



Experiences with Implementation of Single Step at American Angus – 1 year In

BIF 2018 – Genomics and Genetic Prediction Workshop – Loveland CO

Stephen Miller, Genetic Research Director



Angus Genetics Inc.

- For-profit, wholly-owned subsidiary of the American Angus Association
 - Four geneticists
 - Seven customer service representatives
- Deliver genetic evaluation services to the American Angus Association, and five other breed organizations



Dan Moser, Ph.D.
AGI President



Stephen Miller, Ph.D.
AGI Genetic Research Director



Kelli Retallick, M.S.
AGI Genetic Service Director



Duc Lu, Ph.D.
AGI Research Geneticist



Lou Ann Adams
Director of Information Systems



Jason Kenyon
Assistant Director of Information Systems



Janice Blair
Programmer

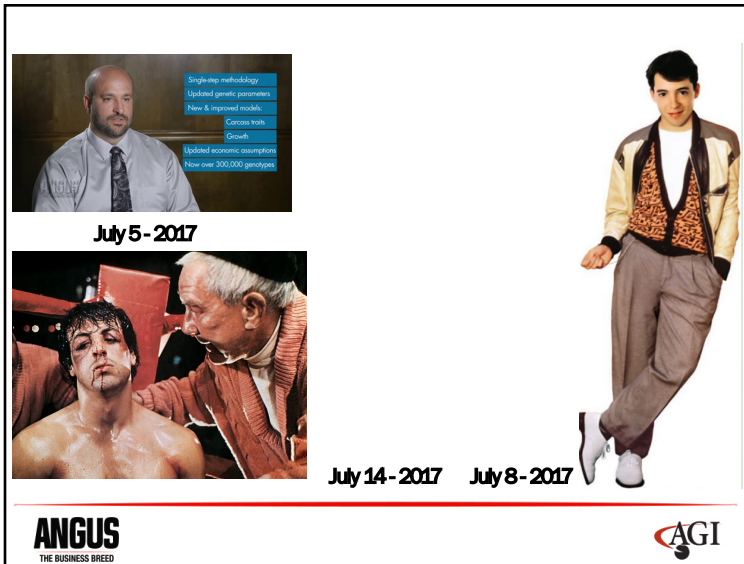


Gayle Billups
Programmer



Marg Dressman
Software Engineer





Single-step methodology
Updated genetic parameters
New & improved models
Carcass traits
Growth
Updated economic assumptions
Now over 300,000 genotypes

July 5-2017

July 14-2017

July 8-2017

ANGUS
THE BUSINESS BREED

AGI



AGENDA > COMMENTARY

Why the Angus Single Step evaluation is an industry game-changer

On July 7th, the American Angus Association unveiled a new genetic evaluation methodology that made big changes to its EPD system. As a result, seedstock and commercial producers have some readjusting to do as some bulls won, and some lost.

Troy Marshall | Jul 13, 2017

Thanks Troy for some Fair and Honest Reporting

ANGUS
THE BUSINESS BREED

AGI



Communication Communication Communication

DAN MOSER, ANGUS GENETICS INC. PRESIDENT

Angus Genetic Evaluation, Common Questions

Single-step Genetic Evaluation – Common Questions

Q: What is single step?
Single-step genetic evaluation is the method that will be implemented July 7, 2017, through AGI to calculate weekly Angus expected progeny differences (EPDs). Single-step methodology represents an evolution in the way AGI has calculated genome-enhanced EPDs (G-E-EPDs) since 2016, and offers the most advanced process available by incorporating all genotype, pedigree, performance and progeny data into one step, as is the current method.

Q: How does single step differ from the current process of cal?
In 2016, the American Angus Association and AGI began estimating G information in addition to the performance, pedigree and progeny record. This information was incorporated using a two-step process that first involved using the G information in the second step. EPDs are then interpreted as a correlated trait and used to calculate the EPD for the two-step process.

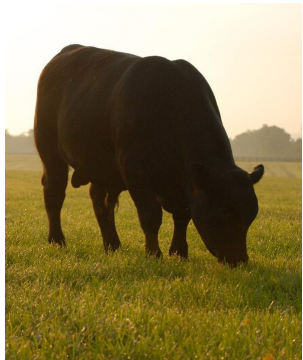
AGI

ANGUS
THE BUSINESS BREED

AGI

Enhancements to Angus Evaluation on 7/7/17

- Single Step genomics
- Improved models for carcass traits
- Additional genotypes and data
- Updated heritability and genetic correlation estimates
- Annual update of economic assumptions for \$Values



ANGUS
THE BUSINESS BREED

AGI

Single Step



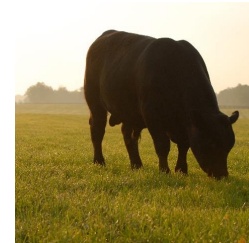




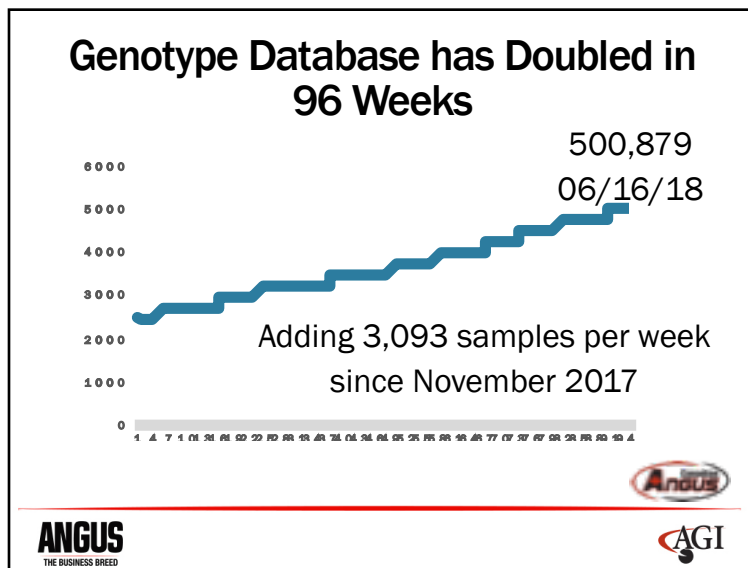


Any Genetic Evaluation is Only as Good as the Data Behind it

- 8.2M birth weights
- 8.9M weaning weights
- 4.4M post-weaning gain records
- 1.6M heifer calving ease scores
- 119K carcass records
- 2.0M ultrasound records
- 22K individual intake records
- 276K docility scores
- 68K heifer pregnancy observations
- 212K mature cow weights
- 14K Foot Score
- **501K Genotypes**



As of 06/16/2018



Why Does the Phone Ring?



How can two
flushmates be this
different on EPD?



The Power in the Pedigree

X

S

D

PGS

PGD

MGS

MGD

- 22 Million Strong



ANGUS

AGI

The Power in the Pedigree

	X	Sire	Dam	PGS	PGD	MGS	MGD
X	1	0.5	0.5	0.25	0.25	0.25	0.25
Sire	0.5	1	0	0.5	0.5	0	0
Dam	0.5	0	1	0	0	0.25	0.25
PGS	0.25	0.5	0	1	0	0	0
PGD	0.25	0.5	0	0	1	0	0
MGS	0.25	0	0.25	0	0	1	0
MGD	0.25	0	0.25	0	0	0	1

Famous A matrix – The magic behind EPDs

ANGUS

AGI

PGS - Semen

PGD - Egg

Sire

ANGUS

AGI

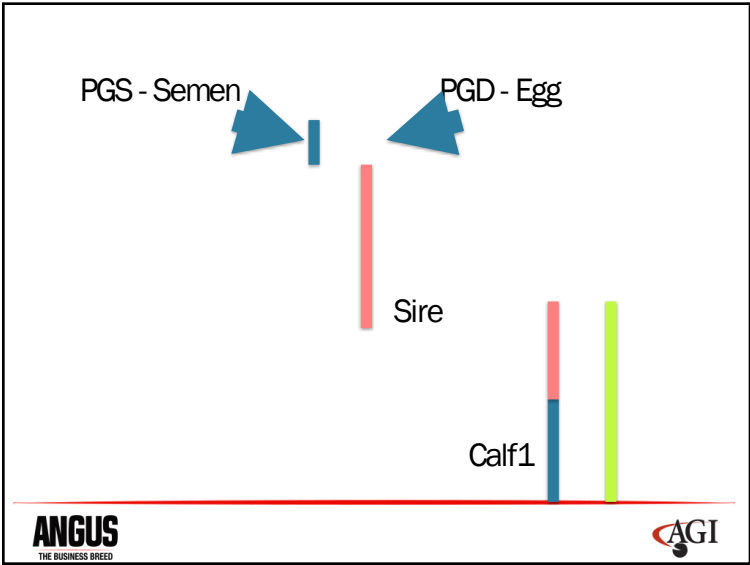
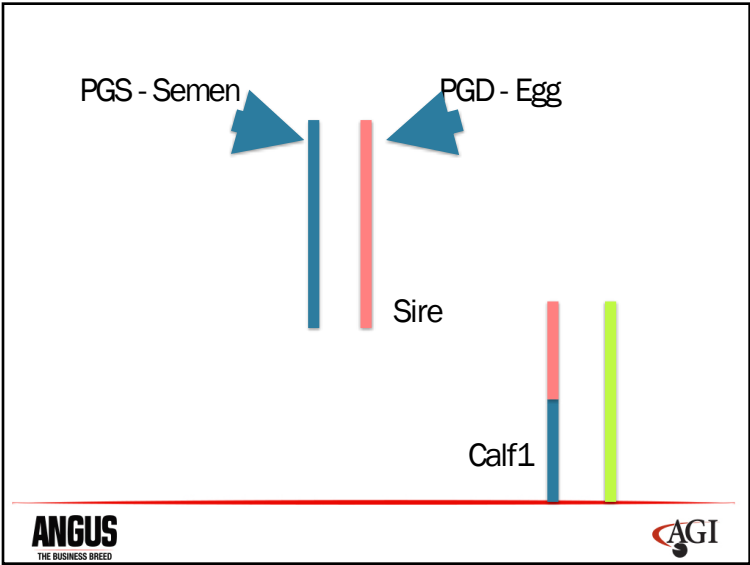
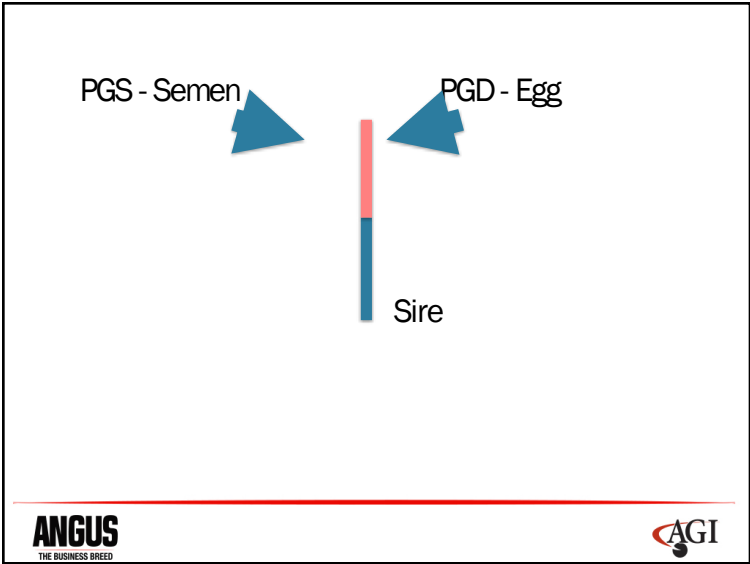
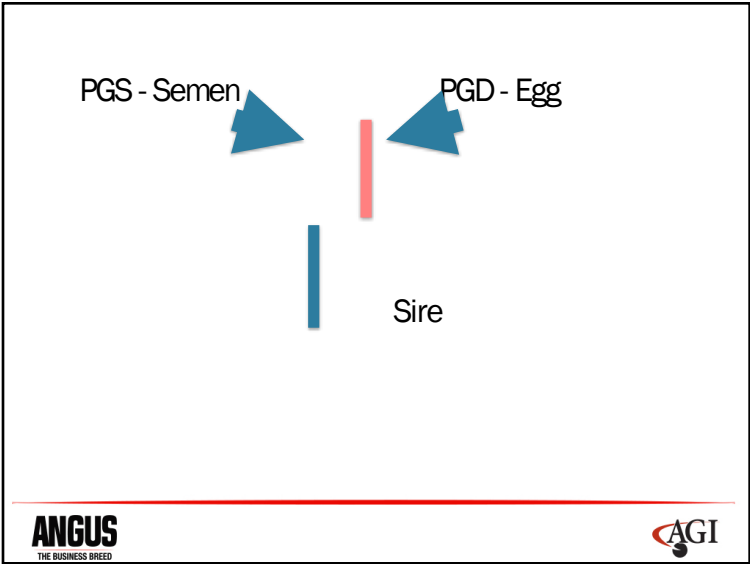
PGS - Semen

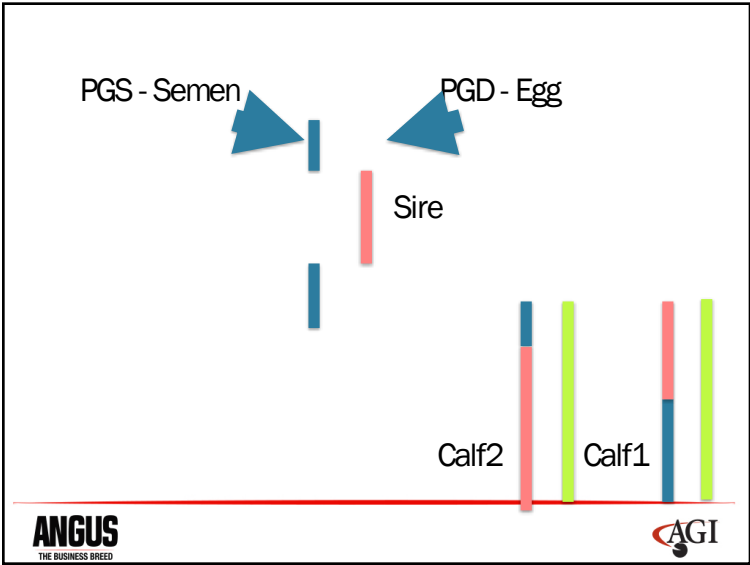
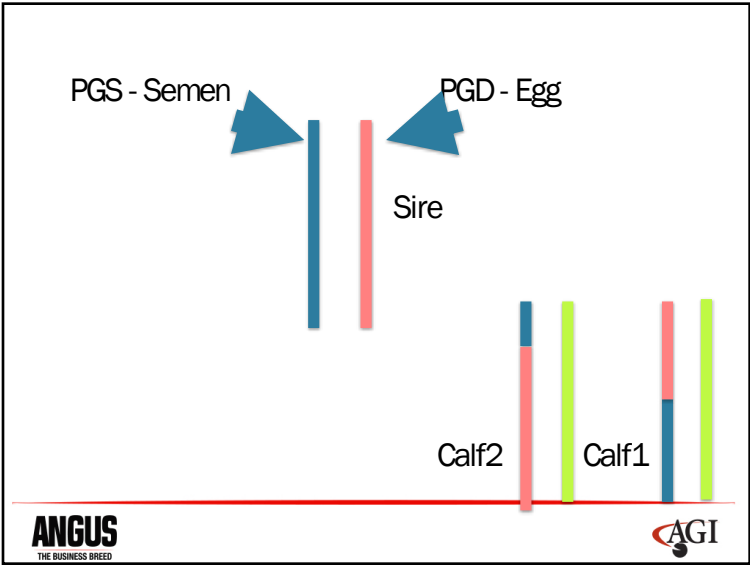
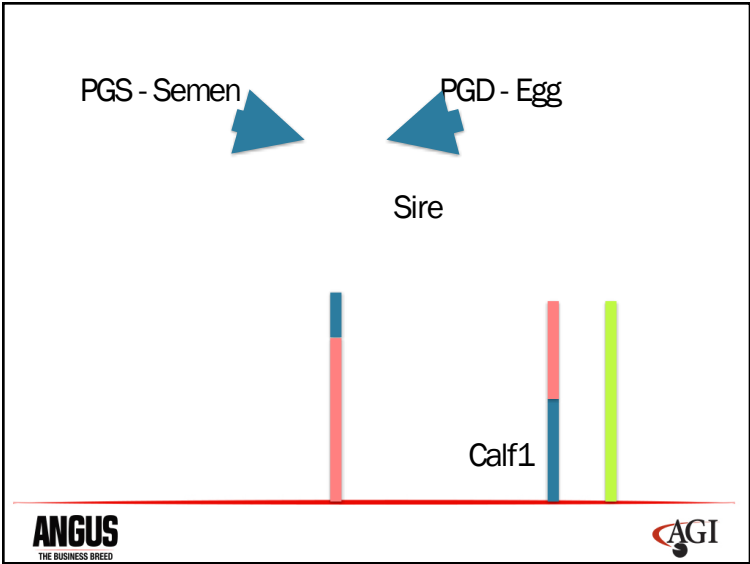
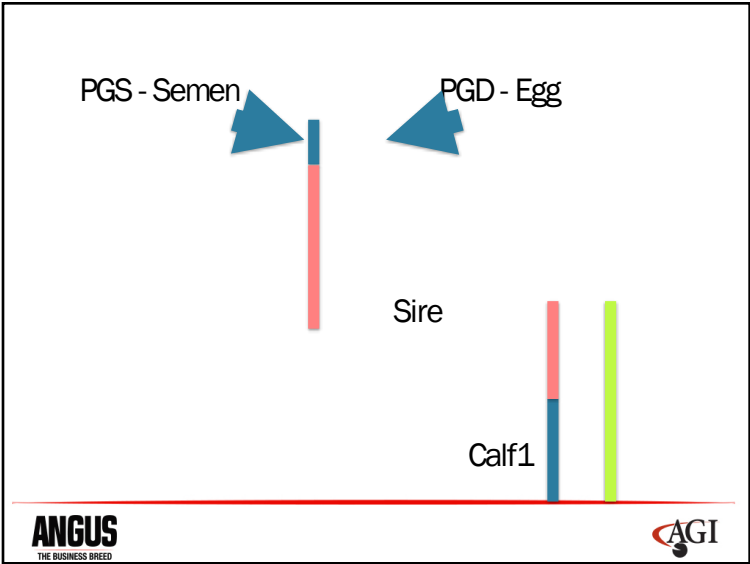
PGD - Egg

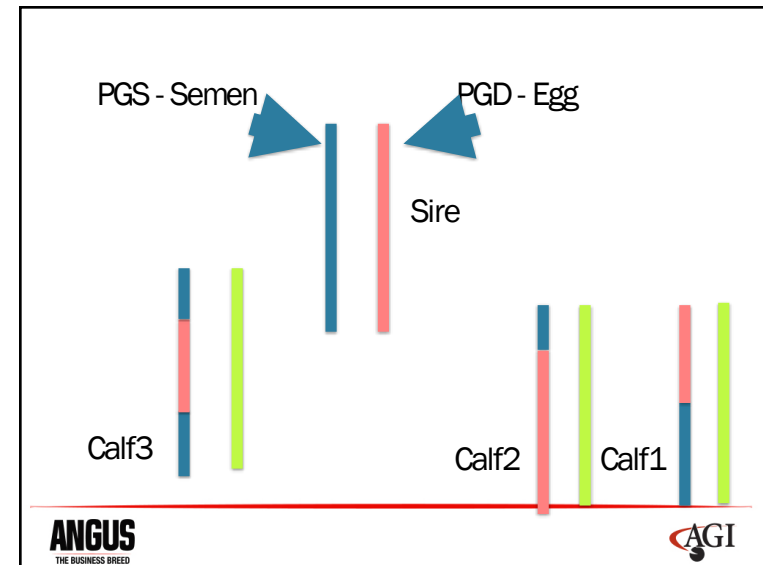
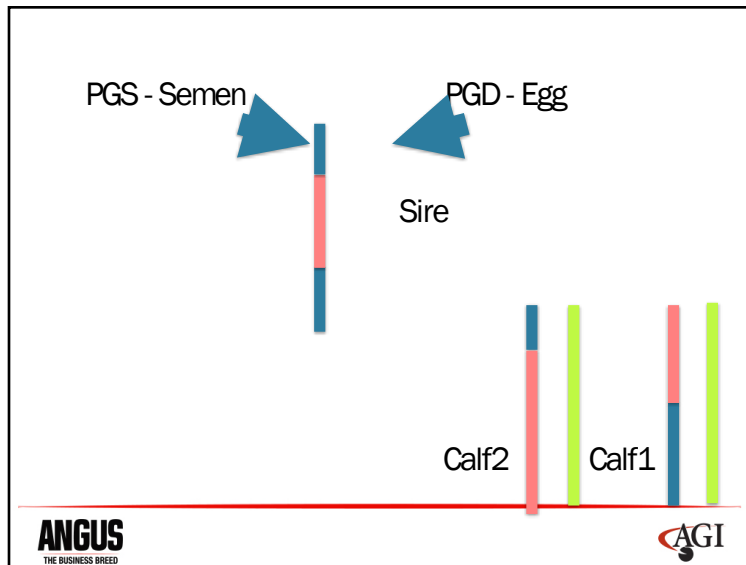
Sire

ANGUS

AGI







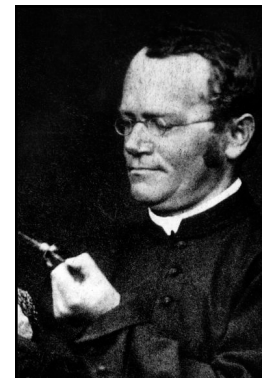
There is variability across the chromosome in the same animal

Sire	Rank whole Chromosome	Rank Top Half	Rank Bottom Half
All Good	1	6	9
Top Good	51	7	167
Bottom Good	58	187	1
All Bad	183	171	184

Top 193 Sires with genotypes ranked 1-193 for Birth Weight DGV based on whole Chromosome (6), top half and bottom half.

ANGUS
THE BUSINESS BREED

AGI



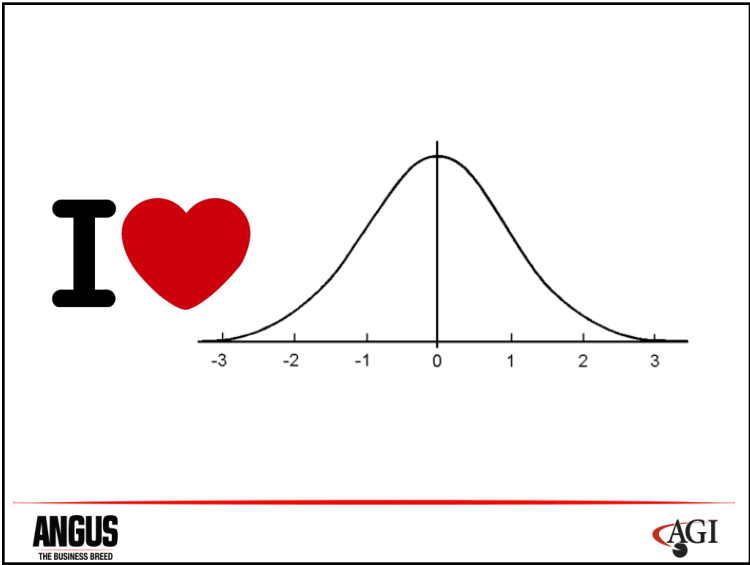
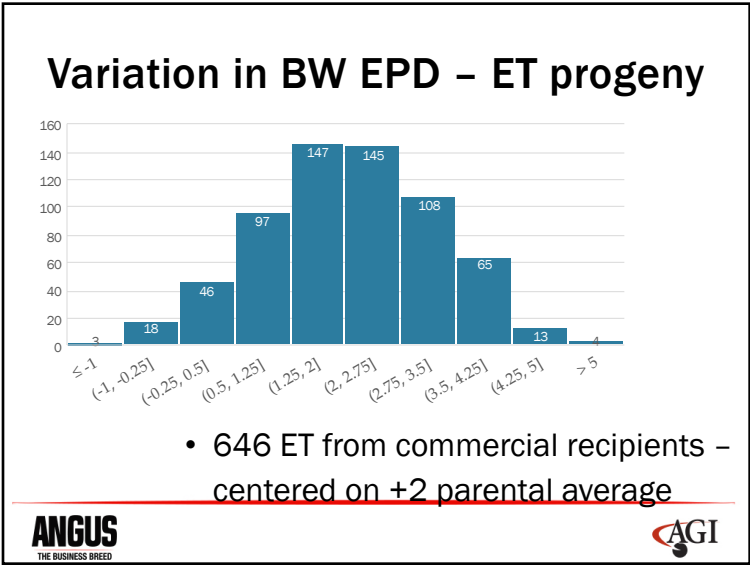
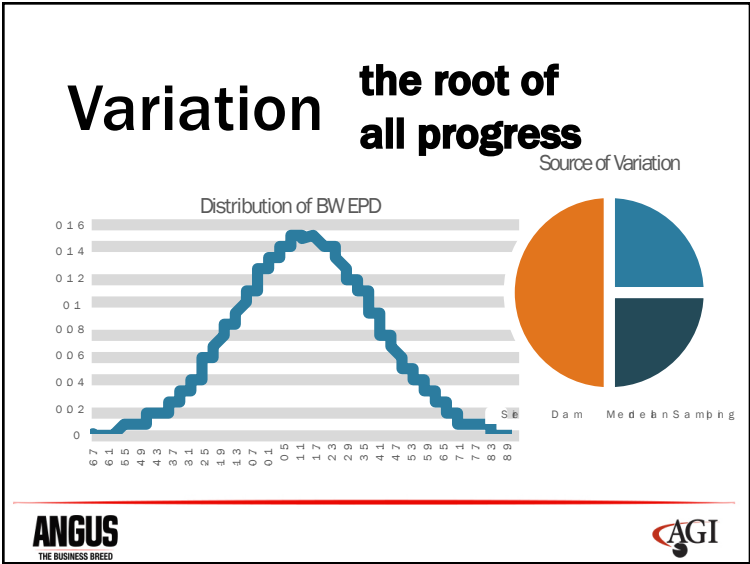
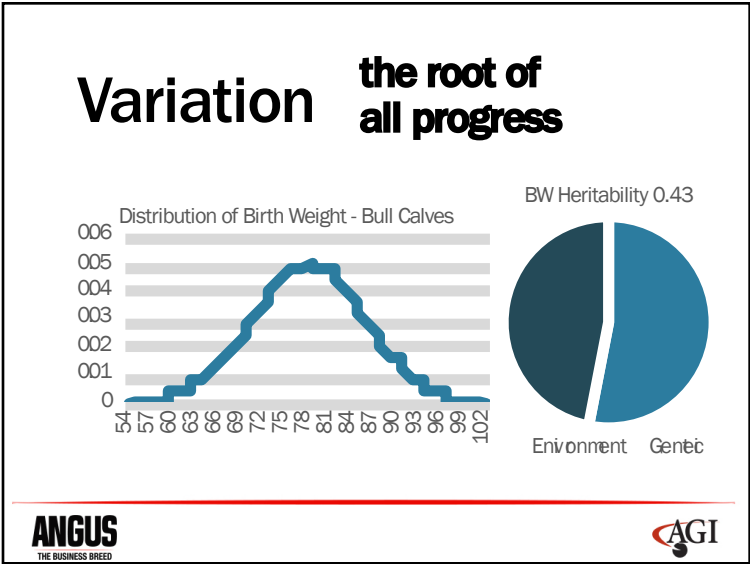
Gregor Mendel
1822-1884

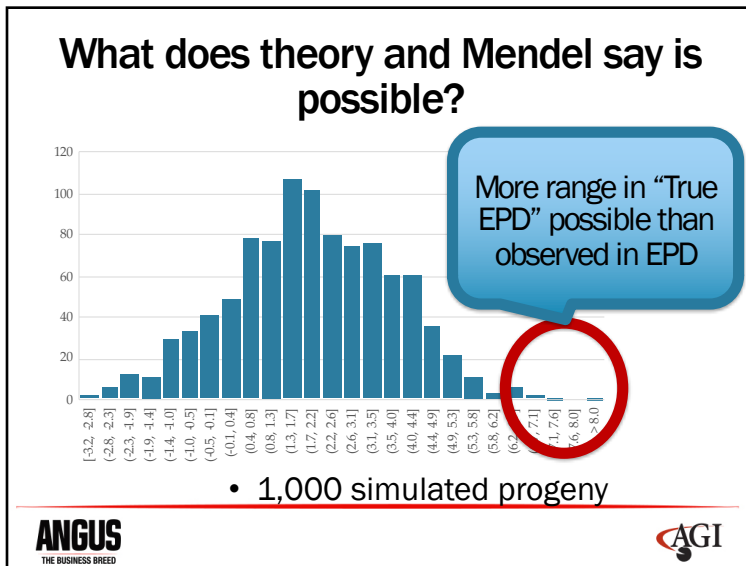
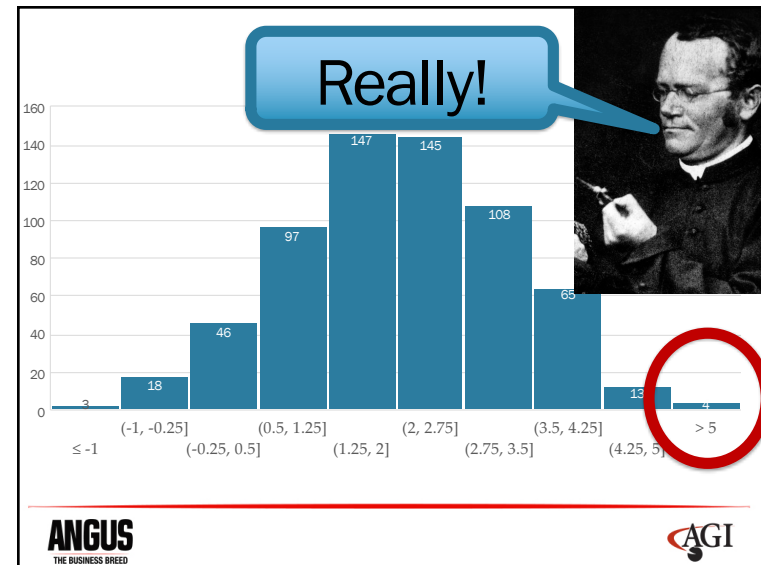
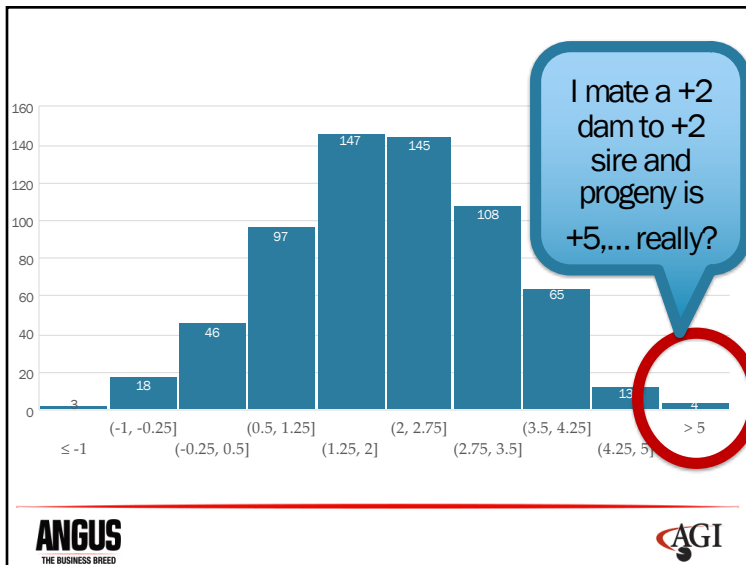
Range among
Full-Sibs has been
known for a
VERY long time

"Mendelian" Sampling

ANGUS
THE BUSINESS BREED

AGI





Two ET Full sibs 505 and 510

Tag 505 BW EPD 1.6
Tag 510 BW EPD 2.5



ANGUS THE BUSINESS BREED

AGI

Top side of Sire pedigree

Schearbrook Shoshone

AAA #7011424 [CAF-D2F-XF]

VDAR Shoshone 548

AAA #9389965

VDAR Polly 308

AAA #8720142

AAR New Trend

AAA #9958634 [OSF]

Candler Forever 376

AAA #7501542

Donna AAR74

AAA 8324606

Donna 244 GDAR

AAA #7473425

Boyd New Day 8005

AAA #13050780 [AMF-CAF-XF]

N Bar Emulation EXT

AAA #10776479 [AMF-CAF-XF]

Leachman Right Time

AAA #11750711 [D2F-M1F-OSF]

Leachman Erica 0025

AAA 11382472

SVF Forever Lady 57D

AAA 12133159

Skarship Saratoga

AAA #10351162 [OHF]

SVF Forever Lady 1128

AAA #11699928

Forever Lady 163 GDAR

AAA #9995297

B/R New Day 454

AAA #14675445 [DDC-AMF-XF]

VDAR New Trend 315

AAA #11105489 [AMF-CAF-XF]

B/R New Design 036

AAA #11418151 [DDC-AMF-XF]

B/R Blackcap Empress 76

AAA 10970296

B/R New Design 323

AAA #11928774 [DDC]

VDAR Pine Drive 251

AAA 10960004

B/R Ruby of Tiffany 155

AAA 11563271

Tiffany BR

AAA 10099738

B/R Ruby 1224

AAA 13879911 [DDC]

Traveler 124 GDAR

AAA #9995349

SVF Gdar 216 LTD

AAA #12309326

GDAR Forever Lady 718

AAA #10989615

HF Ruby 036-951

AAA #13324497

B/R New Design 036

AAA #11418151 [DDC-AMF-XF]

B/R Ruby 624

AAA 12569809

B/R Ruby 492

AAA 12103654

SIRE

VAR Reserve 1111

AAA #16916944 [AMF-CAF-XF]

ANGUS

THE BUSINESS BREED

AGI

Expected Relationship of Schearbrook Shoshone to calf?

Schearbrook Shoshone

AAA #7011424 [CAF-D2F-XF]

VDAR Shoshone 548

AAA #9389965

VDAR Polly 308

AAA #8720142

AAR New Trend

AAA #9958634 [OSF]

Candler Forever 376

AAA #7501542

Donna AAR74

AAA 8324606

Donna 244 GDAR

AAA #7473425

Boyd New Day 8005

AAA #13050780 [AMF-CAF-XF]

N Bar Emulation EXT

AAA #10776479 [AMF-CAF-XF]

Leachman Right Time

AAA #11750711 [D2F-M1F-OSF]

Leachman Erica 0025

AAA 11382472

SVF Forever Lady 57D

AAA 12133159

Skarship Saratoga

AAA #10351162 [OHF]

SVF Forever Lady 1128

AAA #11699928

Forever Lady 163 GDAR

AAA #9995297

B/R New Day 454

AAA #14675445 [DDC-AMF-XF]

VDAR New Trend 315

AAA #11105489 [AMF-CAF-XF]

B/R New Design 036

AAA #11418151 [DDC-AMF-XF]

B/R Blackcap Empress 76

AAA 10970296

B/R New Design 323

AAA #11928774 [DDC]

VDAR Pine Drive 251

AAA 10960004

B/R Ruby of Tiffany 155

AAA 11563271

Tiffany BR

AAA 10099738

B/R Ruby 1224

AAA 13879911 [DDC]

Traveler 124 GDAR

AAA #9995349

SVF Gdar 216 LTD

AAA #12309326

GDAR Forever Lady 718

AAA #10989615

HF Ruby 036-951

AAA #13324497

B/R New Design 036

AAA #11418151 [DDC-AMF-XF]

B/R Ruby 624

AAA 12569809

B/R Ruby 492

AAA 12103654

SIRE

VAR Reserve 1111

AAA #16916944 [AMF-CAF-XF]

ANGUS

THE BUSINESS BREED

AGI

1/2

Schearbrook Shoshone

AAA #7011424 [CAF-D2F-XF]

1/4

VDAR Shoshone 548

AAA #9389965

1/8

VDAR Polly 308

AAA #8720142

1/16

AAR New Trend

AAA #9958634 [OSF]

1/32

Candler Forever 376

AAA #7501542

1/64

Donna AAR74

AAA 8324606

1/128

Donna 244 GDAR

AAA #7473425

1/256

Boyd New Day 8005

AAA #13050780 [AMF-CAF-XF]

1/512

N Bar Emulation EXT

AAA #10776479 [AMF-CAF-XF]

1/1024

Leachman Right Time

AAA #11750711 [D2F-M1F-OSF]

1/2048

Leachman Erica 0025

AAA 11382472

1/4096

SVF Forever Lady 57D

AAA 12133159

1/8192

Skarship Saratoga

AAA #10351162 [OHF]

1/16384

SVF Forever Lady 1128

AAA #11699928

1/32768

Forever Lady 163 GDAR

AAA #9995297

1/65536

B/R New Day 454

AAA #14675445 [DDC-AMF-XF]

1/131072

VDAR New Trend 315

AAA #11105489 [AMF-CAF-XF]

1/262144

B/R New Design 036

AAA #11418151 [DDC-AMF-XF]

1/524288

B/R Blackcap Empress 76

AAA 10970296

1/1048576

B/R New Design 323

AAA #11928774 [DDC]

1/2097152

VDAR Pine Drive 251

AAA 10960004

1/4194304

B/R Ruby of Tiffany 155

AAA 11563271

1/8388608

Tiffany BR

AAA 10099738

1/16777216

B/R Ruby 1224

AAA 13879911 [DDC]

1/33554432

Traveler 124 GDAR

AAA #9995349

1/67108864

SVF Gdar 216 LTD

AAA #12309326

1/134217728

GDAR Forever Lady 718

AAA #10989615

1/268435456

HF Ruby 036-951

AAA #13324497

1/536870912

B/R New Design 036

AAA #11418151 [DDC-AMF-XF]

1/1073741824

B/R Ruby 624

AAA 12569809

1/2147483648

B/R Ruby 492

AAA 12103654

SIRE

1/32 VAR Reserve 1111

AAA #16916944 [AMF-CAF-XF]

Expected Relationship of Schearbrook Shoshone to calf?

ANGUS

THE BUSINESS BREED

AGI

Ancestor	BW/EPD	Gen1	Gen2	Gen3	Gen4	Gen5	Expected G	FS Diff	prop from expected
GAR Grid Maker	5.5	4					0.0625	0.0297	0.48
Ideal 1418 of 8103 4286	5	6					0.0156	-0.0161	1.03
Rito 2100 GDAR	4.6	6					0.0156	0.0332	2.13
Schearbrook Shoshone	4.3	5	6	8			0.0508	0.0110	0.22
VDAR New Trend 315	3.5	4	6	7			0.0859	0.0367	0.43
B/R New Frontier 095	2.9	2					0.2500	-0.0093	0.04
GDAR Traveler 044	2.4	5					0.0313	-0.0206	0.66
B/R Ruby 1224	2.3	3					0.1250	0.0517	0.41
Boyd New Day 8005	2.1	3					0.1250	0.0150	0.12
Altune of Conanga 6104	2	4					0.0625	-0.0059	0.09
B/R New Design 036	1.5	3	5	5			0.1875	0.0326	0.17
P/S Power Play	1.4	6	6	6	8	9	0.0527	-0.0053	0.10
N Bar Emulation EXT	1.4	6					0.0156	0.0055	0.35
GAR Precision 1680	1.2	3	6	6			0.1563	-0.0361	0.23
Riverbend Blackbird									
4301	1.1	3					0.1250	-0.0047	0.04
Connealy Dateline	0.7	3	5				0.1563	-0.0457	0.29
VAR Reserve 1111	0.7	1					0.5000	0.0217	0.04
SAF Fame	0.6	6					0.0156	-0.0016	0.10
SAF Focus of ER	0	5					0.0313	-0.0152	0.48
QAS Traveler 234	-0.9	6	6	7	7		0.0469	-0.0244	0.52
Tehama Bando 155	-1.5	4	5				0.0938	-0.0342	0.36
Band 234 of Ideal 3163	-1.6	5	6				0.0469	-0.0230	0.49

ANGUS

THE BUSINESS BREED

AGI

Ancestor	BWEPD	Gen1	Gen2	Gen3	Gen4	Gen5	Expected G	FS Diff	prop from expected
GAR Grid Maker	5.5	4					0.0625	0.0297	0.48
Ideal 1418 of 8103 4286	5	6					0.0156	-0.0161	1.03
Rito 2100 GDAR	4.6	6					0.0156	0.0332	2.13
Schearbrook Shoshone	4.3	5	6	8			0.0508	0.0110	0.22
V/DAR New Trend 315	3.5	4	6	7			0.0859	0.0367	0.43
B/R New Frontier 095	2.9	2					0.2500	-0.0093	0.04
GDAR Traveler 044	2.4	5					0.0313	-0.0206	0.66
B/R Ruby 1224	2.3	3					0.1250	0.0517	0.41
Boyd New Day 8005	2.1	3					0.1250	0.0150	0.12
Altitude of Conanga 6104	2	4					0.0625	-0.0059	0.09
Average							0.08	.01	0.15

Calf with higher BW EPD is
15% **MORE** related to the
higher BW EPD Ancestors

ANGUS
THE BUSINESS BREED

AGI

Ancestor	BWEPD	Gen1	Gen2	Gen3	Gen4	Gen5	Expected G	FS Diff	prop from expected
N Bar Emulation EXT	1.4	6					0.0156	0.0055	0.35
GAR Precision 1680	1.2	3	6	6			0.1563	-0.0361	0.23
Riverbend Blackbird 4301	1.1	3					0.1250	-0.0047	0.04
Connealy Dateline	0.7	3	5				0.1563	-0.0457	0.29
VAR Reserve 1111	0.7	1					0.5000	0.0217	0.04
SAF Fame	0.6	6					0.0156	-0.0016	0.10
SAF Focus of ER	0	5					0.0313	-0.0152	0.48
QAS Traveler 234	-0.9	6	6	7	7		0.0469	-0.0244	0.52
Tehama Bando 155	-1.5	4	5				0.0938	-0.0342	0.36
Band 234 of Ideal 3163	-1.6	5	6				0.0469	-0.0230	0.49
Average							0.12	-0.02	-0.13

Calf with higher BW EPD is
13% **LESS** related to the
lower BW EPD Ancestors

ANGUS
THE BUSINESS BREED

AGI

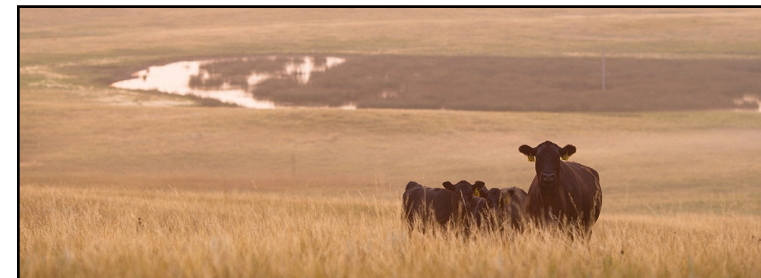
Main Points

- 7/7 was an improvement
- All about relationships
 - Pedigree
 - Genomics
 - Mendelian sampling
- Models are Important
 - Pre-selection
 - Correlated response
- More rapid progress



ANGUS
THE BUSINESS BREED

AGI



Questions/Discussion

Dan W. Moser, Ph.D.
dmoser@angus.org

Kelli Retallick, M.S.
kretallick@angus.org

Stephen Miller, Ph.D.
smiller@angus.org

AGI President
816-383-5196

Genetic Service Director
816-383-5190

Genetic Research Director
816-383-5157

ANGUS
THE BUSINESS BREED

AGI