2018 Innovative Grazing Forum

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What do Reef Catchment / Management and Bull Selection practices have in common?

- ✓ Increased efficiency in use of the grazing system
- ✓ Decreased stocking pressure for a given level of productivity
- ✓ Minimising run-off, maintaining pasture cover yet meeting market specifications following better Breeding Objectives

2018 Innovative Grazing Forum

Specific topics of Interest:

- What traits make you money?
- What's important to consider when selecting traits in a bull?
- BBSE (Bull breeding soundness examination)
- What drives genetics?
- What tools can we use? (i.e. Breed plan selection and Breedplan data, planned database search & Genomics, where are we headed)
- How do we move forward with our own business?

What is the primary purpose of a bull?

✓**Get maximum cows in calf in minimum time**

- Produce offspring for turnoff that grow quickly and meet market specifications
- Produce offspring for breeding with good fertility in a short period

(Require both sire and progeny to have the adaptation to perform and survive in the given environment)

Set your Breeding Objectives for your Herd

Reproductively sound bulls

- Are structurally sound
- Have good sperm production and quality
- Have good libido and ability to serve
- Have the required genetic fertility traits
- Are free from reproductive diseases
- With desirable docility

Reproductive/Fertility assessments

- ‘Clearly visible’
- Microscopic assisted
- Genetically defined
- Pedigree / Dam performance data


How fertile is this bull?

Calf Output Of Individual Bulls

Of the 245 bulls mated:

- 58% bulls (142) sired 10% or less calves
- 7% bulls (17) sired no calves.
- 13% bulls (33) sired over 30% of the calves

in each of the respective mating groups.

- No single trait will consistently predict calf-output.

- A number of traits have been demonstrated to influence calf-output in multiple-sire matings in northern Australia.

Bull Breeding Soundness Evaluation

* Phenotype

BBSE
A systematic examination recording:

- ✓ Identification
- ✓ Legs and Hooves
- ✓ Joints
- ✓ Head and eyes
- ✓ Sheath and contents
- ✓ Scrotum and contents
- ✓ Mating ability and behaviour

Bull Breeding Soundness Evaluation Certificate - BBSE

	Scrotum	Physical	Semen	Morphology	Serving
AACV	35.5	✓	✓	P	nt

Physical Soundness

Legs, feet and Joints

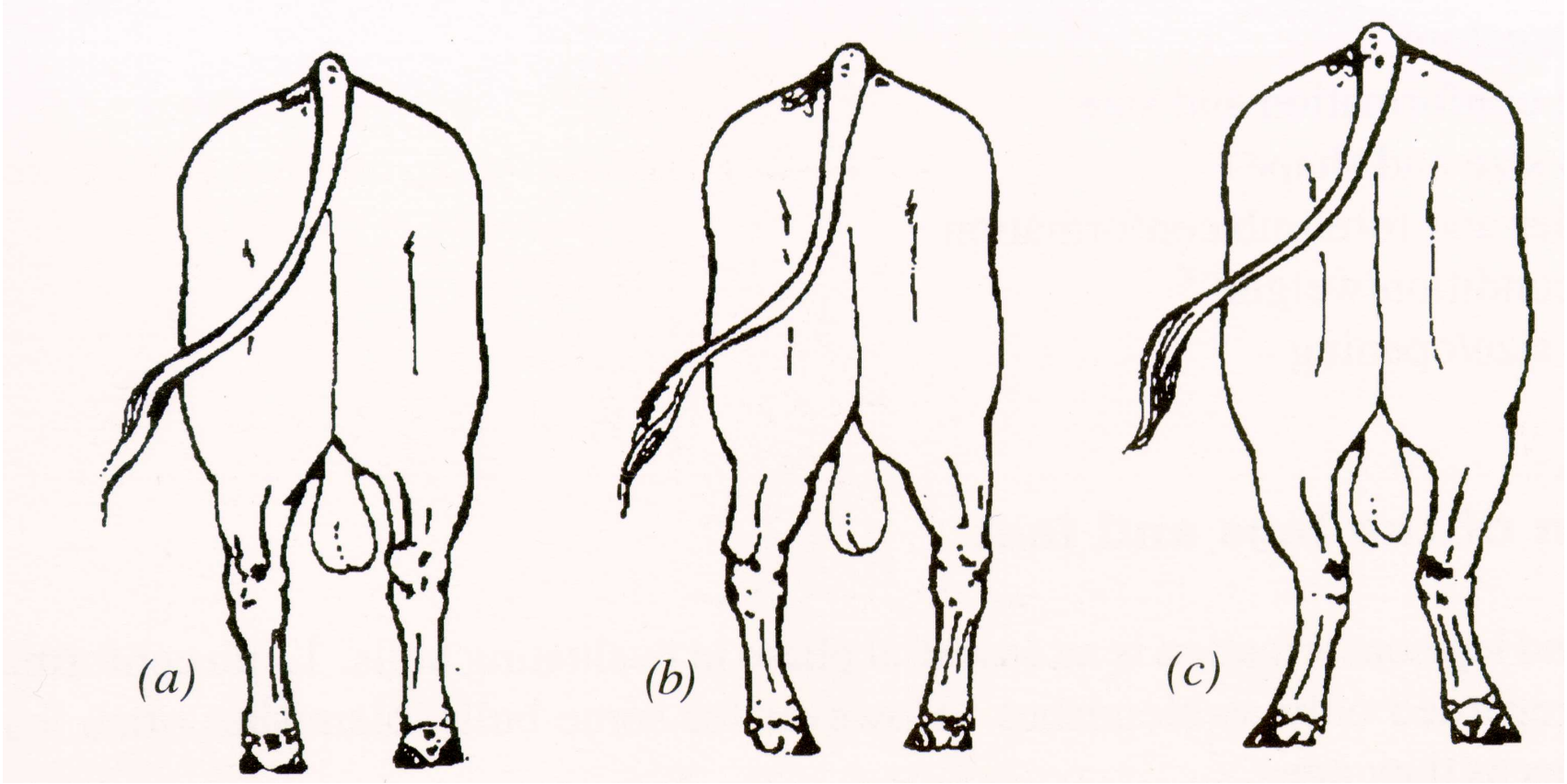
Head and Eyes

Sheath navel and eversion of prepuce

Penile structure

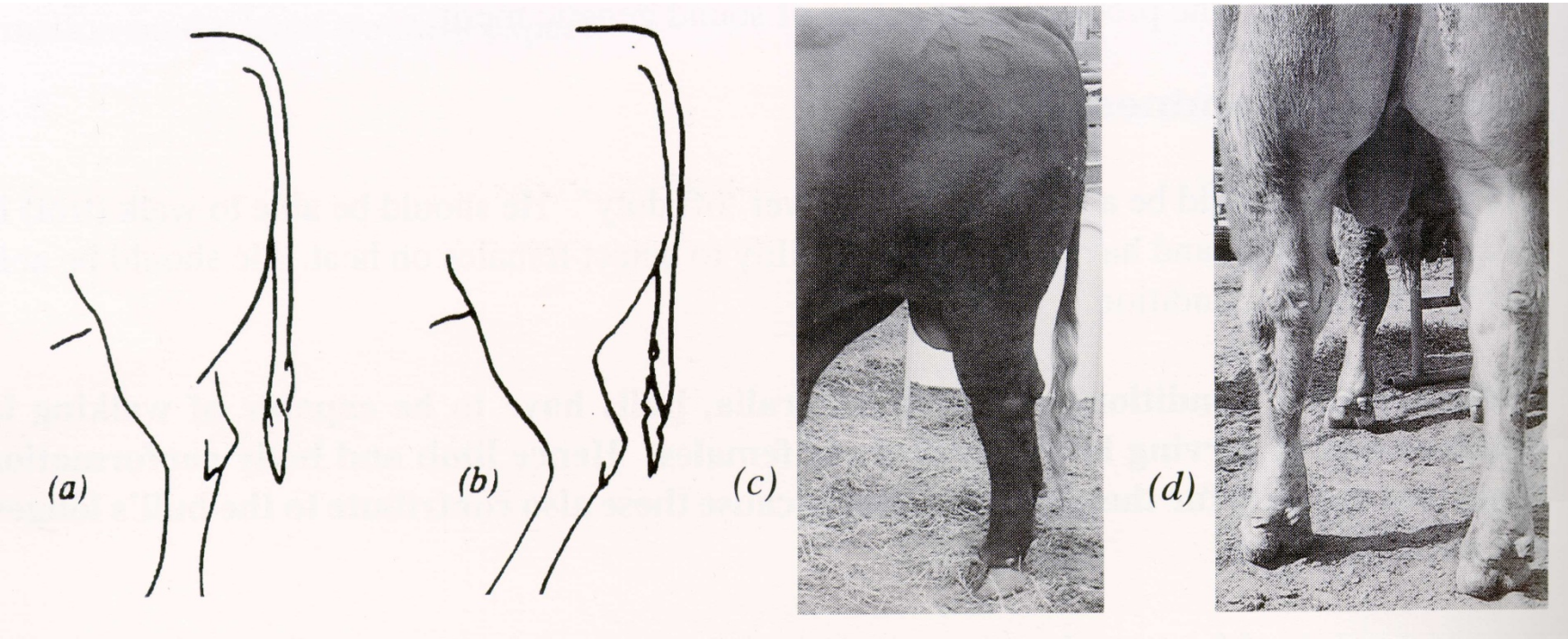
Scrotum and Testicles

Leg conformation



Rear view of Hind legs
(a) normal, (b) bow legged and (c) cow hocked.

Leg conformation



Side view of hind limbs :
(a) normal (b) sickle hocked (c) ‘posty leg’
(d) swollen hocks from straight legs

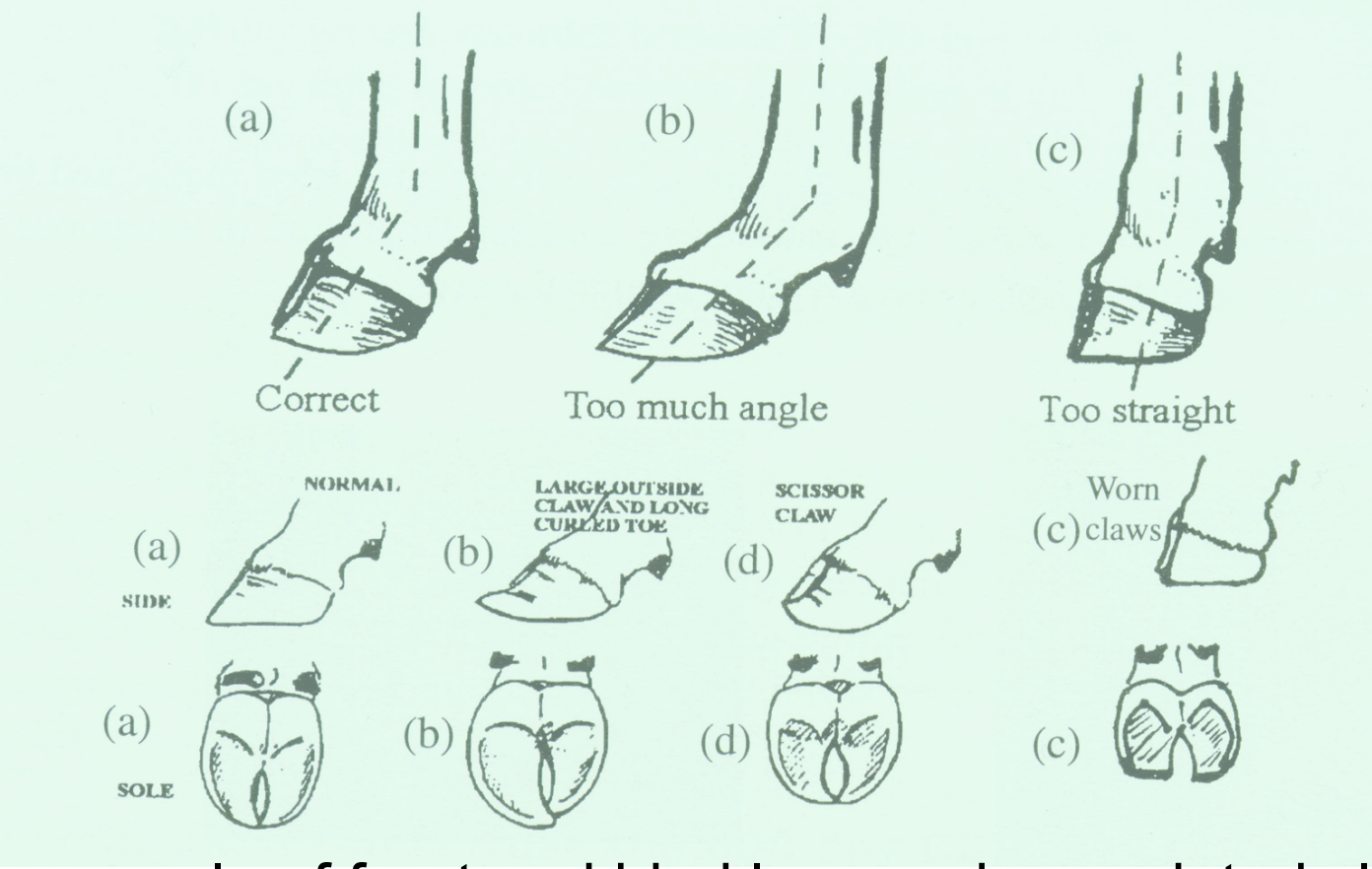
Hock swelling scores

Score 1

Score 3

Score 5

Feet conformation



Pastern angle of front and hind legs and associated claws: (a) correct structure (b) weak in the pastern (c) too straight (d) scissor claw

Interdigital hypoplasia scores


Interdigital fibroma

Head and eyes

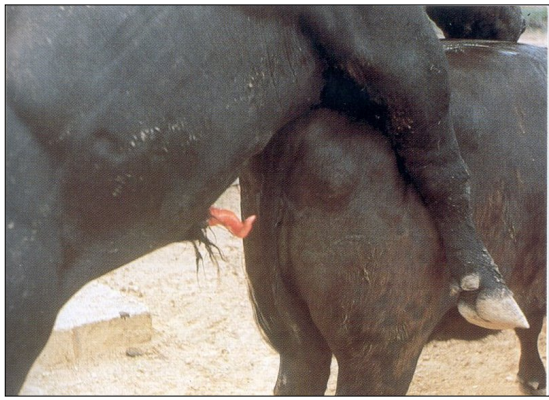
- Hooding
- Pigment
- Entropian Eyelids
- Corneal Scarring
- Cancer / growths

Sheath and navel structures

- Sheath Depth
- Umbilical thickness score
- Rosette score
- Sheath score


Sheath Depth measurement

Penile structure



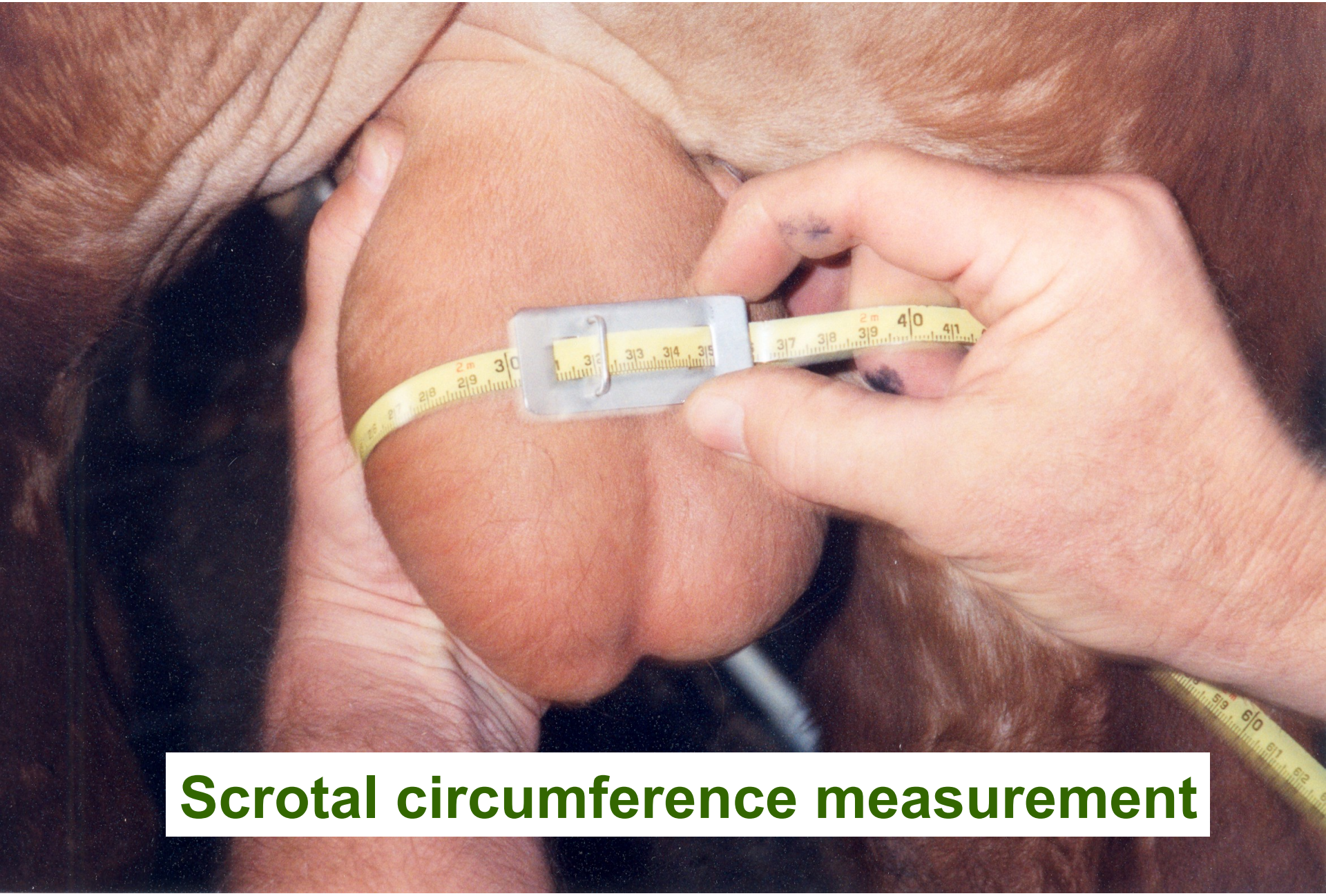
Penile abnormalities:

- Premature Spiral Deviation of the Penis (PSDP)
- Persistent Penile (Retained) Frenulum
- Stenosis (ring stenosis)
- Penile haematoma
- Penile Deviation
- Penile warts etc

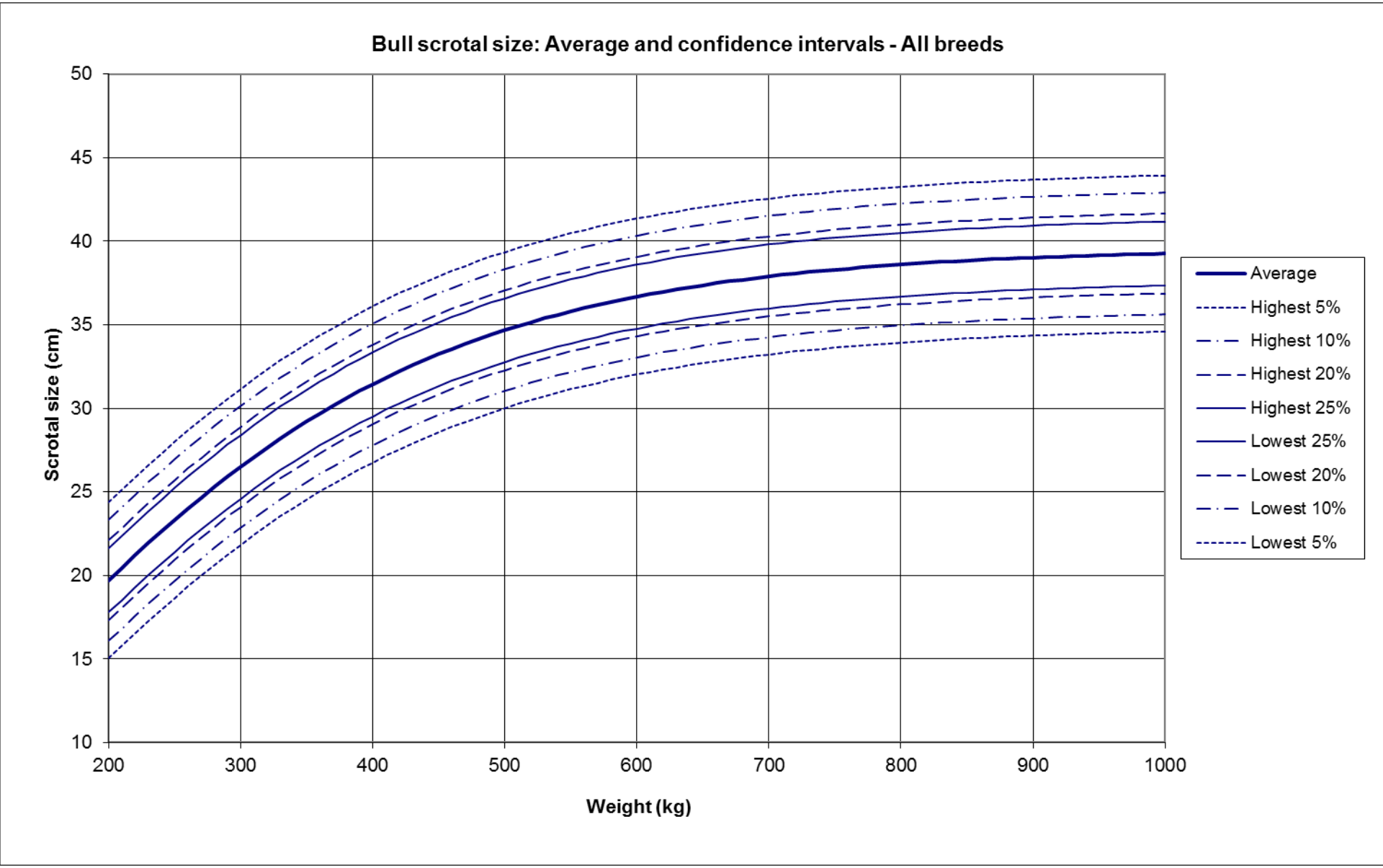
Preputial abnormalities

- Prolapse

Scrotal Circumference and Testicular Tone



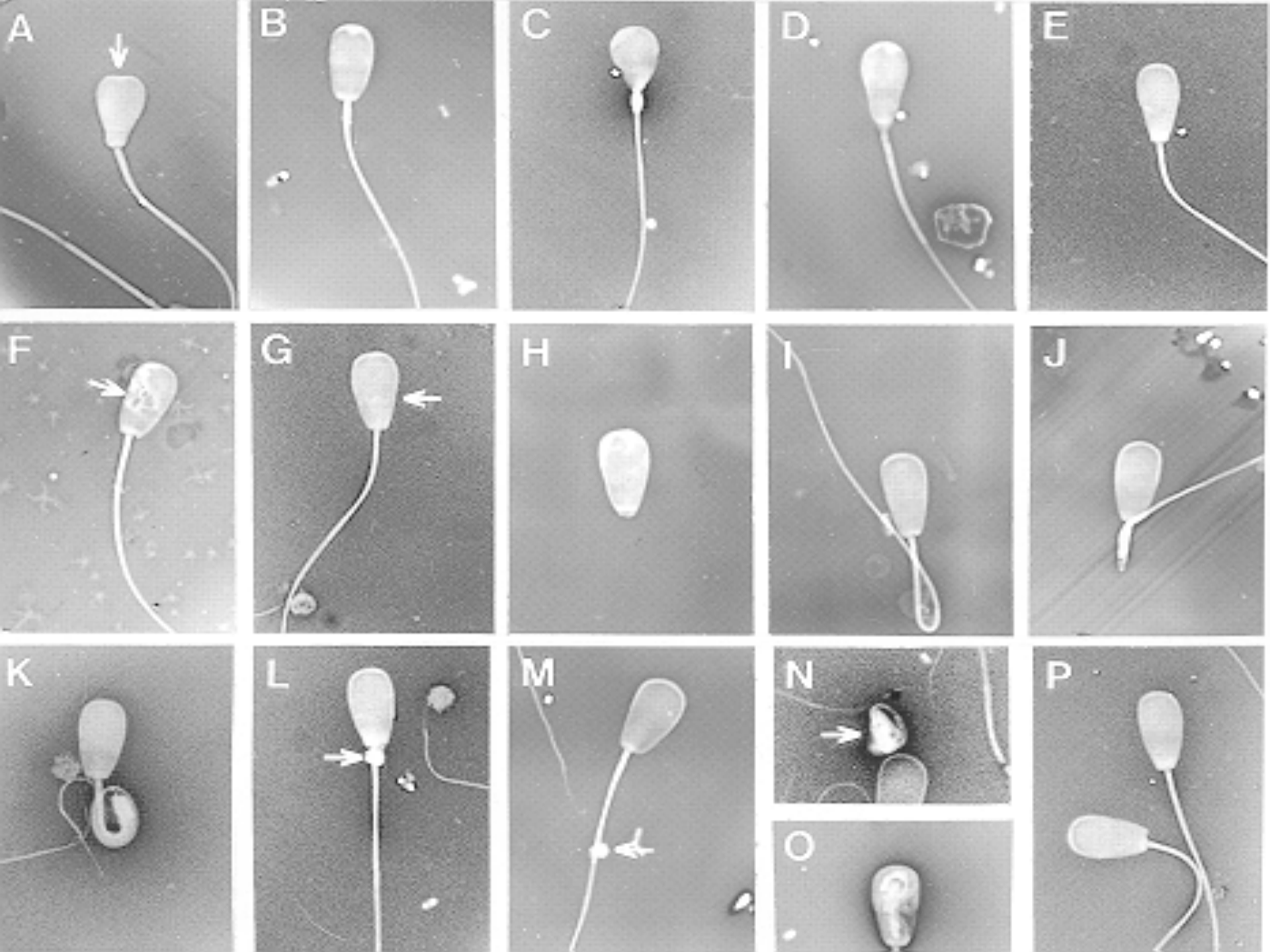
Scrotal circumference measurement


Bull scrotal size: Average and confidence intervals - All breeds
Scrotal size (cm)
50
45
40
35
30
25
20
15
10
200
300
400
500
600
700
800
900
1000
Weight (kg)
Average
Highest 5%
Highest 10%
Highest 20%
Highest 25%
Lowest 25%
Lowest 20%
Lowest 10%
Lowest 5%

Testicular Abnormalities ?

Semen collection and evaluation


Crush side: Gross motility
and slide preparation

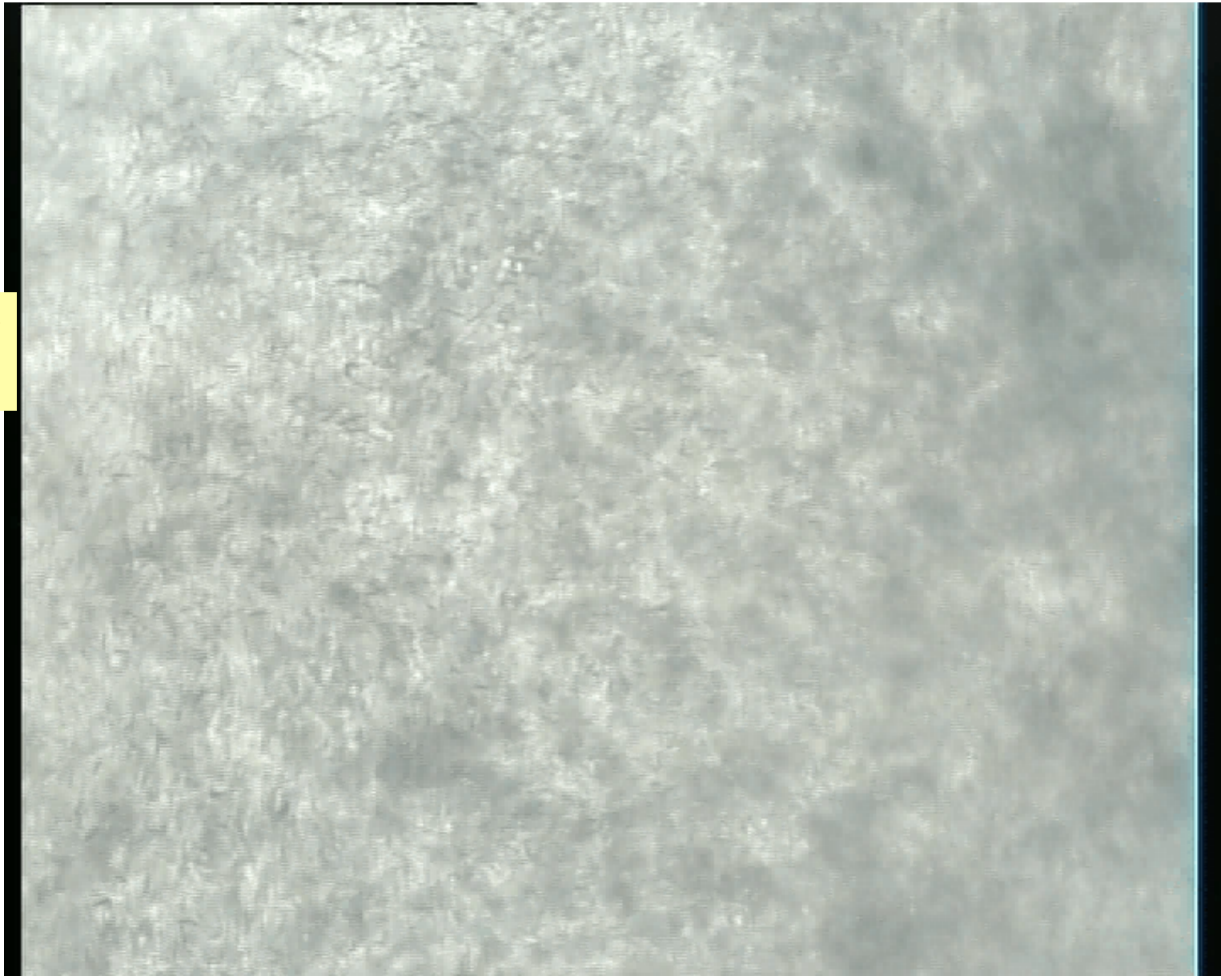

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P

Mass activity
1-5 scale

% Progressively motile = %

Sale bulls
Min. - **70%N**

Annual retest
Min. - **50%N**

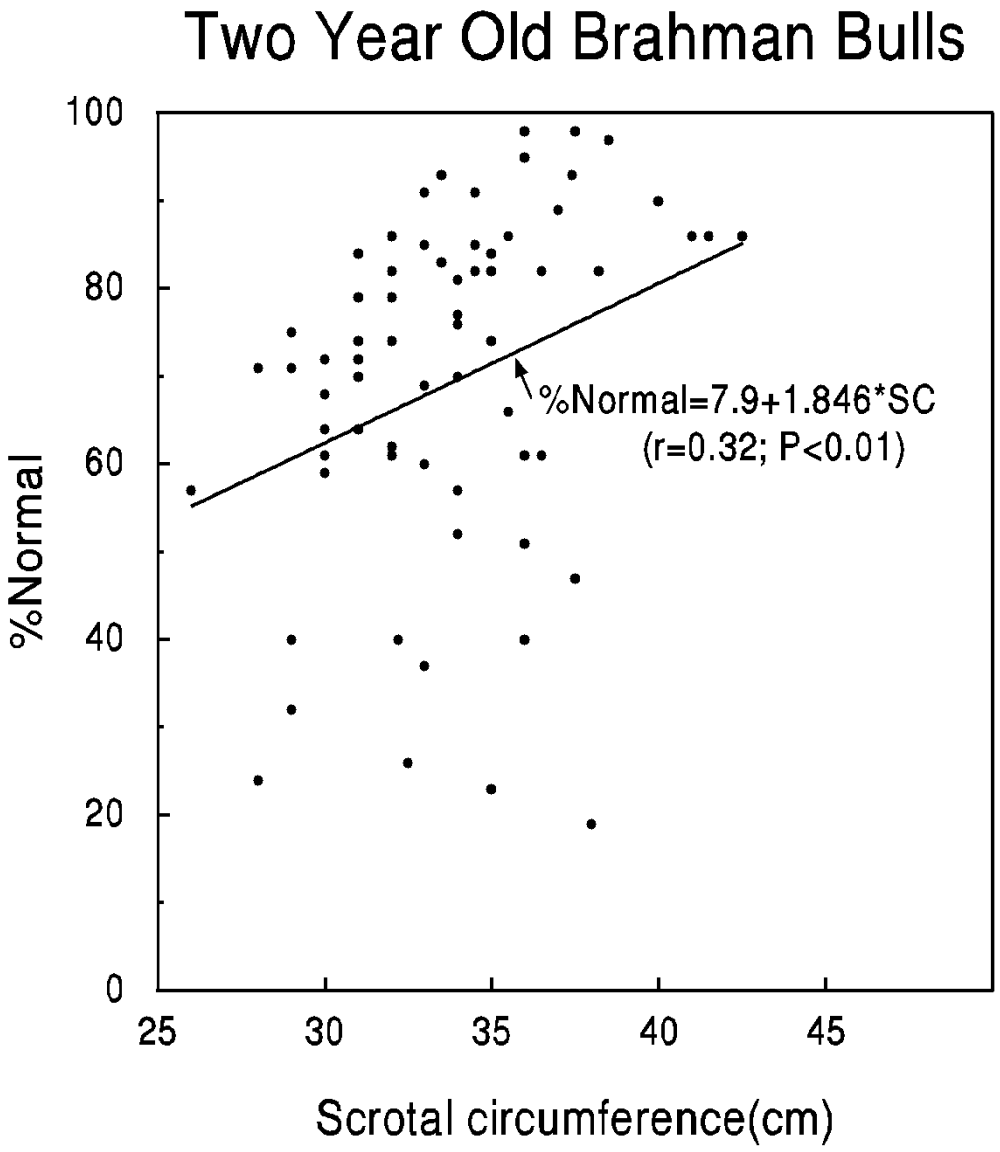


Semen evaluation measures

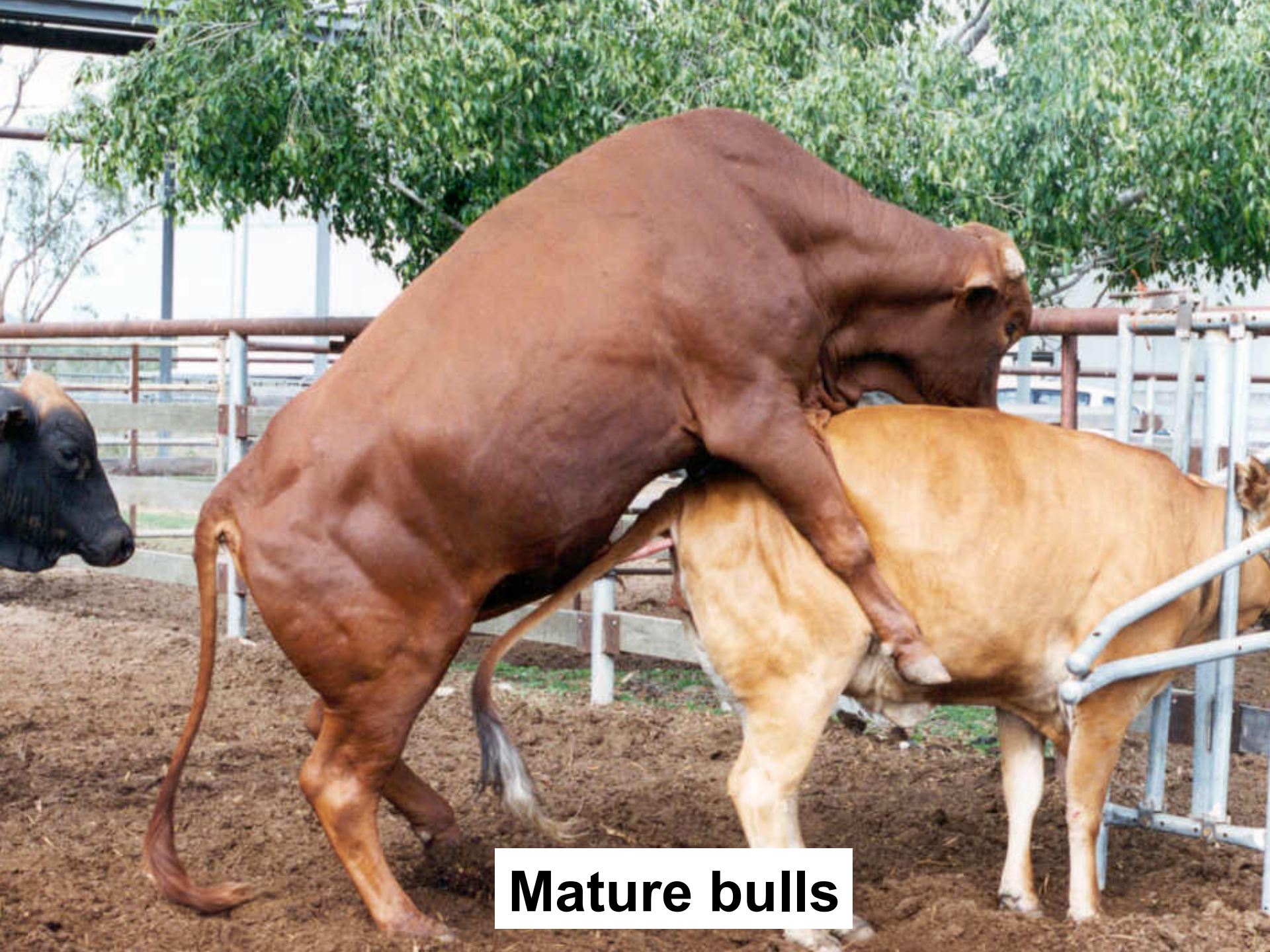
Mass activity 1-5 scale

% Progressively motile = %

Morphology -	Sale bulls	Min. - **70%N**
(% normal)	Annual retest	Min. - **50%N**


Two Year Old Brahman Bulls
100
80
60
40
20
0
%Normal
25
30
35
40
45
Scrotal circumference(cm)
%Normal=7.9+1.846*SC
(r=0.32; P<0.01)

Mating Behaviour


Mature bulls

Genetic relationships between bull fertility measures and daughter fertility

Genetic correlation between male and female traits

Age at puberty

Scrotal size at 12 months showed favourable genetic correlation with age at puberty in females (more in Brahmans)

Percent normal sperm at 18 months and % progressively motile at 18 months favourably associated with earlier puberty in the females

Genetic correlation between bull traits and Age of Puberty of dams with (standard error).

Bull trait	Brahman	Composite
Scrotal 6 mth.	-0.30 (0.11)	-0.30 (0.13)
Scrotal 12 mth.	-0.41 (0.11)	-0.21 (0.11)
% Prog. motile 18 mth	-0.49 (0.20)	-0.38 (0.18)
%Normal 18 mth.	-0.48 (0.21)	-0.24 (0.17)

Genetic correlation between male and female traits
Post-partum anoestrous interval (PPAI)/ LAI; days

- Percent normal sperm in tropical composite bulls at 12 months old was favourably associated with LAI in females.

- Percent normal sperm in bulls at 18 and 24 months was favourably associated with shorter LAI in females (particularly in Brahmans)

Genetic correlation between bull traits and Days to cycling of lactating cows - Lactation anestrus interval of dams with (se).

Bull trait	Brahman	Composite
% Normal sperm 12 months old	NR	-0.34 (0.25)
% Normal sperm 18 months old	-0.52 (0.31)	-0.30 (0.25)
% Normal sperm 24 months old	-0.65 (0.24)	-0.05 (0.20)

Other factors affecting bull fertility

Diseases

Sexual Maturity

Factors influencing the onset of puberty

- Genetic effects
- Nutritional influences

Disease effects on bull fertility

- ✓ Vibriosis
- ✓ Trichomoniasis
- ✓ Leptospirosis
- ✓ Akabane virus
- ✓ Neosporosis
- ✓ Bovine pestivirus
- ✓ Infectious bovine rhinotracheitis (IBR)
- ✓ Ephemeral fever (3 day sickness)
- ✓ Tick fever / Anaplasmosis

What drives genetics ?

What tools can we use ?

i.e. Breed plan selection,
Breed plan data, planned database search,
Genomics and where are we heading ?

Where are we headed – moving forward in the business?

- The genotype of an animal is it genetic makeup
- The environment is all non-genetic factors that influence the animal
  - Nutrition, climate, health, handling
- The phenotype of an animal is the trait as we see it or measure it

The advantage an animal gains from the environment is not passed on to its offspring

$$P = G+E$$

What are genes?

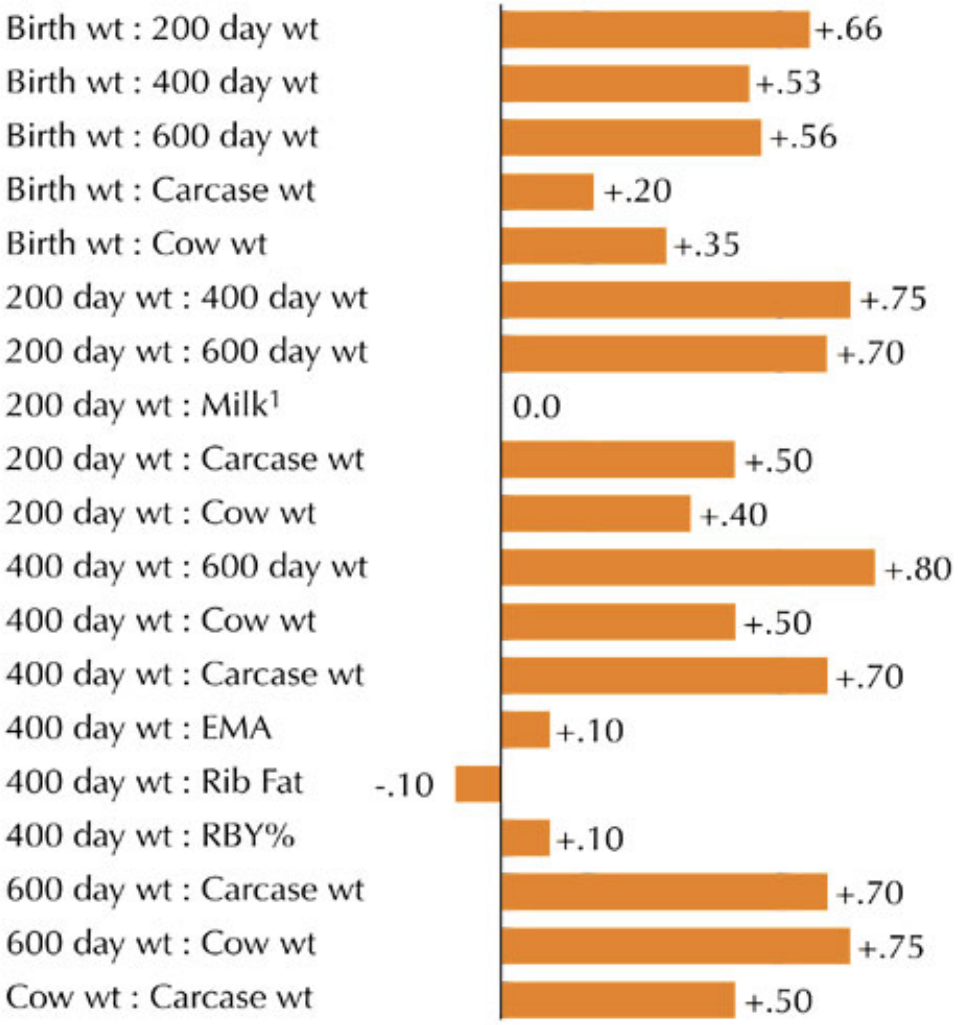
- A gene is a small section of DNA
- Genes are the units of inheritance
- Genes determine traits in the animal
- A number of gene pairs and/or an interaction between different gene pairs determine some traits
- Many genes are linked to form a chromosome

Genetic Principles and Terms

- Single gene effects (complete or partial Dominance)
- Additive gene effects
- Distribution
- Variation
- Intensity of Selection
- Genetic Progress
- Genetic Correlation
- Heritability

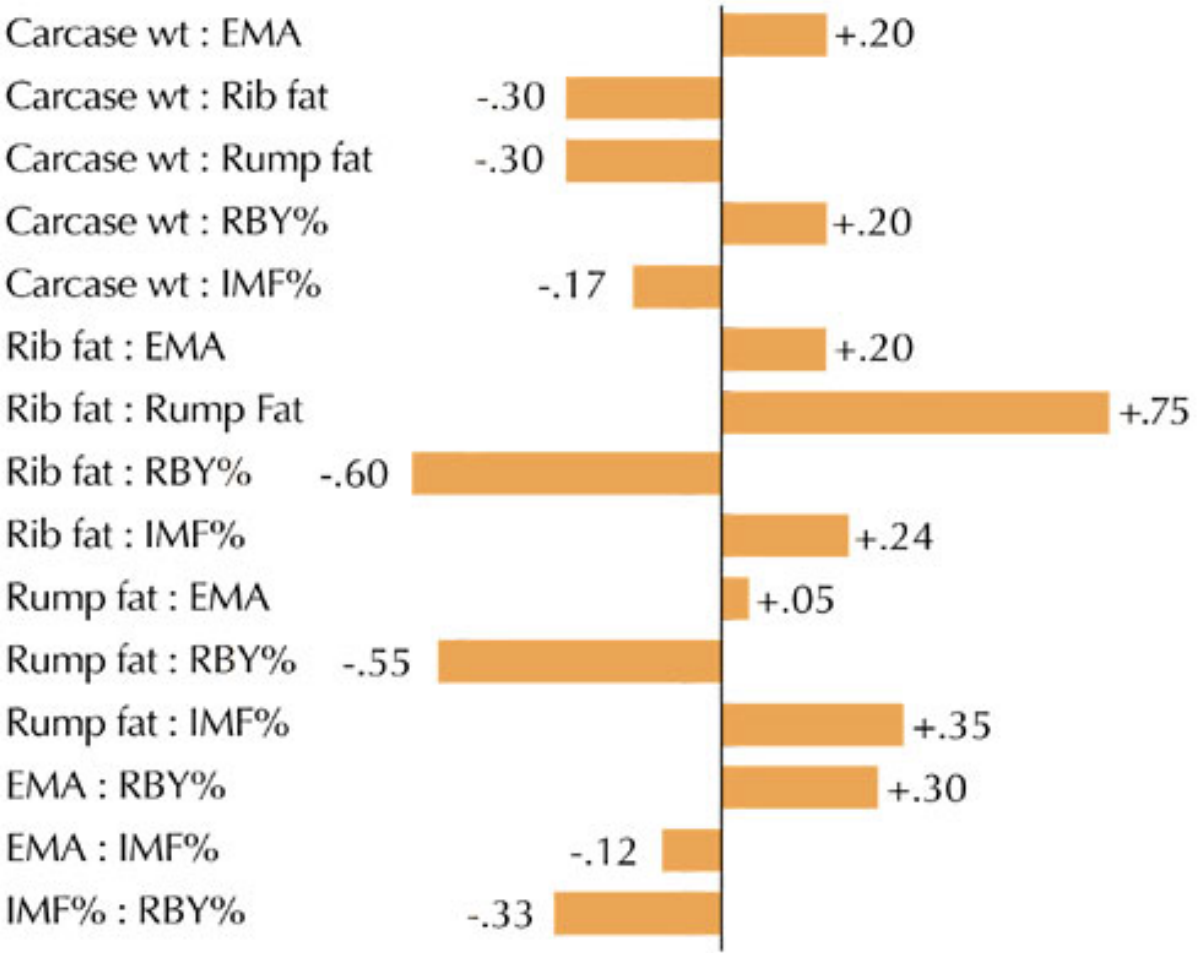
Relationships between traits : Growth traits

Source: Angus Society of Australia 2002



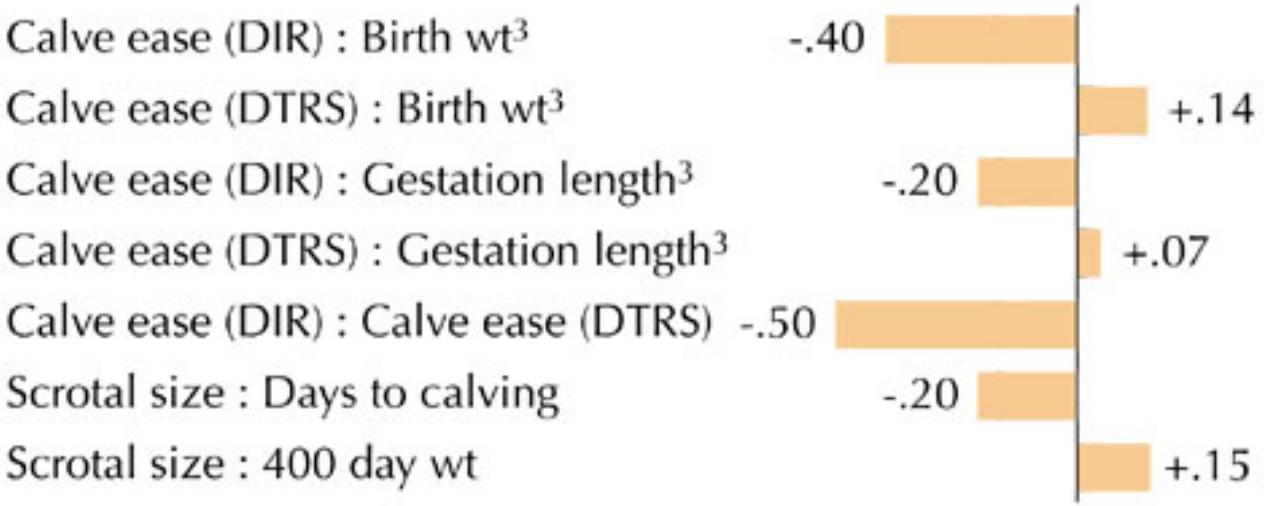
Carcase traits

Source: Angus Society of Australia 2002



Calving ease and fertility traits

Source: Angus Society of Australia 2002



Heritability

- Heritability is the proportion of the measured variation between animals that is attributable to their genetic differences (ie the proportion of parental ability that is passed on to the progeny)

- Different value with each trait and genotype

Heritability of various traits

Trait	Heritability description	Heritability% (BREEDPLAN)*	
		Temperate (AA)	Tropical (BR)
Reproduction			
conception	low	0–5	5–20
days-to-calving	low	0–10 (7)	0–10 (9)
calving ease (heifers)	low–medium	15–50	na
semen quality	low–medium	25–40	6–44
scrotal circumference (18 months)	medium–high	20–50 (39)	28–36 (40)
serving capacity (18 months)	low–high	15–60	na
maternal ability	medium	20–40	na
gestation length	medium	15–25 (21)	(21)
Conformation and growth			
body length	medium	25–45	na
chest girth	medium–high	25–55	na
wither height	medium–high	30–50	na
birthweight	medium	35–45 (39)	35–45 (46)
milk yield	medium	20–25 (10)	(4)
weaning weight	medium	20–30	3–50
200-day weight	medium	(18)	(28)
weight gain — birth to weaning	medium	25–30	16–40
yearling gain (pasture)	medium	30–45	20
400-day weight	medium	(25)	(37)
18 month weight (pasture)	medium–high	40–50	30
600-day weight	medium	(31)	(43)
mature cow weight	high	50–70 (41)	25–40 (39)
dry season gain	medium	na	17–30
wet season gain	low	na	18
Carcase			
carcase weight/day of age	medium	25–45 (36)	(36)
rib Fat (12/13th rib)	medium	(27)	(27)
P8 rump Fat	medium–high	29 (28)	18 (28)
intramuscular fat (IMF%)	medium–high	15 (22)	30 (22)
eye muscle area (EMA)	medium	20–25 (23)	(23)
dressing percent	medium–high	15	37
tenderness	high	4–25	16–30
retail beef yield (RBY%)	high	29 (36)	36 (36)
yield % carcase weight	high	49	52
Other traits			
cancer eye susceptibility	medium	20–40	na
eyelid pigmentation	high	45–60	na
temperament	medium–high	25–50	25–50
tick resistance	medium	na	20–42
worm resistance	medium	na	25–36
buffalo fly resistance	medium	na	20–30

* – BREEDPLAN heritability values for AA (Angus) and BR (Brahman).
na – (not available)
Sources: (a)Hammond, K. (ed.) (1981) (19XX), Selecting Beef Cattle for Maximum Production in the 80s, AGBU, UNE.
(b) Davis, G.P. (1993) Genetic Parameters for Tropical Beef Cattle for Northern Australia. *Aust. J. Agric. Res.*, **44**, pp. 170–198. (c) Robinson, DL., Ferguson, DM. & Skerritt, JW. (1998) Genetic Parameters for Beef Tenderness, Marbling and Yield. Proc. 6th World Congress Genet. App. Livestock Prod.

What influences the rate of genetic change?

- The heritability of the trait
- The variation that exists in that trait
- The intensity of selection
- Genetic correlations between traits
- Generation interval
- Accuracy of selection

Current EBV's available

Growth

- Birth weight
- 200 growth and milk, 400, 600 day weight
- Mature cow weight

Fertility

- Calving Ease – Direct, Maternal
- Gestation Length
- Days to calving
- Scrotal size

Carcase

- Fat depth (P8 and 12/13th rib)
- Eye Muscle Area (EMA)
- Retail Beef Yield (RBY%)
- Intramuscular Fat (IMF%)
- Carcase weight (300kg)

Australian Brahman Breeders Association Animal Enquiry Facility

AUSTRALIAN BRAHMAN | BreedObject - Brahma

www.breedobject.com/society/results.html?show_full=full

Details, Pedigree, Accuracies click on the animal name	ID	Sex	Status	Australian Brahman Breeders Association		Calving Ease		Birth		Growth					Fertility		Carcase					
				Jap Ox Index ($)	Live Export Index ($)	Calv. Ease Direct	Calv. Ease Dtrs	Gest. Len	Birth Wt.	200 Day Wt.	400 Day Wt.	600 Day Wt.	Mat. Cow Wt.	Milk	Scrotal Size	Days to Calv.	Carcase Wt.	Eye Muscle Area	Rib Fat	Rump Fat	RBY%	IMF%
BLACKDOWN 15/16859 (S) (COM)	SCC15/16859M(COM)	M	Active	+$61	+$56	###	###	###	+3	+25	+37	+53	+79	+2	+3.4	-10.2	+30	+1.9	-0.1	-0.4	+0.6	-0.1
BLACKDOWN 15/16869 (P) (COM)	SCC15/16869M(COM)	M	Active	+$54	+$47	###	###	###	+4	+28	+41	+62	+72	+1	+3.2	-3.4	+33	+3.1	-0.3	+1.1	+0.8	-0.2
BLACKDOWN 15/16879 (S) (COM)	SCC15/16879M(COM)	M	Active	+$53	+$49	###	###	###	+4	+29	+42	+59	+71	###	+3.2	-4.8	+32	+2.0	-0.5	-0.9	+0.9	+0.0
BLACKDOWN 15/16862 (P) (COM)	SCC15/16862M(COM)	M	Active	+$53	+$47	###	###	###	+5	+33	+48	+75	+93	+0	+2.0	+0.1	+37	+4.6	-1.0	-0.8	+1.0	-0.2
BLACKDOWN 15/16875 (S) (COM)	SCC15/16875M(COM)	M	Active	+$52	+$45	###	###	###	+4	+29	+40	+59	+69	+1	+2.3	-4.7	+36	+1.7	+0.0	+0.9	+0.6	-0.3
BLACKDOWN 15/16870 (S) (COM)	SCC15/16870M(COM)	M	Active	+$52	+$47	###	###	###	+3	+28	+40	+62	+68	+1	+3.0	-3.0	+29	+3.8	-0.5	+0.1	###	-0.1
BLACKDOWN 15/16877 (S) (COM)	SCC15/16877M(COM)	M	Active	+$51	+$44	###	###	###	+3	+29	+43	+58	+60	+2	+2.8	-4.0	+32	+3.5	-0.1	+1.1	+0.8	-0.2
BLACKDOWN 15/16853 (S) (COM)	SCC15/16853M(COM)	M	Active	+$51	+$46	###	###	###	+5	+35	+49	+72	+92	+2	+2.3	+0.4	+34	+4.9	-1.2	-0.7	+1.3	-0.1
BLACKDOWN 15/16868 (S) (COM)	SCC15/16868M(COM)	M	Active	+$50	+$46	###	###	###	+3	+29	+43	+62	+69	###	+1.9	-3.3	+30	+4.0	-0.8	-0.8	+1.0	+0.0
BLACKDOWN 15/15137 (H) (COM)	SCC15/15137M(COM)	M	Active	+$50	+$44	###	###	###	+4	+32	+46	+62	+64	+0	+1.5	-3.8	+35	+3.2	-0.4	-0.8	+0.9	-0.1
BLACKDOWN 15/16864 (S) (COM)	SCC15/16864M(COM)	M	Active	+$49	+$44	###	###	###	+2	+22	+32	+47	+43	+1	+3.1	-6.8	+27	+1.7	+0.0	+0.7	+0.6	+0.0
BLACKDOWN 15/16836 (H) (COM)	SCC15/16836M(COM)	M	Active	+$49	+$46	###	###	###	+3	+23	+32	+44	+51	+1	+3.5	-7.6	+21	+2.6	+0.2	+0.2	+0.8	+0.0
BLACKDOWN 15/16704 (H)	SCC15/16704M(CR)	M	Active	+$48	+$47	###	###	###	+3	+20	+29	+39	+49	-1	+2.4	-10.3	+20	+1.9	-0.1	-2.1	+0.6	+0.2
BLACKDOWN 15/18356 (H)	SCC15/18356M(CR)	M	Active	+$47	+$44	###	###	###	+3	+23	+31	+42	+48	+1	+2.7	-8.7	+25	+2.1	+0.2	-0.4	+0.5	+0.0
BLACKDOWN 15/18354 (H) (COM)	SCC15/18354M(COM)	M	Active	+$47	+$43	###	###	###	+4	+28	+37	+54	+68	+0	+1.3	-5.0	+30	+4.6	-0.6	-0.7	+0.8	-0.2
BLACKDOWN 15/16692 (H)	SCC15/16692M(CR)	M	Active	+$47	+$46	###	###	###	+4	+25	+35	+47	+65	+0	+3.0	-6.1	+21	+3.7	-0.4	-1.6	+1.0	+0.2
BLACKDOWN 15/16678 (H) (COM)	SCC15/16678M(COM)	M	Active	+$47	+$44	###	###	###	+4	+24	+30	+47	+64	+0	+1.7	-7.6	+27	+1.6	-0.4	-1.5	+0.4	-0.2
BLACKDOWN 15/16781 (H) (COM)	SCC15/16781M(COM)	M	Active	+$46	+$41	###	###	###	+4	+23	+34	+49	+61	-2	+1.6	-5.3	+27	+2.6	-0.2	-0.3	+0.5	-0.1
BLACKDOWN 15/16746 (H) (COM)	SCC15/16746M(COM)	M	Active	+$45	+$43	###	###	###	+2	+24	+31	+34	+29	+2	+2.3	-9.9	+19	+3.7	-0.3	-0.3	+1.2	+0.1
BLACKDOWN 15/15138 (P) (COM)	SCC15/15138M(COM)	M	Active	+$45	+$41	###	###	###	+3	+26	+37	+55	+68	+1	+2.9	-2.0	+28	###	###	-0.5	###	###
Breed Avg. EBVs for 2016 Born Calves				+$25	+$22				+2.6	+18	+25	+35	+40	-2	+0.6	-0.4	+21	+2.4	-0.4	-0.6	+0.5	-0.1

view pedigree and details

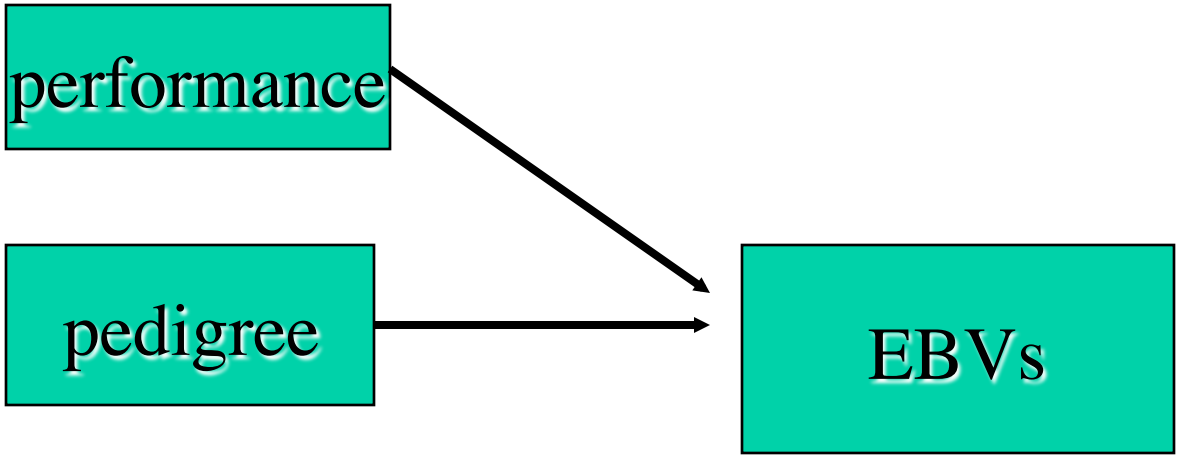
www.breedobject.com/society/animal.html?id=SCC15%2F16859M%28COM%29&b=33&no_sale=1

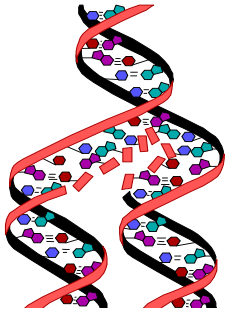
e comparable within a column but usually not between columns

5. Genetics | BreedObject - Brahm... | 2018 Innovative Grazi... | Links | 2:24 PM

Transitioning EBVs to Genomic Breeding Values

Traditional selection uses performance and pedigree to calculate EBVs


performance
pedigree
EBVs



DNA

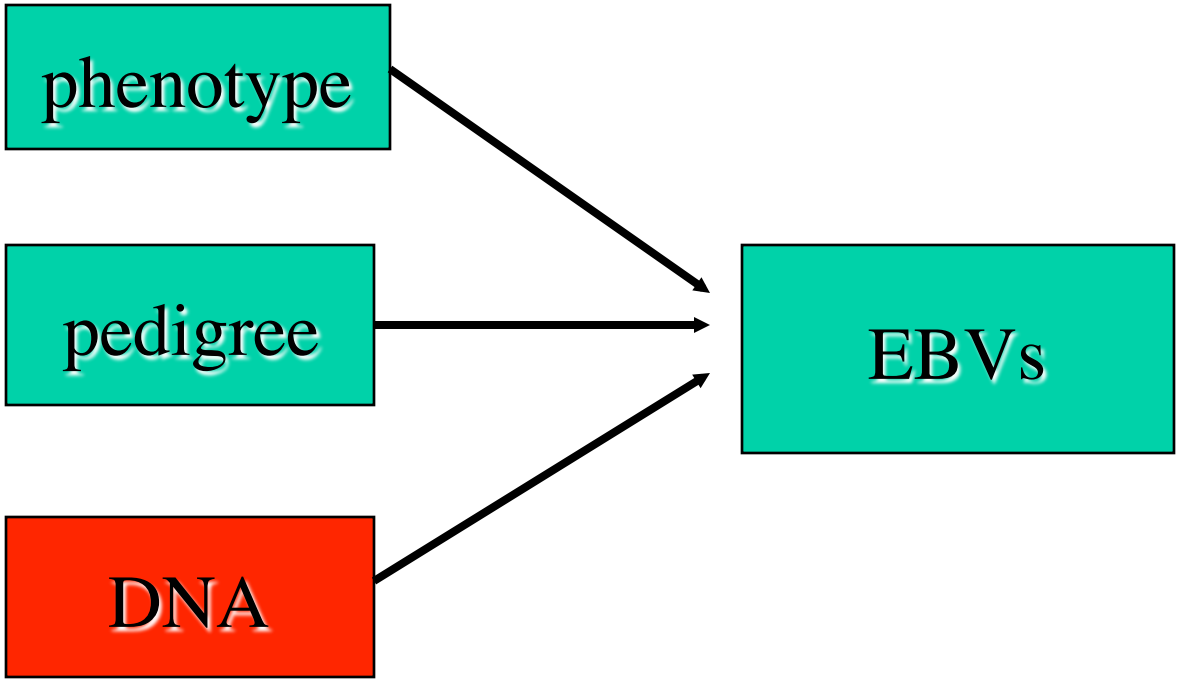
- Deoxyribonucleic Acid
- Blue print for life; a lifetime identification
- In all cells in the body
- Hair sample / follicles easiest sample and convenient storage

DNAfp
36 markers (99.998%)

DNA
Marker assisted selection
10, 18, 50 and 800K SNP technology

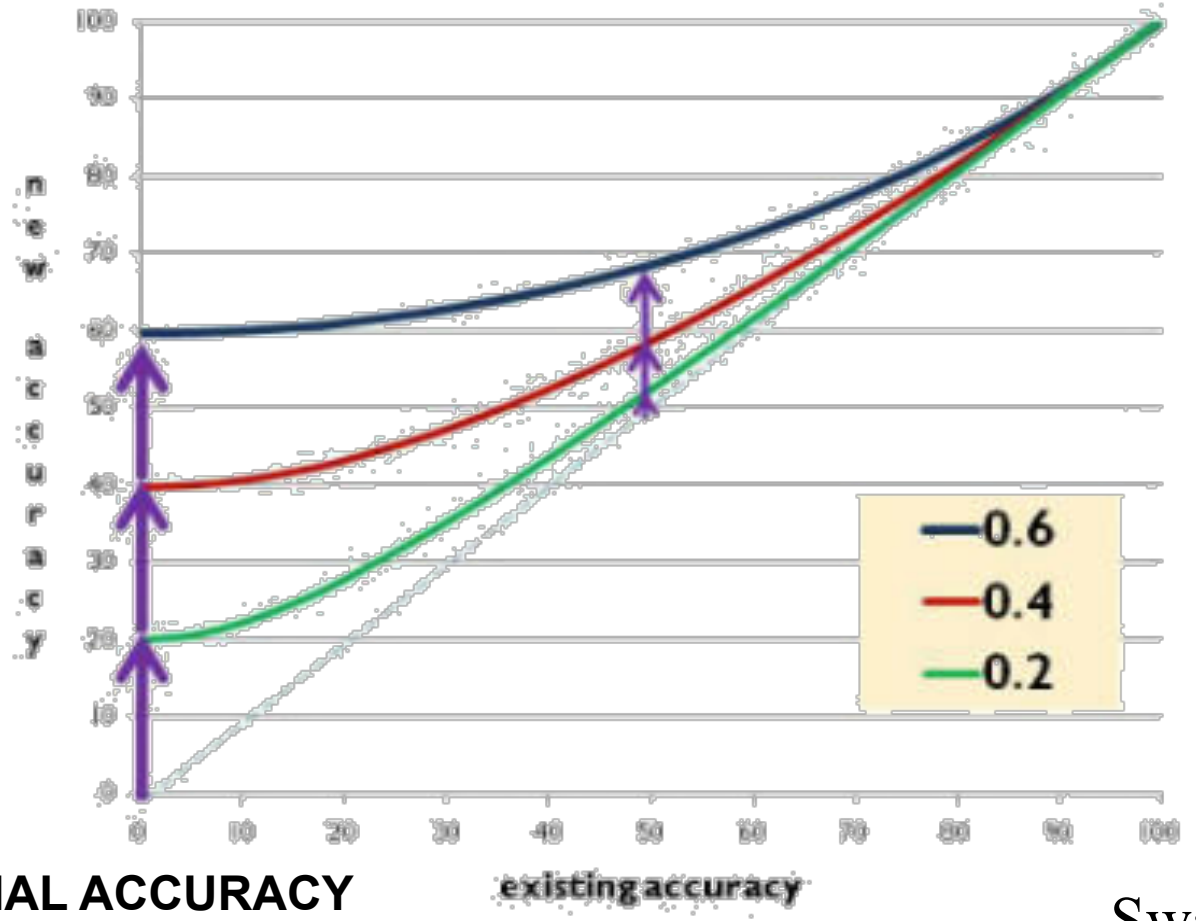
SNP – single nucleotide polymorphism

Adding DNA sequence data to calculate more accurate EBVs



Increase EBV accuracy including genomic predictions (GEBVs)

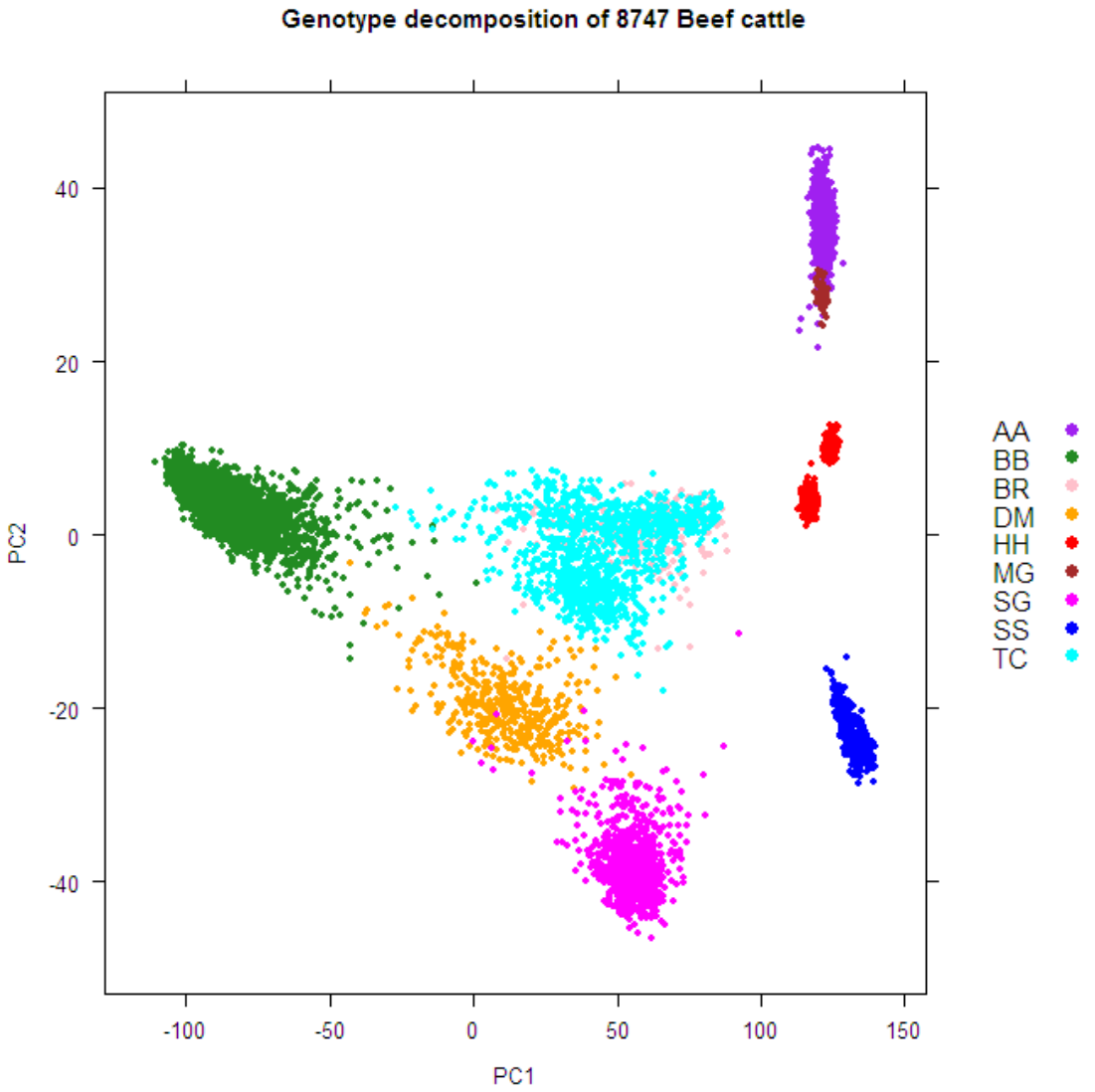
BLENDED EBV ACCURACY



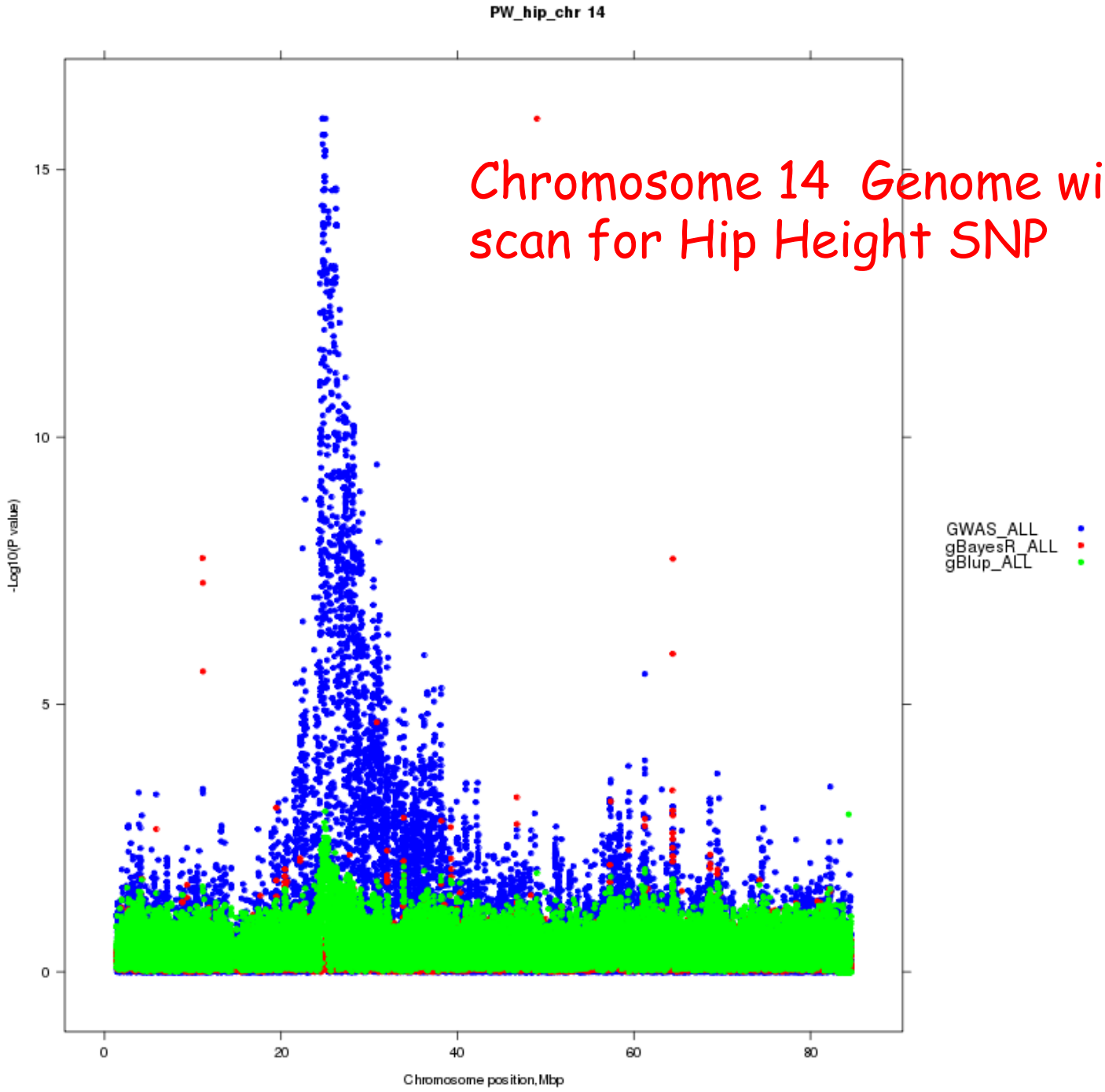
INITIAL ACCURACY

Swan et al

Can we distinguish breeds by SNP genotypes?



Can we find the genes?



Chromosome 14 Genome wide scan for Hip Height SNP

Prediction equations

Predict the trait using all SNPs on the chip

Prediction equation for various breeds: moving rapidly towards a single step GBV and incorporating breed composition and pedigrees

Test the prediction in a different group of cattle (Validation)

Validate in cattle from different sires to those used to find prediction equations

Essential to have ongoing phenotypic measures for various traits to produce GBVs independent of BREEDPLAN

GBVs are more valuable early in life and for hard to measure traits

Where are we heading ?

- Animal protein competitors have moved to a multibreed genetic analyses including genomic testing,
- Beef industry still has a ‘Breed Society’ based mentality – subjective ‘breed selection’ criteria,
- MLA enthusiastic to progress a multibreed genetic analyses – “Tropical Composite Analyses” is the first non-breed aligned genetic analyses available’

Moving forward in the business

- Adoption of currently available information and technologies !
- Any clarification required ??