeye Area
  - Color
  - **Production Efficiency** 
    - Feed Efficiency
    - Fertility & Reproductive Efficiency
    - Longevity
    - Growth
    - Heat & Parasite Tolerance
  - Pharmacogenomics
    - Disease Resistance
    - Pharmaceutical Complimentarity