Implementation and Deployment of Genomically-Enhanced EPDs: Challenges and Opportunities

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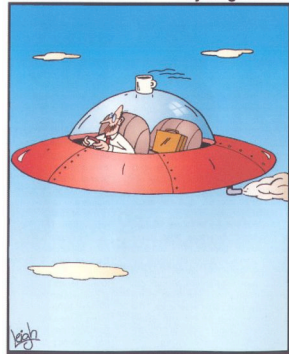
Beef Improvement Federation
Columbia, Missouri
June 30, 2010

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ANGUS
THE BUSINESS BREED

OVERVIEW

- **The Role of AGI**
- **The BIF Approach and Collaboration**
- **Data Flow and Information Exchange**
- **Initial Implementation of Genomic Results**
- **Genomic-enhanced EPDs and Accuracies**
- **Opportunities and Challenges**

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RUBES® By Leigh Rubin

Technology advances; people stay the same.

AGI is one of four subsidiaries of the American Angus Association
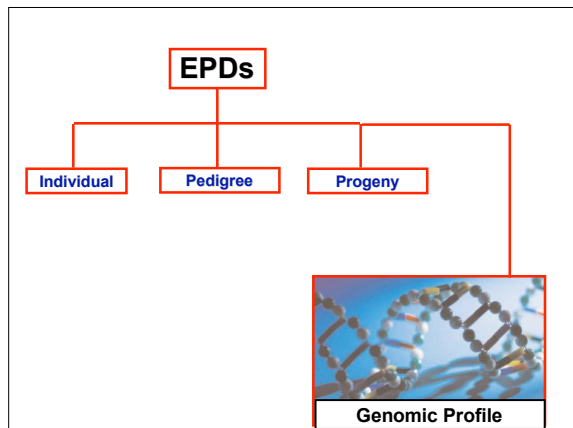

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Objectives

- **To provide services to the beef industry that would assist in the genetic evaluation of cattle traits**
- **To develop and promote technology for use by the beef industry including DNA technology**
- **To conduct research, develop, and prove new science and technology to benefit all beef producers**

Cooperative Research

University of Georgia
University of Missouri
Iowa State University
Colorado State University
Texas A&M University
Texas Tech University
University of Illinois
Mississippi State University
North Carolina State University
Kansas State University

University of Nebraska
University of Tennessee
Virginia Tech
USDA/ARS
   Clay Center
   Miles City
   Beltsville

National Beef Cattle
Evaluation Consortium

Slide 1

EPDs

Individual **Pedigree** **Progeny**

Genomic Profile

Slide 2

"BIF believes that information from DNA tests only has value in selection when incorporated with all other available forms of performance information for economically important traits in NCE, and when communicated in the form of an EPD with a corresponding BIF accuracy. For some economically important traits, information other than DNA tests may not be available. Selection tools based on these tests should still be expressed as EPD within the normal parameters of NCE."

Slide 3

The Collaboration

- **Started in 2006/2007.**
  Build Angus-specific panels for incorporation into genomic-enhanced EPDs.

- **Merial/Igenity and University of Missouri:**
  Develop genomic prediction equations.
  - Maximally informative, reduced panel from 50K chip.

- **American Angus Association/AGI:**
  Estimate genetic (co)variances between genomic results and phenotypes for:
  - Developing EPDs using the genomic profile results.
  - Incorporation of genomic information into NCE.

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Slide 4

Selecting SNP panels from the SNP50 chip to predict marbling in Angus cattle.

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University of Missouri

Iowa State University

Merial Limited

Angus Genetics Inc.

Slide 5

Variance Component Estimation Genetic Parameters

JOURNAL OF ANIMAL SCIENCE
The Premier Journal and Leading Source of New Knowledge and Perspective in Animal Science

National cattle evaluation system for combined analysis of carcass characteristics and indicator traits recorded by using ultrasound in Angus cattle
M. D. MacNeil and S. L. Northcutt

Combine Carcass and Ultrasound Data

Genetic evaluation of Angus cattle for carcass marbling using ultrasound and genomic indicators
M. D. MacNeil, J. D. Nkrumah, B.W. Woodward and S. L. Northcutt

Incorporate Genomic Results

Slide 6

Genetic Correlation between Genomic Profiles and Phenotypic Marbling, Rib, Fat, and Carcass Weight

Carcass Trait	Corr with Profile
Marbling	.65
Rib	.58
Fat	.50
Weight	.54

MacNeil, M. D., S. L. Northcutt, R. D. Schnabel, D. J. Garrick, B.W. Woodward and J. F. Taylor. 2010. (in press).

Slide 1

Genomic-Enhanced EPD Timeline

September 2009
- **DNA samples accepted at AGI**
- **IGENITY profile for Angus results available to breeders in their AAA Login account**
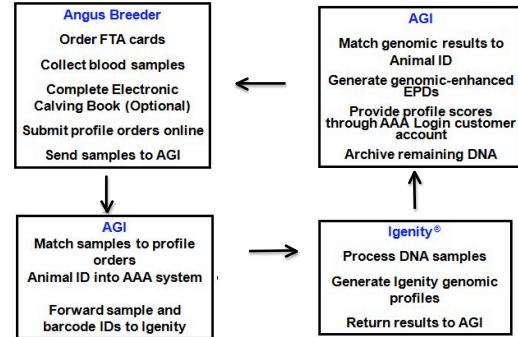
October 2009
- **Release of genomic-enhanced carcass EPDs**

March 2010
- **Implement results derived from a High Density Whole Genome Scan**

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Slide 2

Angus Breeder - AGI ® - Igenity® - Information Exchange

Angus Breeder
Order FTA cards
Collect blood samples
Complete Electronic Calving Book (Optional)
Submit profile orders online
Send samples to AGI

AGI
Match genomic results to Animal ID
Generate genomic-enhanced EPDs
Provide profile scores through AAA Login customer account
Archive remaining DNA

AGI
Match samples to profile orders
Animal ID into AAA system
Forward sample and barcode IDs to Igenity

Igenity®
Process DNA samples
Generate Igenity genomic profiles
Return results to AGI

Slide 3

AAA Login
- **Breeders and Affiliates can setup an account**
- **Password protected**
- **www.angus.org**

ANGUS THE BUSINESS BREED — American Angus Association

Slide 4

AMERICAN ANGUS ASSOCIATION®— THE BUSINESS BREED
3201 Frederick Avenue • St. Joseph, MO 64506 • (816) 383-5100 • Fax (816) 233-9703 • E-mail: angus@angus.org

4. Order the IGENITY® Angus Profile

1. Create a file of animals and complete the profile order.
2. Submit the completed file through the AAA Login cart check out.
3. A confirmation email will be sent upon receipt of order.
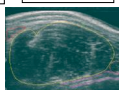
Click here to submit your file of animals.

DNA Test	Price
IGENITY® Profile	$65.00
Add BVD PI	$3.00
Add Coat Color	$5.00
Add AM Test	$24.00
Add NH Test	$9.00
Arthrogryposis Multiplex (AM) Test Only	$26.00
Neuropathic Hydrocephalus (NH) Test Only	$26.00

Slide 5

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Genomic Enhanced Carcass EPDs

Harvest Data	Usnd Bull	Usnd Heifer	Usnd Steer	Genomic Profiles

Slide 6

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Search Again | Home | Breed Association Codes | Defect Codes

Woodhill Extra T186-W44   Reg: AAA 16451563   Bull
Birth Date: 02/11/2009 Tattoo: W44
Genomic profile

Weekly NCE Carcass EPDs

EPD Pedigree Lookup

EPD Percentiles

As of 04/06/2010

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
+5 .28	+2.3 .35	+49 .25	I+101 .33	I+.3 .22	I+.66 -.22	+8 .16	+23 .17				-5.10

Carcass					
CW Acc	Marb Acc	RE Acc	Fat Acc	Carc Grp Carc Pg	Usnd Grp Usnd Pg
+9 .24	+.50 .34	+.08 .33	-.022 .25		

$Values				
$W	$F	$G	$QG	$YG	$B
+22.62	+40.76	+31.88	+24.50	+7.38	+53.35

EPDs (CW, Marb, RE, Fat) are enhanced by genomic profiles generated by ✪ igenity.

Calves with genomic profile results have calculated NCE EPDs using all data contributing to the comprehensive EPD system.

- ✓ **Harvest data**
- ✓ **Ultrasound data**
- ✓ **Genomic profile results**
- ✓ **Pedigree relationships**
- ✓ **Animal model evaluation concepts**

Example EPDs --- Interims vs. Genomic-Enhanced NCE

Animal has a profile only

(no ultrasound scan data)

OLD	CWT	MARB	RE	FAT
EPD	I +15	I +.79	I +.41	I -.001
Acc	.05	.05	.05	.05

NEW	CWT	MARB	RE	FAT
EPD	+ 18	+ .71	+ .50	+.004
Acc	.30	.38	.35	.28

Example Carcass EPDs
Genomic-Enhanced National Cattle Evaluation

Cow has ultrasound data and 11 scan progeny

OLD	CWT	MARB	RE	FAT
EPD	+12	+.46	+.08	-.008
Acc	.21	.25	.31	.24

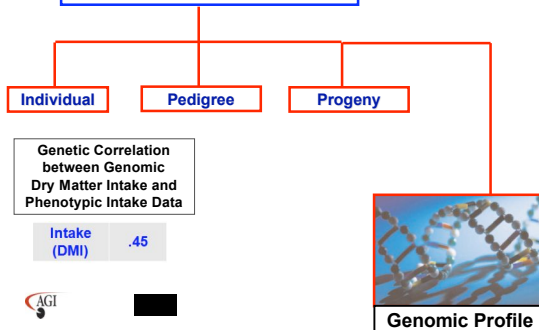| NEW	CWT	MARB	RE	FAT
EPD	+ 12	+ .86	+ .13	+.024
Acc	.28	.37	.38	.30

Advantages of Weekly Carcass EPDs

- NCE EPDs are the best genetic predictions for carcass traits – surpassing ratios and Interim EPDs as selection tools.
- NCE EPDs are available on Angus cattle in a rapid timeframe.
- Genomic profile results are incorporated into EPDs without a six-month wait for biannual evaluations.
- Ultrasound, carcass and genomic databases with a four-generation pedigree are used simultaneously each week in a full NCE.

The Next Step

Feed Efficiency

Residual ADG EPDs

Individual   **Pedigree**   **Progeny**

Genetic Correlation between Genomic Dry Matter Intake and Phenotypic Intake Data

Intake (DMI)	.45

AGI

Genomic Profile
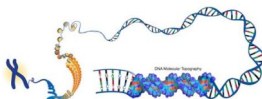
Residual ADG

Production							Maternal					
CED Acc	BW Acc	WW Acc	YW Acc	RADG Acc	YH Acc	SC Acc	CEM Acc	Milk Acc	MkH MkD	MW Acc	MH Acc	$EN
+14 .96	-1.3 .98	+54 .97	+100 .96	+.22 .75	-.1 .96	+1.73 .96	+12 .86	+25 .90	651 2266	+48 .83	+.4 .83	+.67

Carcass					
CW Acc	Marb Acc	RE Acc	Fat Acc	Carc Grp Carc Pg	Usnd Grp Usnd Pg
+2 .69	+.62 .73	-.07 .74	+.017 .68	33 78	5377 16257

$Values					
$W	$F	$G	$QG	$YG	$B
+38.43	+37.71	+30.21	+27.72	+2.49	+44.55

RADG: Residual Average Daily Gain

Challenges

- **As genomic panels are improved, the correlation between the molecular breeding value and the trait of interest must be re-estimated.**
- **Databases and methodology must allow for multiple genomic results on animals.**
- **Printed materials containing EPDs require an 'as of' date.**
- **New technologies generate demand for additional outreach and education.**