



Meat quality and thermotolerance in *Bos Indicus* influenced cattle

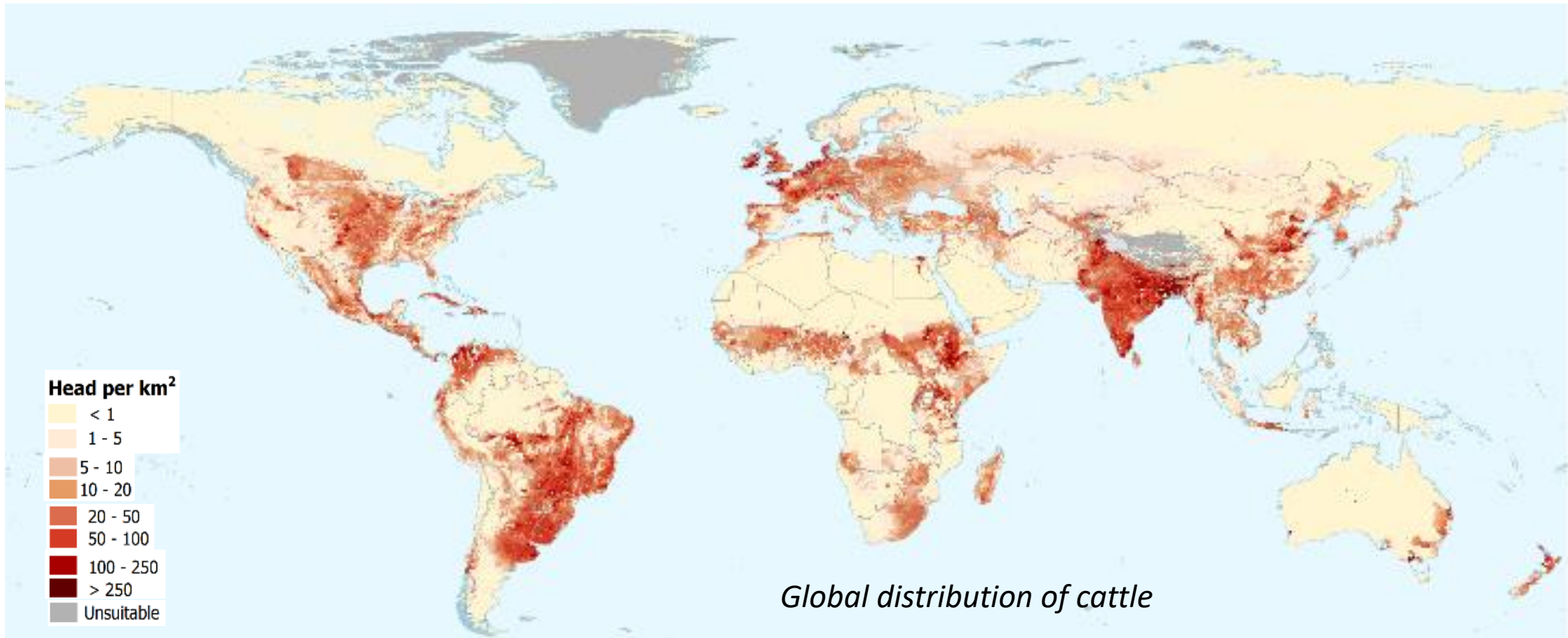
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Department of
Animal Sciences

UF | UNIVERSITY of
FLORIDA

Beef cattle in the world

- > **50%** cattle in the world – maintained in hot and humid environments
 - including ~ 40% of beef cows in US



Bos Indicus cattle

- Approximately **80%** of global beef production is *Bos Indicus* based.

Bos indicus germplasm:

- Critical role in US and worldwide beef production
- Particularly when used as part of a well-structured crossbreeding program



- **Adapted to heat and humidity**
- **Resistant (or at least tolerant) to internal and external parasites**
- **In crossbreeding systems produce improved cattle:**
 - Fertile
 - Gain well
 - Long lived

Two areas of interest

Meat Quality

- Top priority for beef industry
 - Great power to influence demand
 - Can be improved
- V. important for *B. indicus* crosses
 - Routinely penalized for relatively **low marbling** score.
 - Routinely penalized for **perceived** inadequate **tenderness**

Thermotolerance

- Climatic stress - major limiting factor of production efficiency
- Genomic tools can help select
 - Animals with superior ability for both **thermal adaptation** and **food production**
 - Energy-efficient, **sustainable** approach to meet the challenge of global climate change.

A decorative border consisting of a repeating DNA double helix pattern in red and blue, framing the central text. The background is white with a blue rectangular area containing the text.

Meat quality

Meat Quality



USDA grading system

Based on marbling
and maturity

Limited in predicting
eating quality

Tenderness

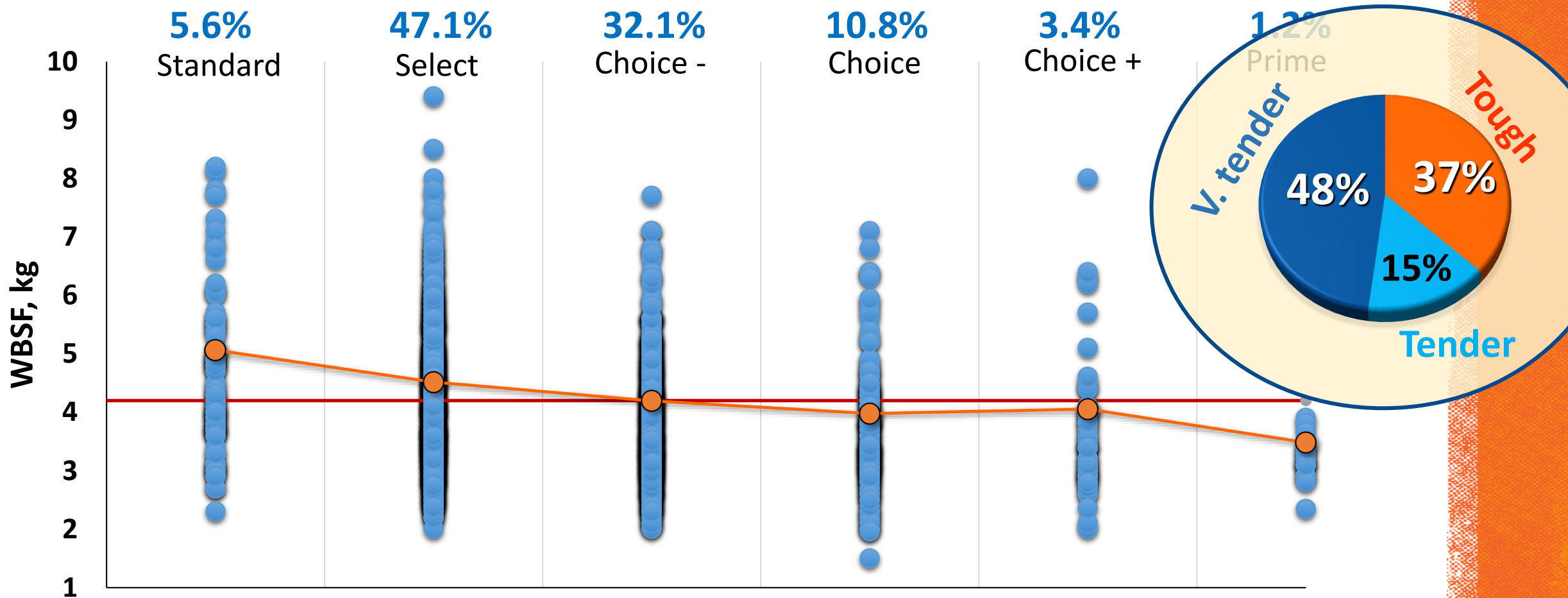
Genomic Tests

Developed on
B. Taurus data

Limited prediction in
B. Indicus -influenced

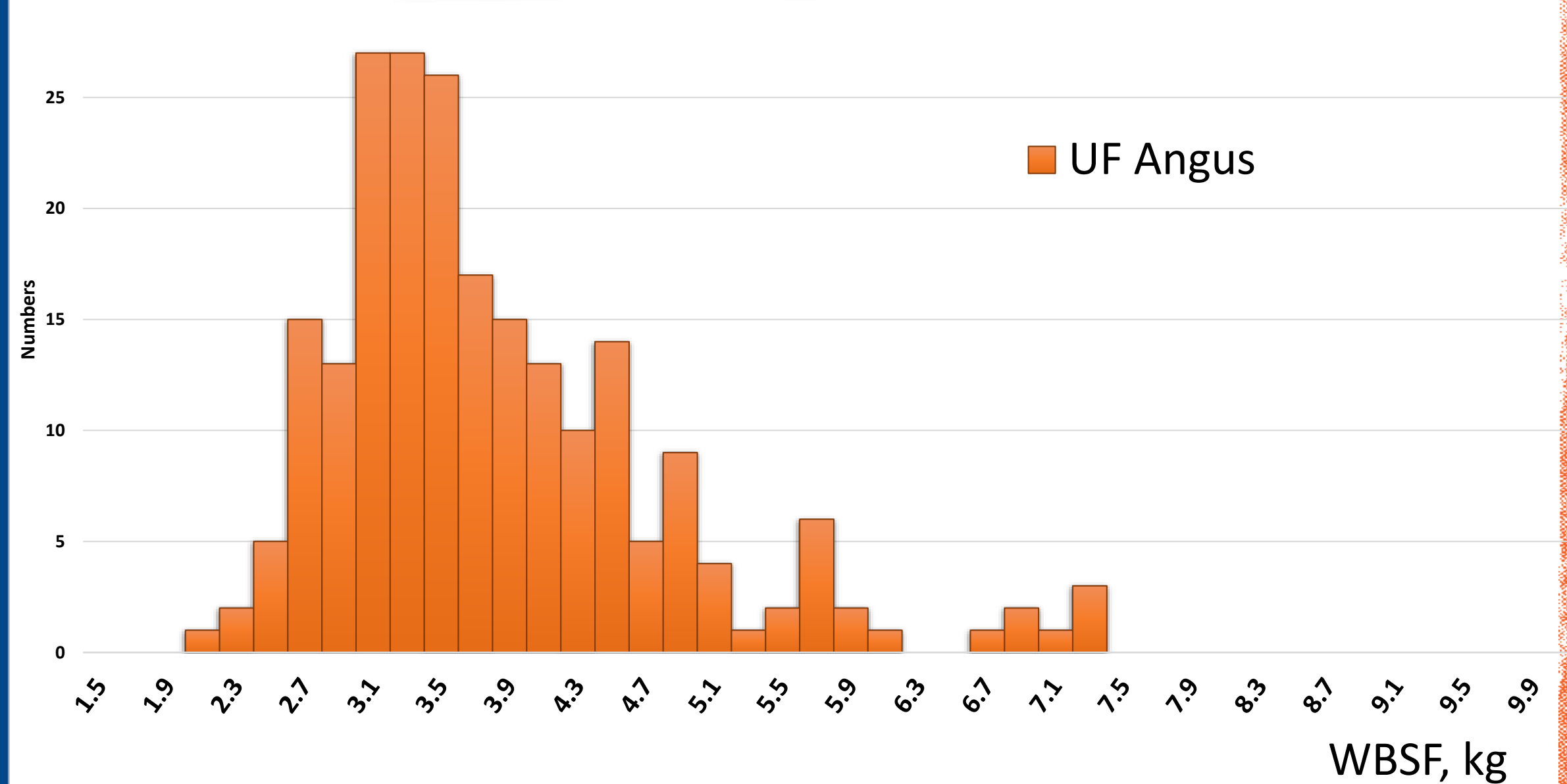
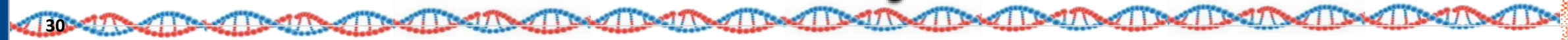
Need to be
breed specific

Tenderness by USDA Quality Grade

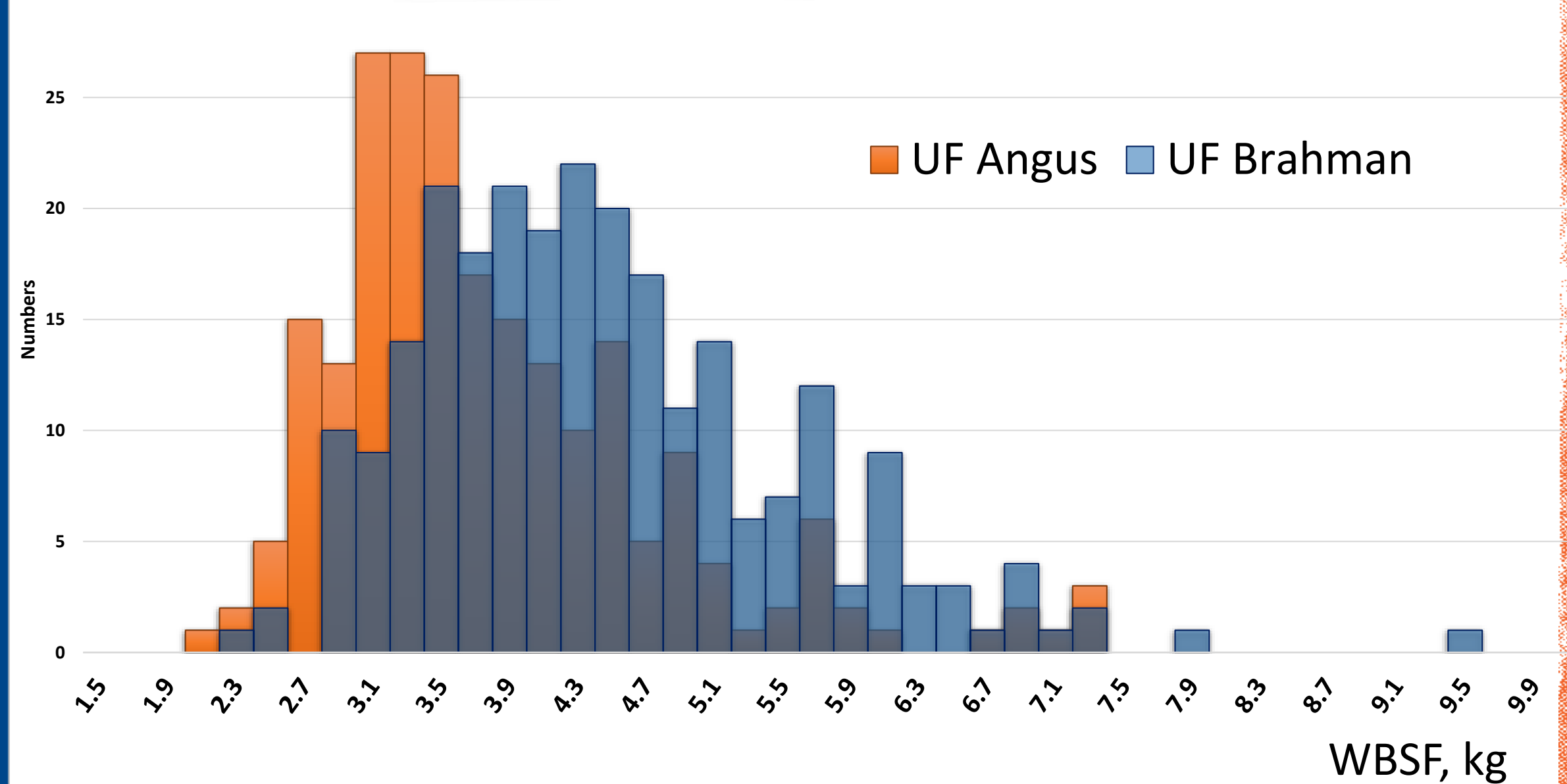
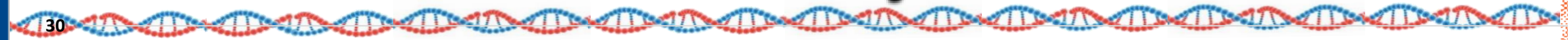


UF MAB
(N = 1,366)

Variation in WBSF – by breed



Variation in WBSF – by breed



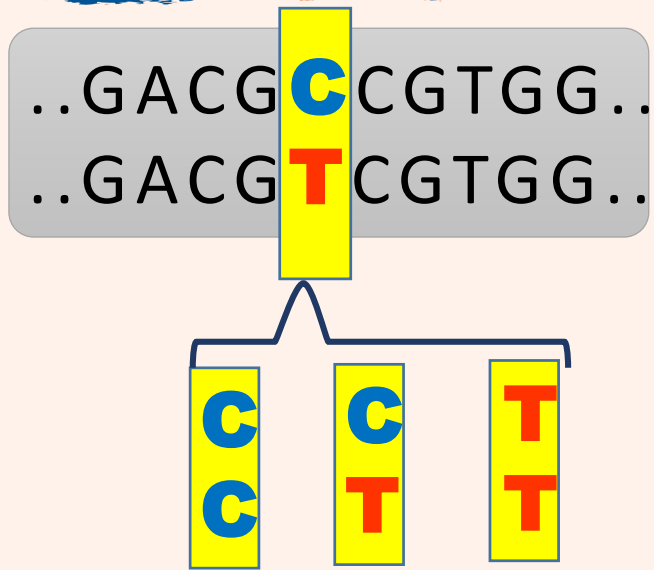
A decorative border consisting of a repeating DNA double helix pattern in red and blue, framing the central text.

Genetic tests Tenderness

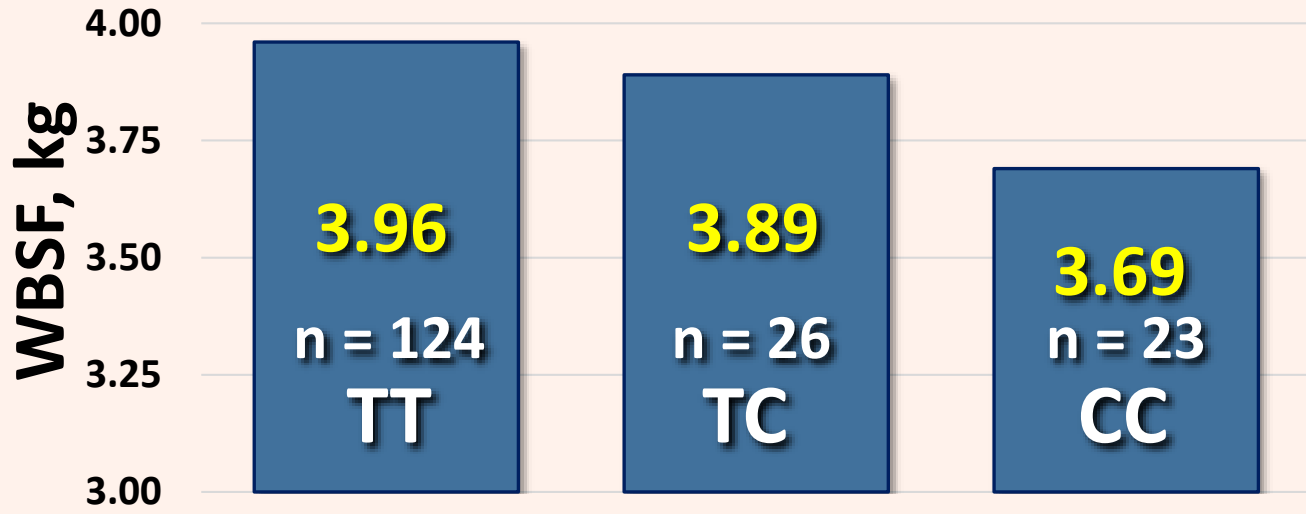
Genomics Tests

UF Angus, n = 153

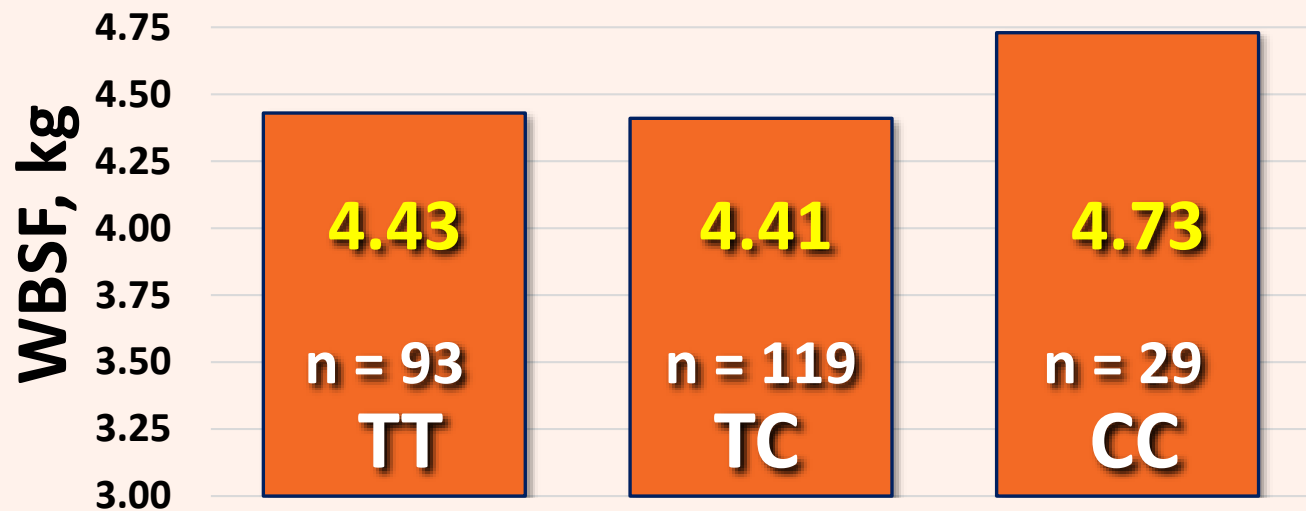
SNP – genetic marker



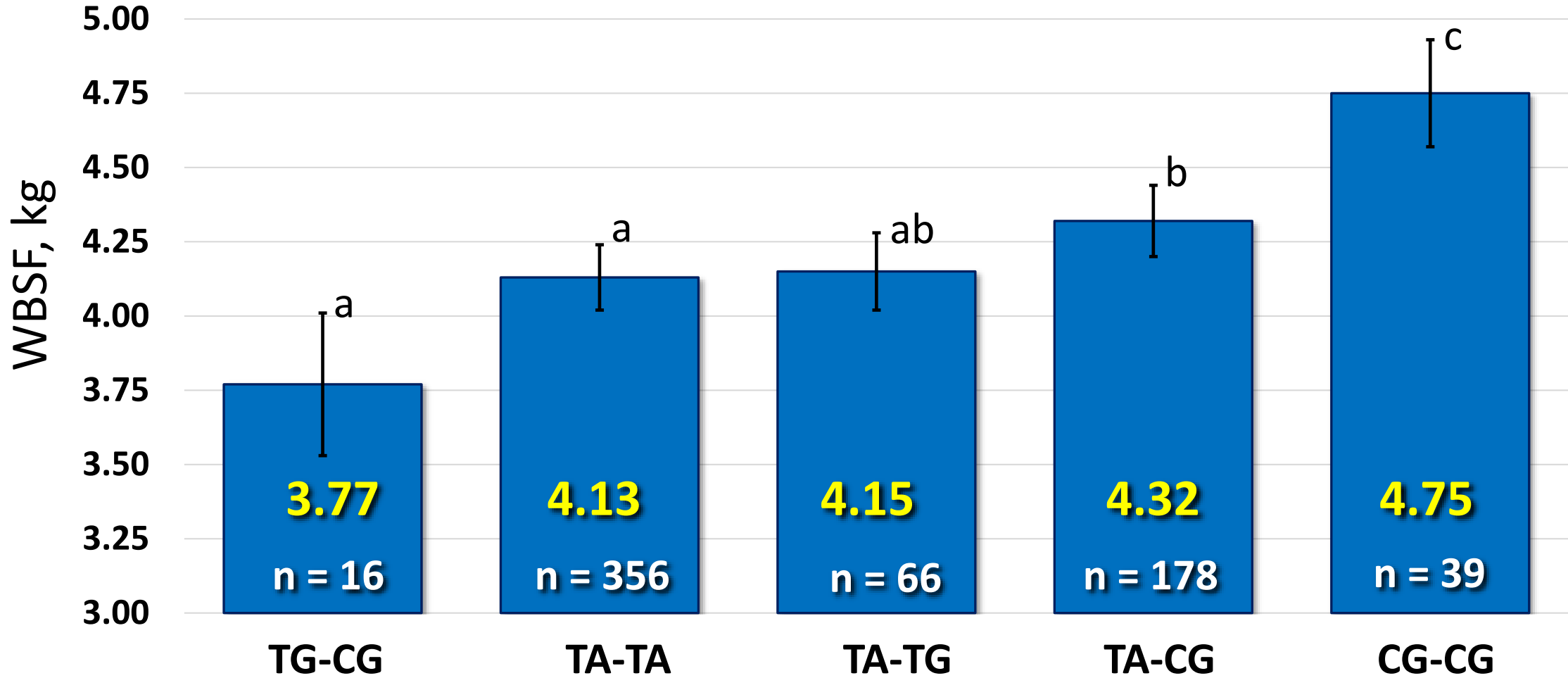
3 possible genotypes



UF Brahman, n = 241



Combination of markers in calpastatin



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Thermo- tolerance



In response to heat stress, cattle will regulate:



Heat Production

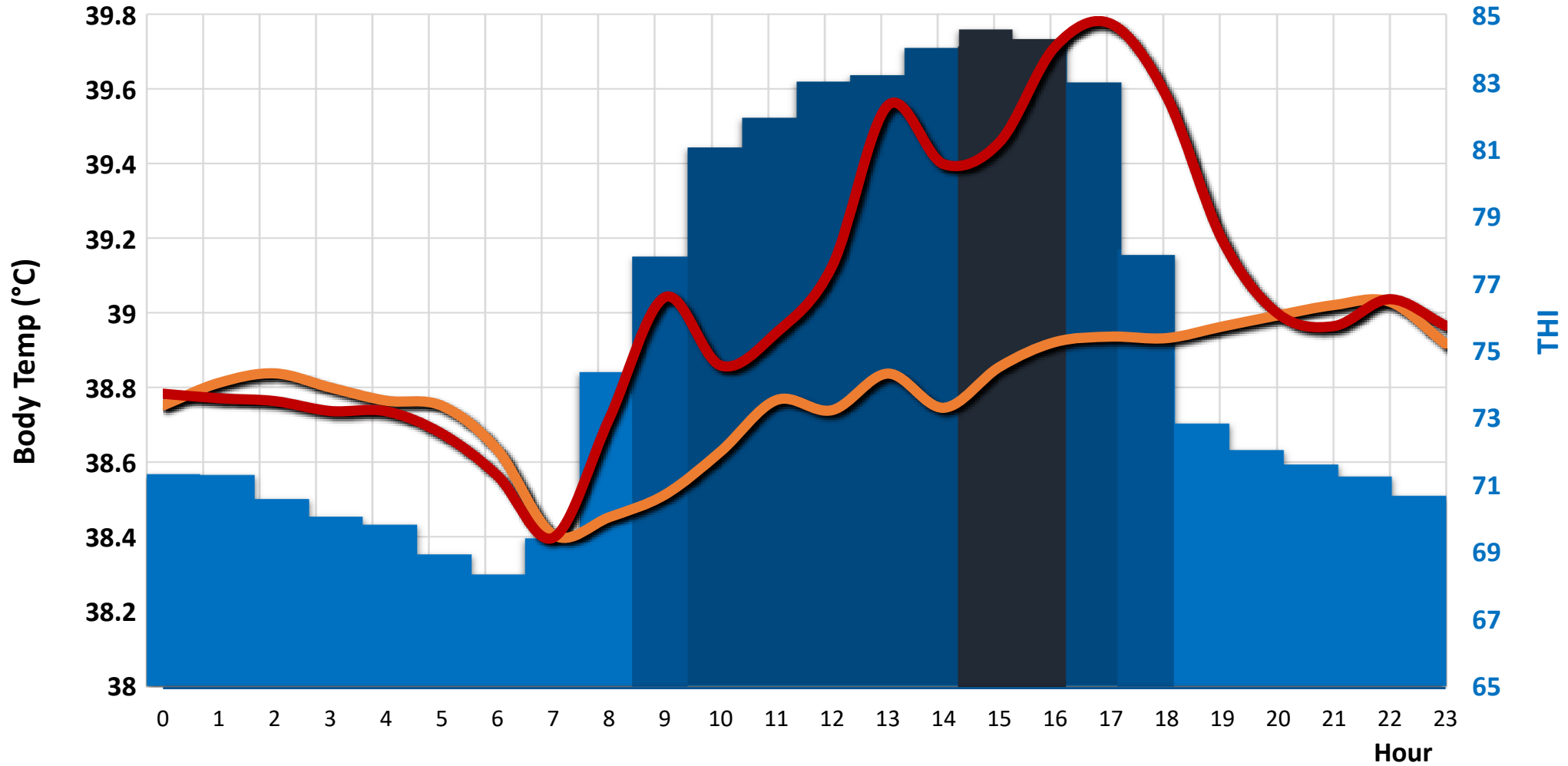
- Modulating basal metabolic rate
- Changing: feed intake, growth, lactation, activity

Heat Exchange

- Blood flow to the skin
- Evaporative heat loss through sweating & panting

Goal: Develop genomic tools to select for superior ability for both thermal adaptation and food production.

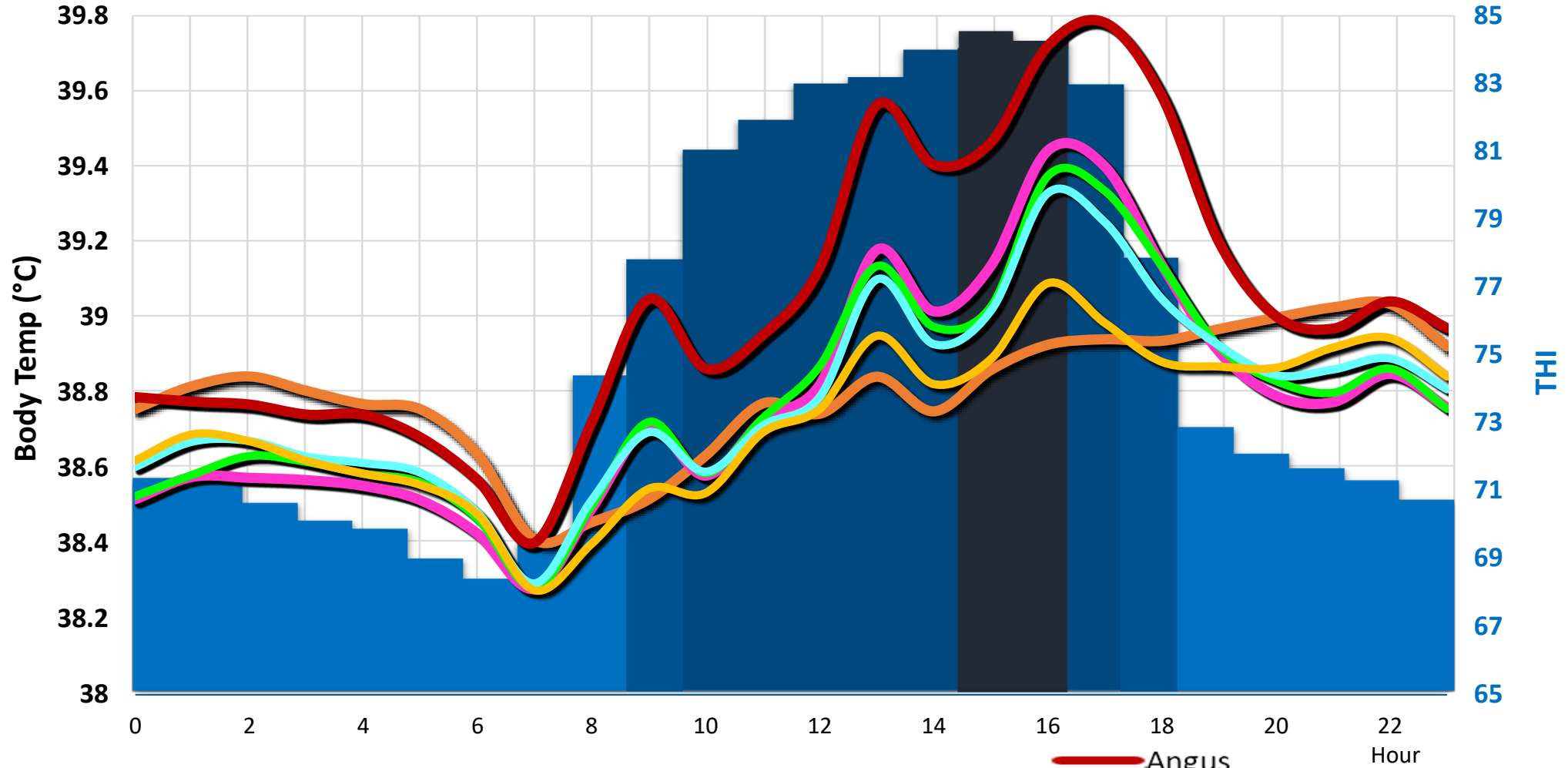
Breed effect on body temperature



vagtmp every 15 min by day - REPEATED with cov structure type = ARH(1)

- ≥ 84 ■ Critical heat stress
- 79 - 83 ■ Major heat stress
- 75 - 78 ■ Moderate heat stress
- ≤ 75 ■ Minimal heat stress
- Brahman
- Angus

Breed effect on body temperature



vagtmp every 15 min by day - REPEATED with cov structure type = ARH(1)

- | | | |
|-----------|------------------------|-----------|
| ≥ 84 | ■ Critical heat stress | — Angus |
| 79 - 83 | ■ Major heat stress | — 75A |
| 75 - 78 | ■ Moderate heat stress | — Brangus |
| ≤ 75 | ■ Minimal heat stress | — 50A |
| | | — 25A |
| | | — Brahman |

Factors important in thermotolerance

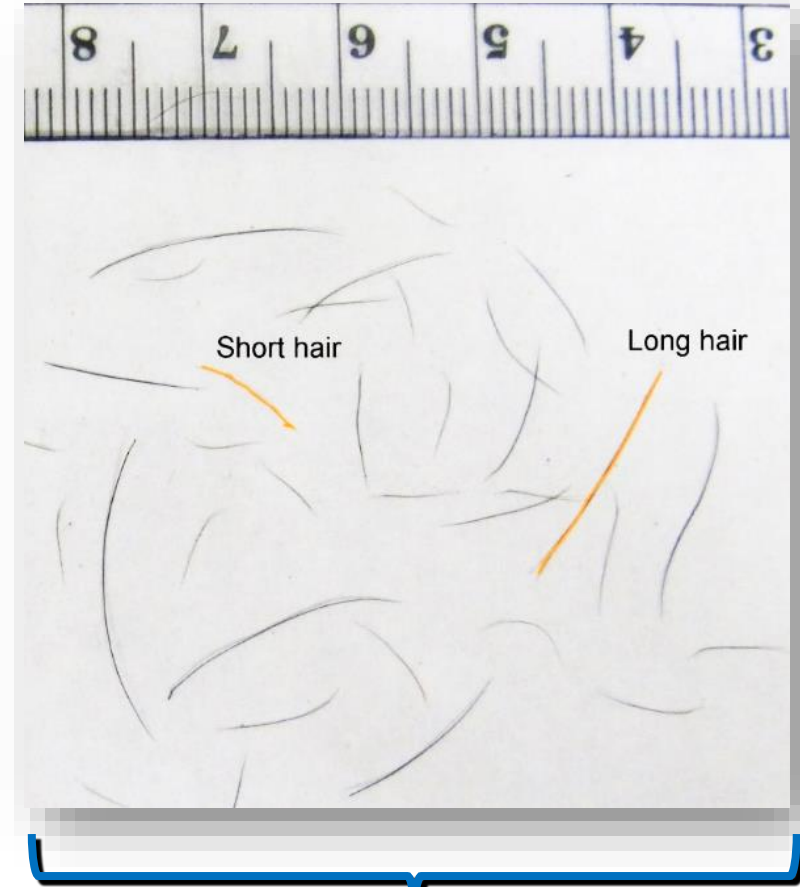


Coat
Hair



Sweat
Glands

Other
Skin Prop.

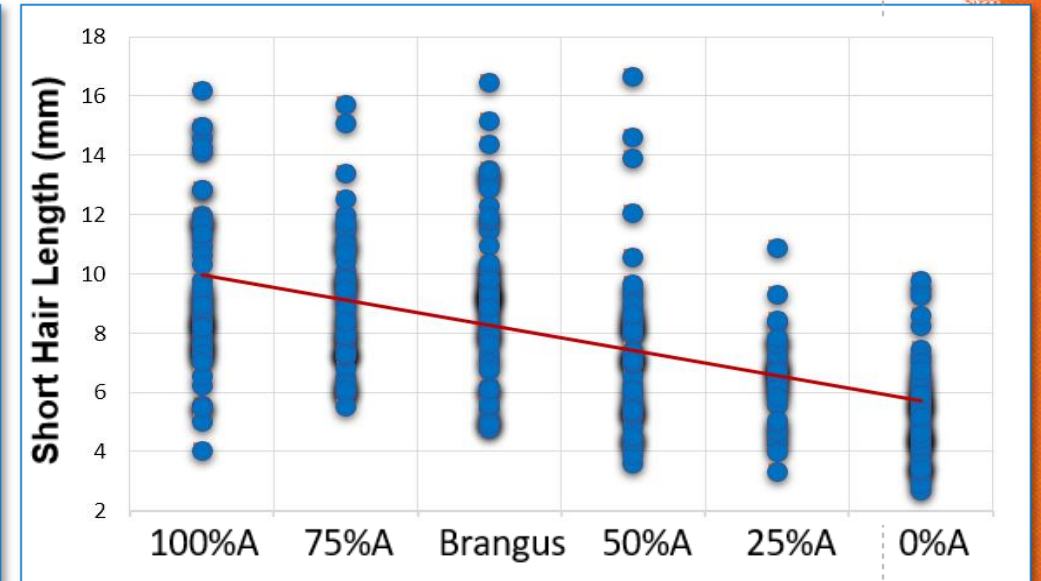
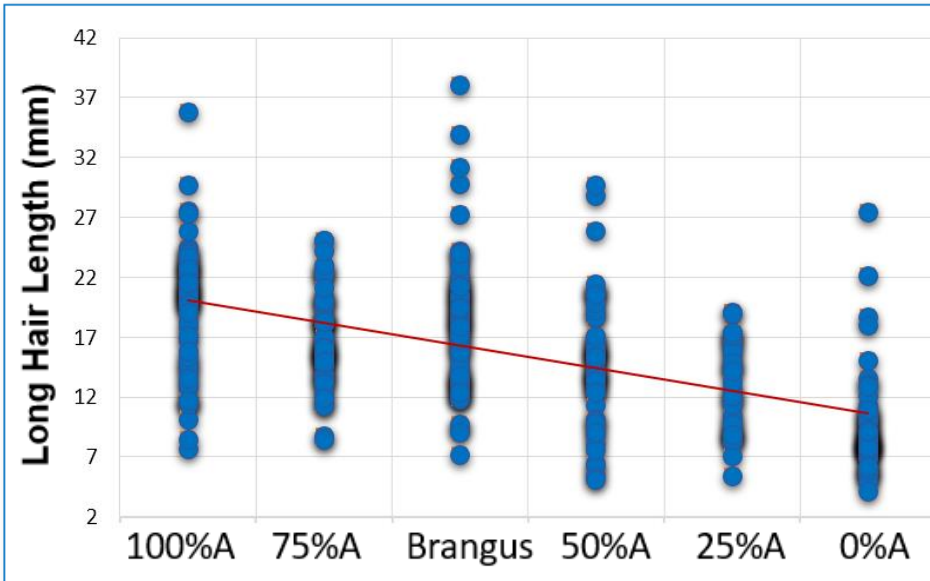


Long Hair Length
Long Hair Diameter
Short Hair Length
Short Hair Diameter

Factors important in thermotolerance

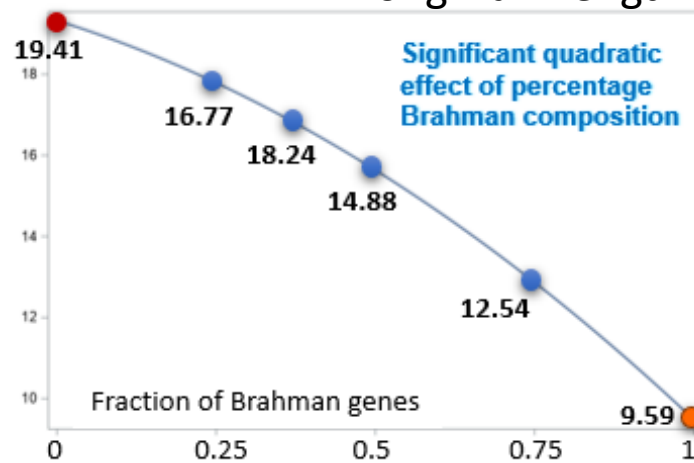


Coat
Hair

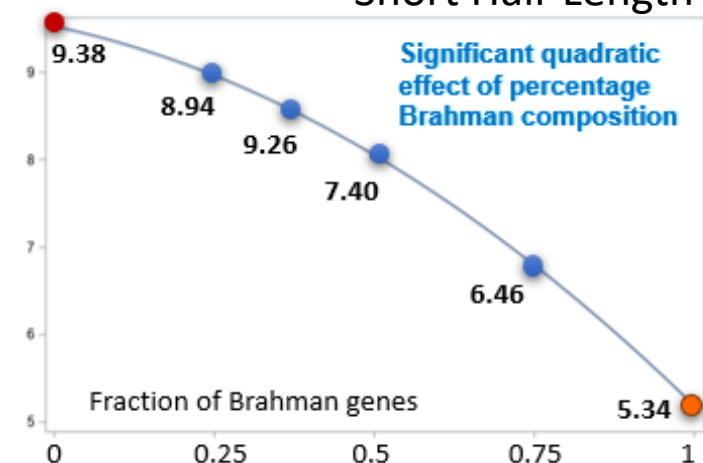


Sweat
Glands

Long Hair Length



Short Hair Length



- Angus
- Brahman

Other
Skin Prop.

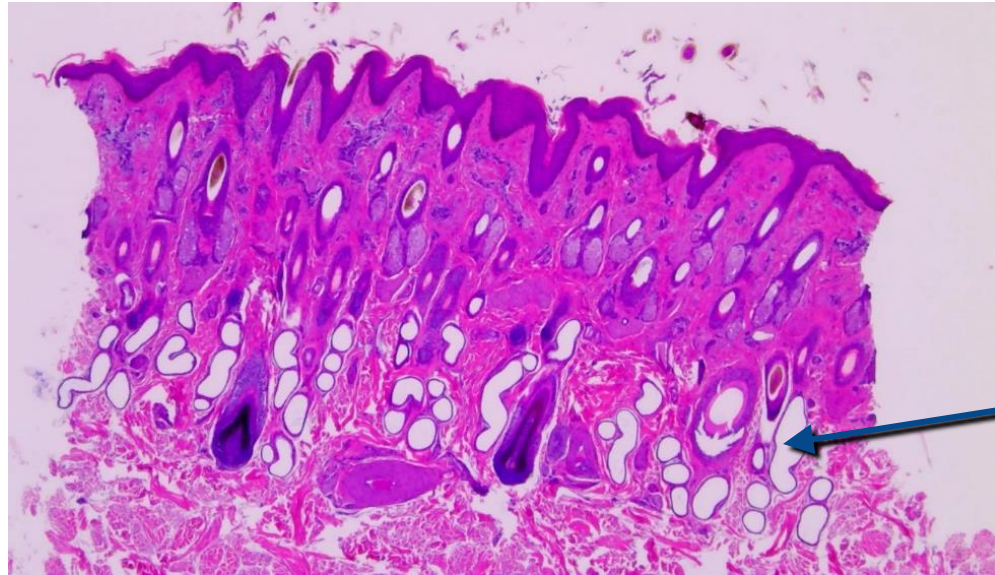
Factors important in thermotolerance



Coat
Score

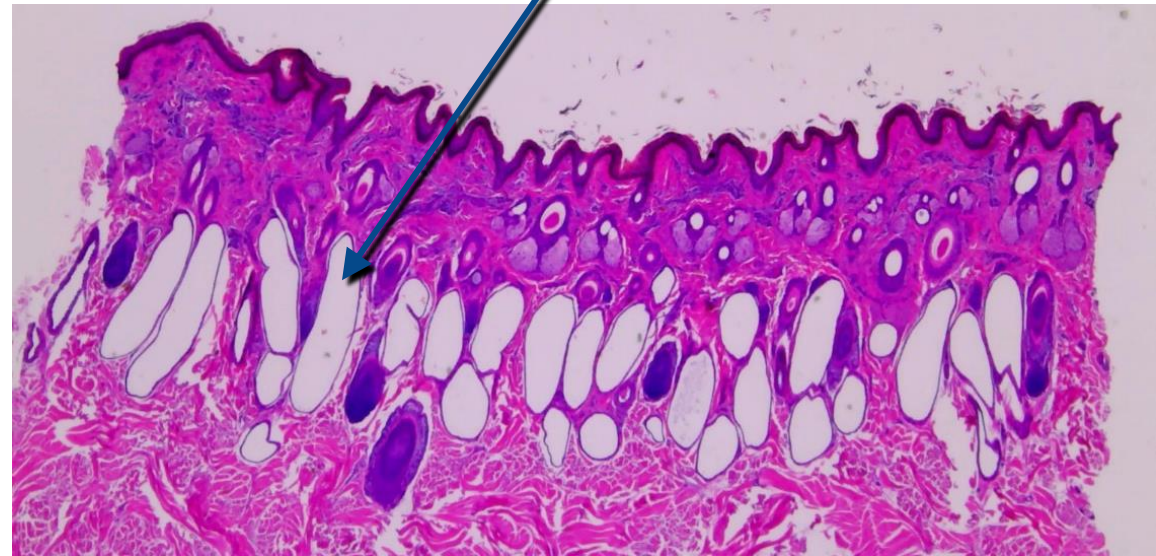
Sweat
Glands

Other
Skin Prop.



Angus

Sweat Glands



Brahman

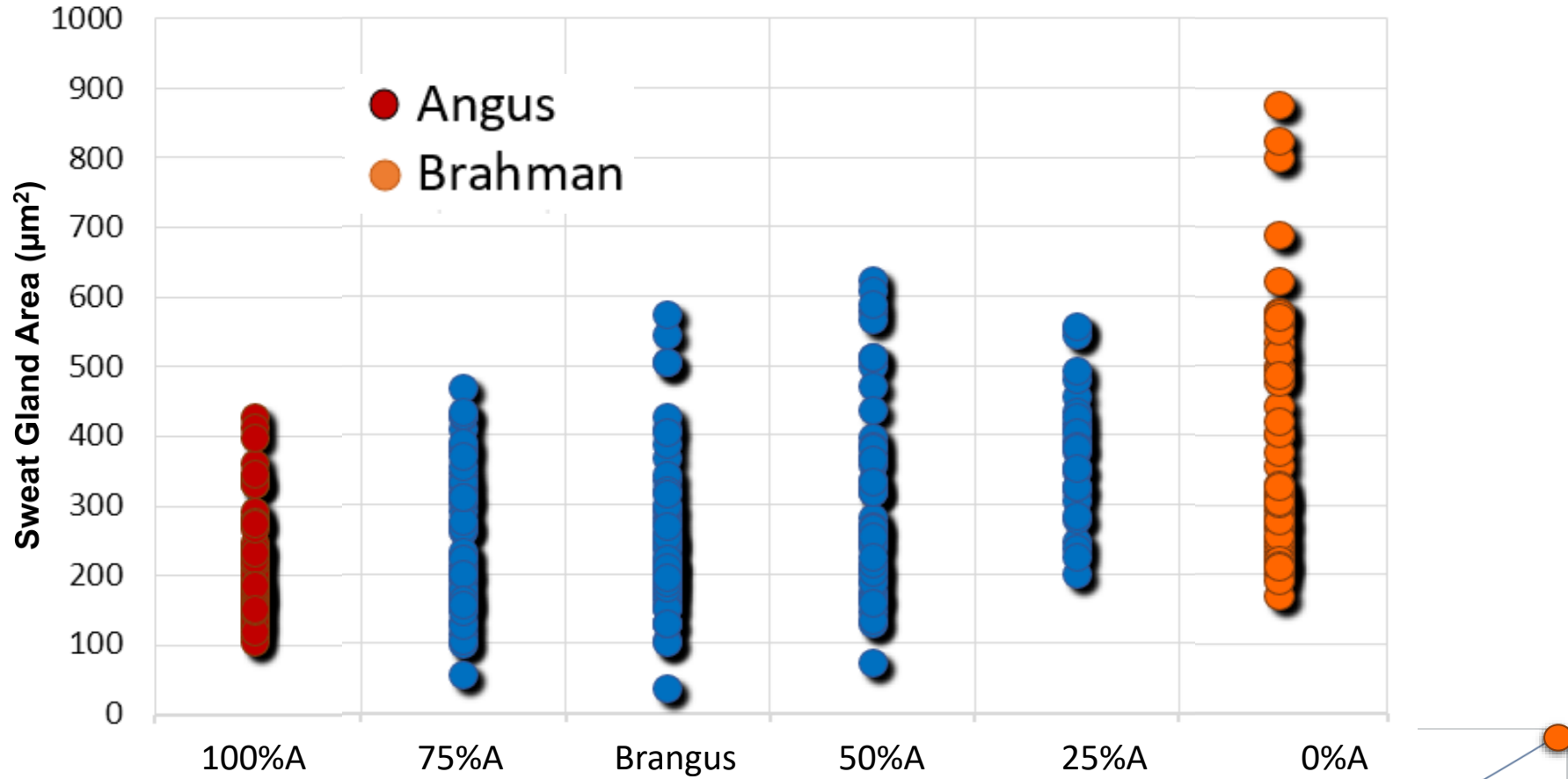
Factors important in thermotolerance



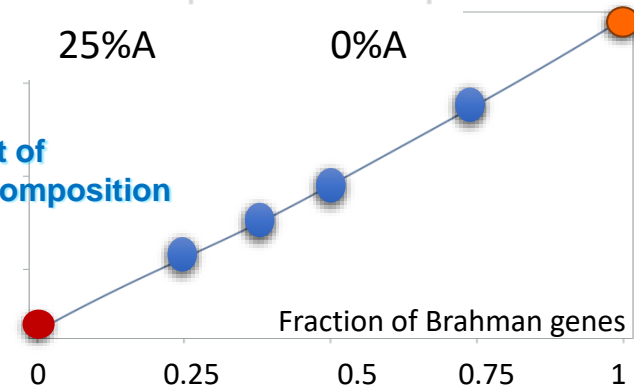
Coat Score

Sweat Glands

Other Skin Prop.



Significant linear effect of percentage Brahman composition



Factors important in thermotolerance



Coat
Score

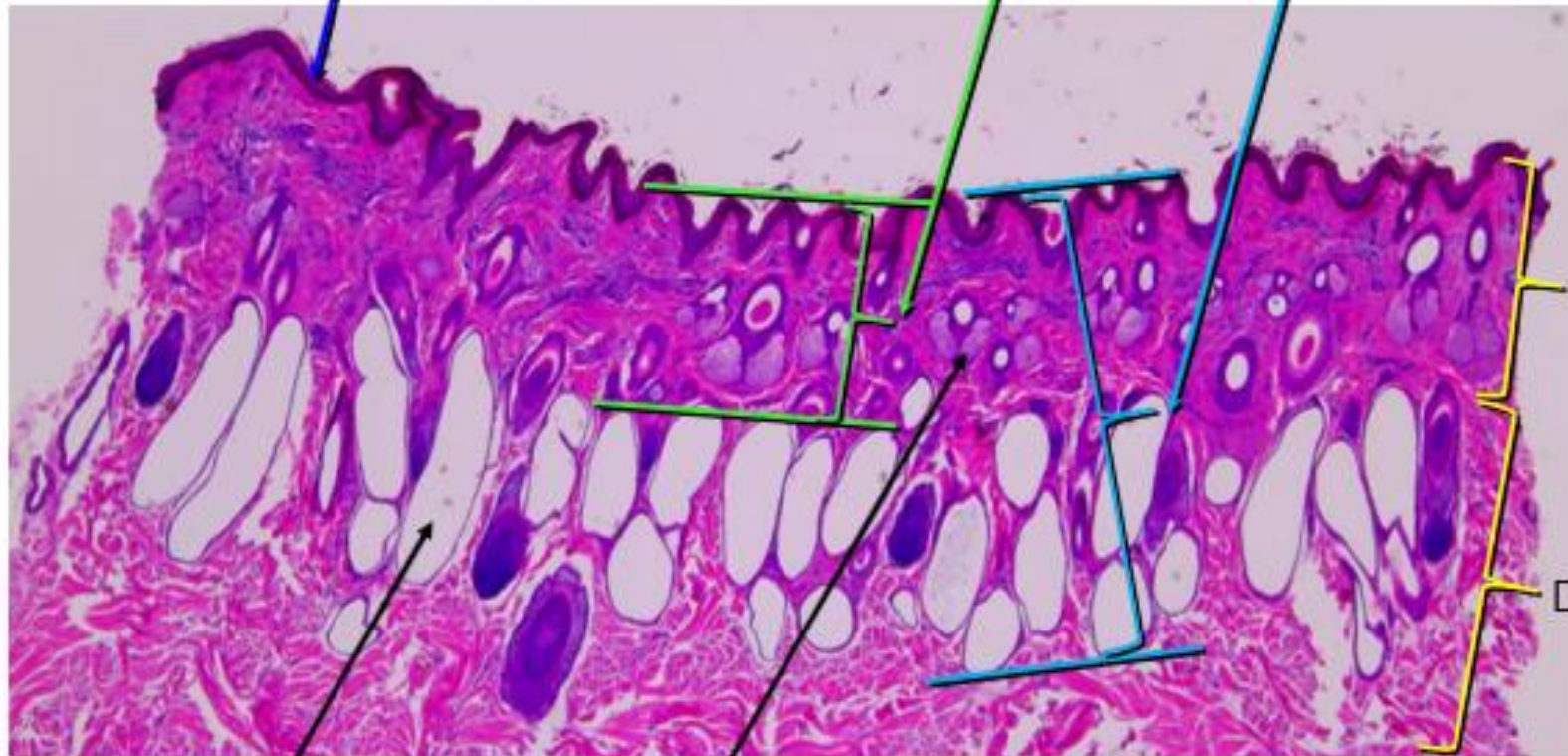
Sweat
Glands

Other
Skin Prop.

Skin Thickness
(stratum corneum,
spinosum and basale)

Distance top of
SG to skin surface

Distance bottom of
SG to skin surface



Epidermis

Dermis

Sweat
gland (SG)

Sebaceous
gland

Skin Histology

Take-home points



Meat Quality

- The USDA grading system (marbling and maturity) - limited in predicting eating quality (**tenderness**).
- Existing genomic tests, developed mostly on *Bos Taurus* data, are not predictive in our **Brahman** influenced cattle populations.

Thermotolerance

- Selection for production ignoring **adaptability** = animals more sensitive to heat stress
- Variation in **coat** and **skin** properties = allows selection for increased thermotolerance without affecting production.

Population Specific Genomic Tools

Acknowledgments

University of Florida

- Dr. Pete Hansen
- Dr. Mauricio Elzo
- Dr. Dwain Johnson
- Dr. Tracy Scheffler
- Dr. Jason Schaffler
- Dr. Serdal Dikmen
- Danny Driver
- Michelle Driver
- Joel Leal, Heather Hamblen, Sarah Flowers, Kaitlyn Sarlo, Mesfin Gobena, Eduardo Rodriguez, Zaira Estrada
- Adriana Zolini, William Ortiz, Samantha Eifert, Lauren Peacock, Alexa Chiroussot

Seminole Tribe of Florida

- Alex Johns
- Phillip Clark
- Sheri Holmes
- Bobby Yates
- Mike Ciorocco
- Dayne Johns, etc.



Financial Support

- USDA-NIFA Grant 2017-67007-26143
- UF Agricultural Experim. Station
- UF ANS Hatch Project
- Seminole Tribe of Florida
- Brangus Breeders Association
- Florida Beef Council
- Florida Cattlemen's Association



United States Department of Agriculture
National Institute of Food and Agriculture

