Utilizing reproductive management and technologies to enhance production efficiency in beef cattle operations

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Overview

- Introduction
- Early reproductive management technologies
- Current reproductive technologies
- Impact of reproductive technologies on cattle production
- Future opportunities for reproductive technologies
- Summary

Introduction

Early reproductive management developments

- Castration
- Removing genetically inferior bulls
- Breeding season management
- Diagnosis of pregnancy
- Weaning

Introduction

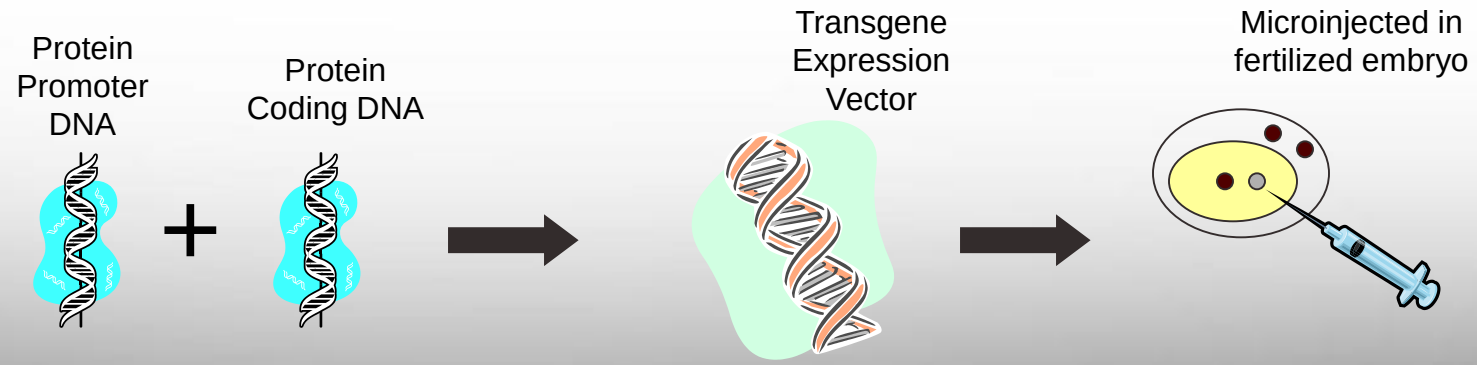
Recent reproductive management developments

- Artificial insemination (AI)
- Estrous synchronization (ES)
- Fixed-time AI (FTAI)
- Multiple ovulation and embryo transfer (MOET)
- *In vitro* fertilization
- Sex determination of semen and embryos
- Nuclear transfer
- Reproductive ultrasound diagnoses

Introduction

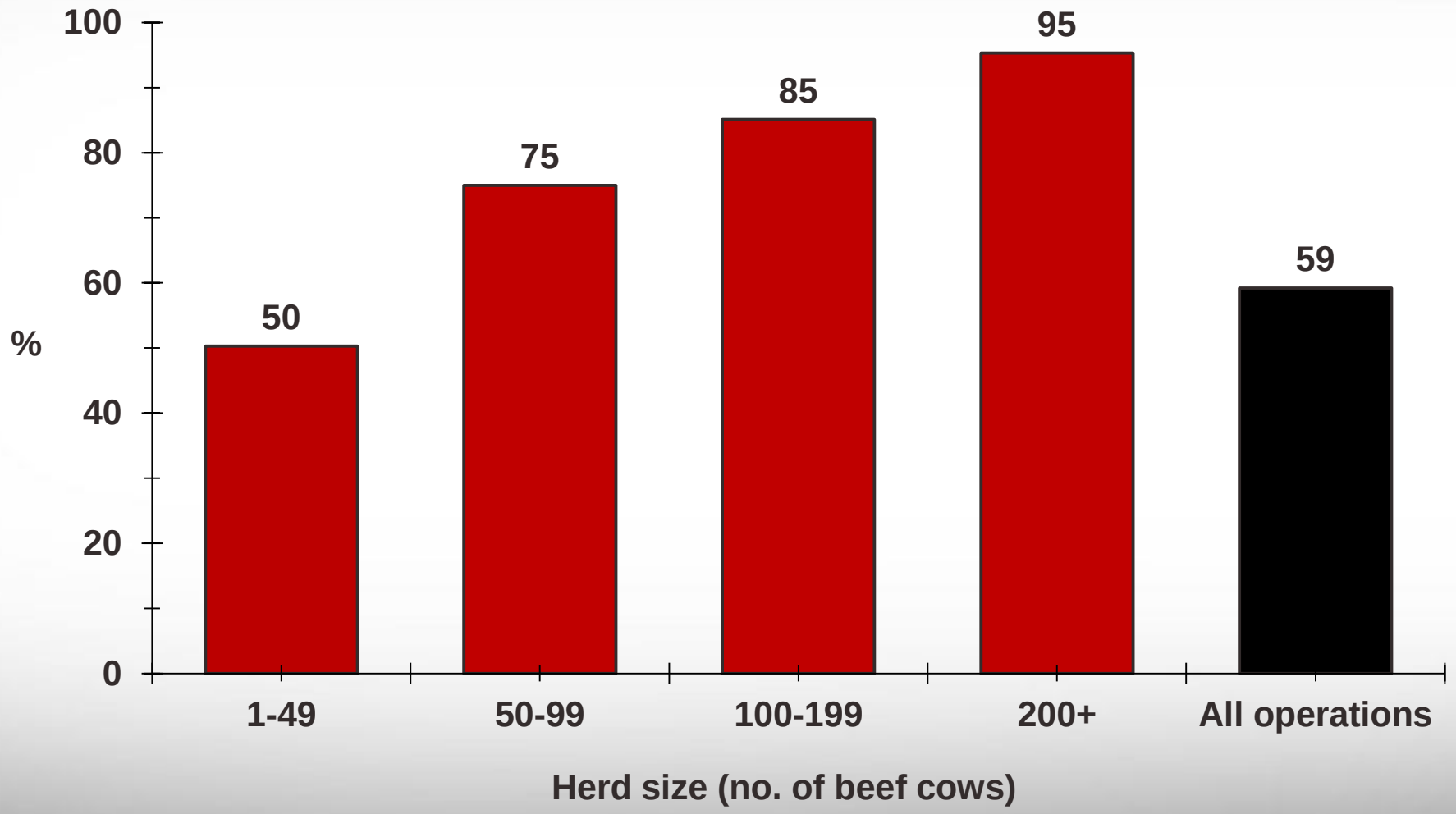
Advanced reproductive management developments

- Somatic cell nuclear cloning
- New pregnancy diagnosis tools
- Stem cell technology
- Transgenic technologies
- Other methods to incorporate new genetic enhancement tools



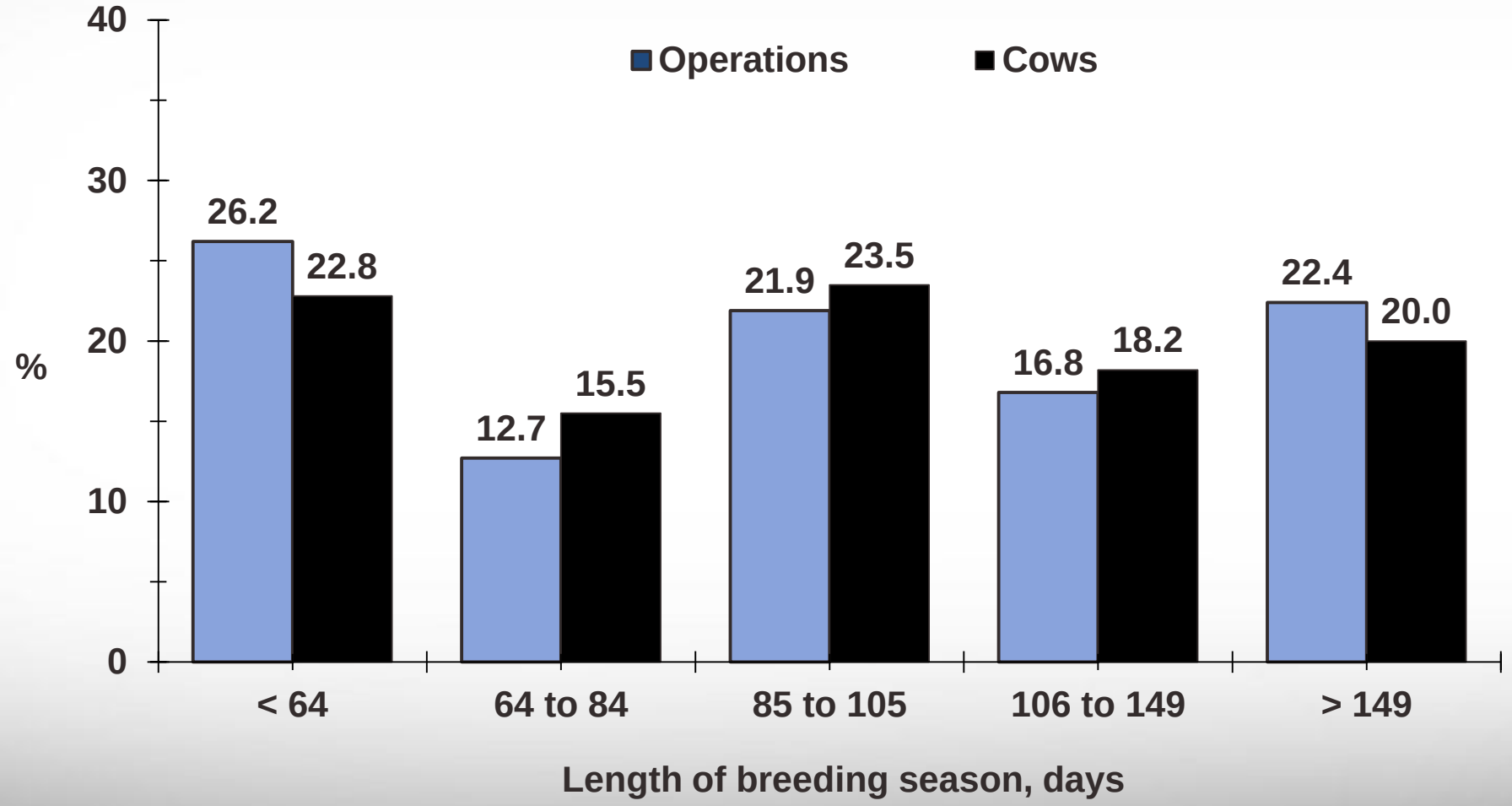
Traditional Reproductive Management Technologies

Percentage of Operations that Castrated any Bull Calves



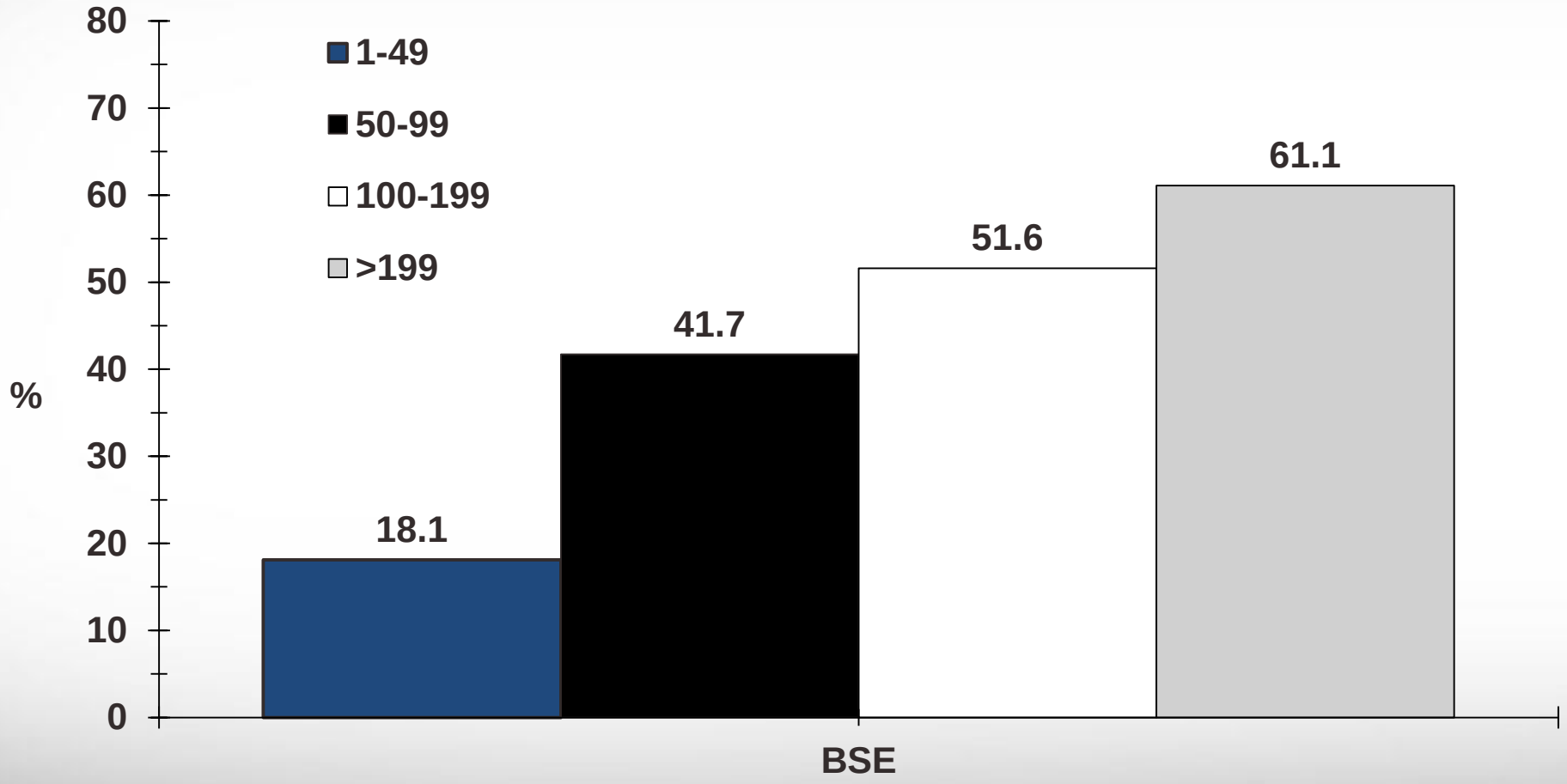
(NAHMS, 2008)

Breeding Season Length of US Beef Cattle Operations



(NAHMS, 2008)

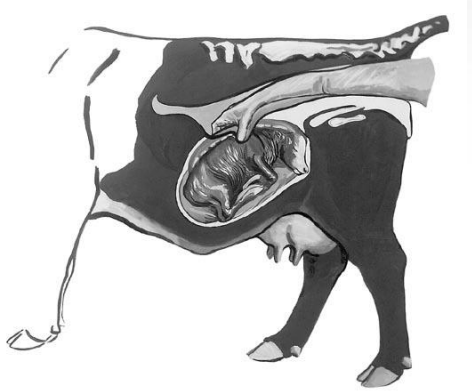
Use of Reproductive Technologies in US Beef Herds - BSE



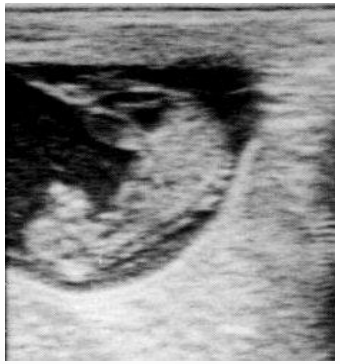
(NAHMS, 2008)

Pregnancy Diagnosis

- Rectal palpation



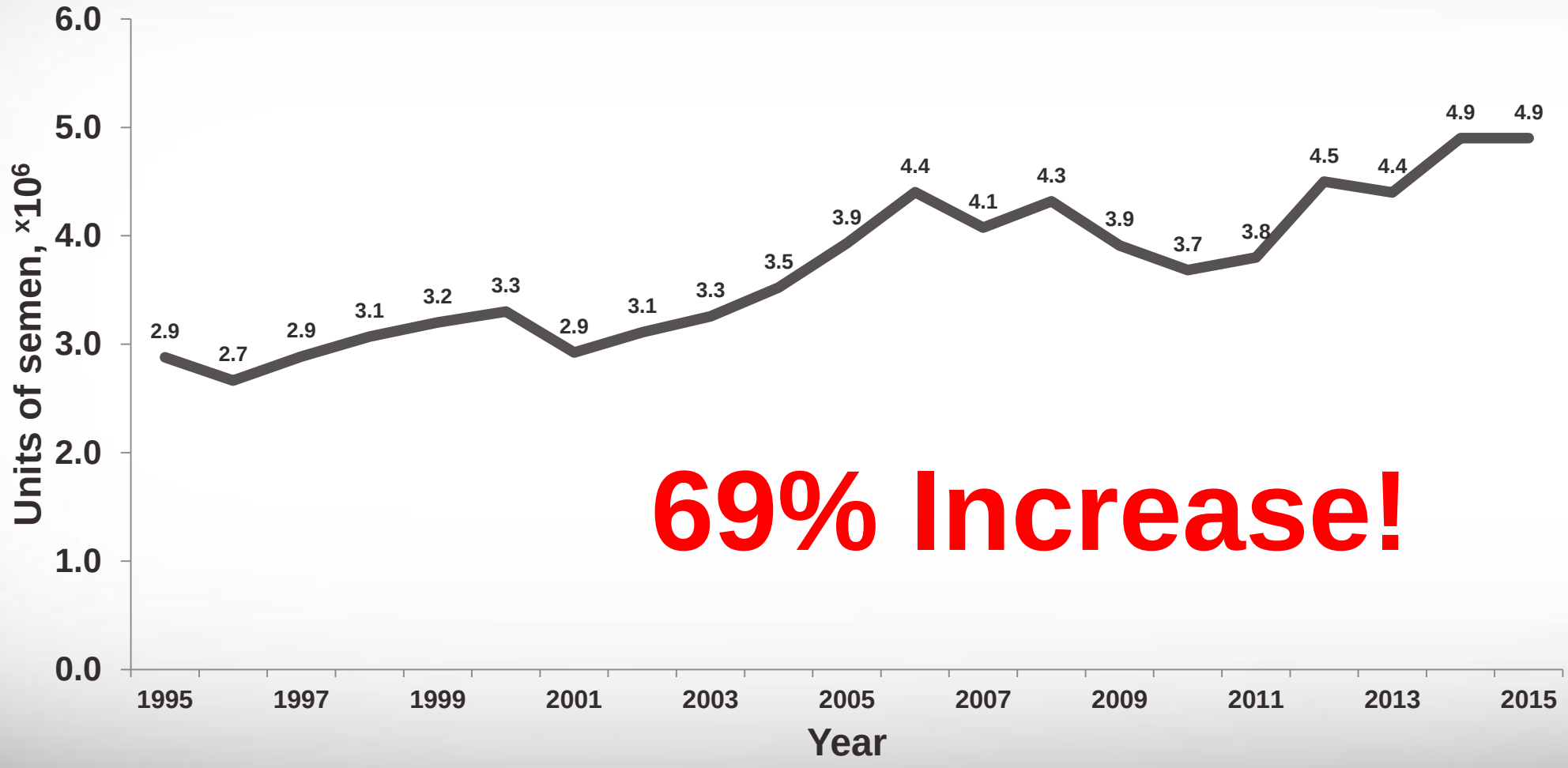
- Ultrasound



- Blood test

Recent Reproductive Management Technologies

Semen Sales in USA from 1995 to 2015



69% Increase!

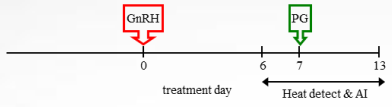
(NAAB, 2014)

Estrus Synchronization and AI in Beef Cattle

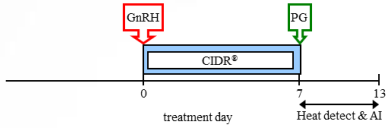
Beef Cow Protocols - 2016

Heat Detection

Select Synch

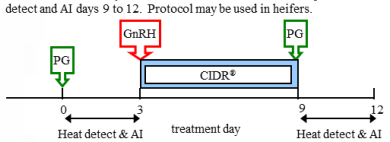


Select Synch + CIDR®



PG 6-day CIDR®

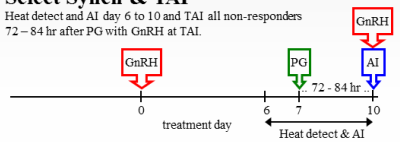
Heat detect and AI days 0 to 3. Administer CIDR to non-responders and heat detect and AI days 9 to 12. Protocol may be used in heifers.



Heat Detect & Time AI (TAI)

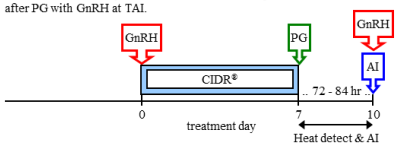
Select Synch & TAI

Heat detect and AI day 6 to 10 and TAI all non-responders 72 – 84 hr after PG with GnRH at TAI.



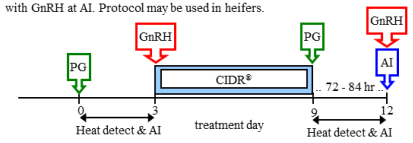
Select Synch + CIDR® & TAI

Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



PG 6-day CIDR® & TAI

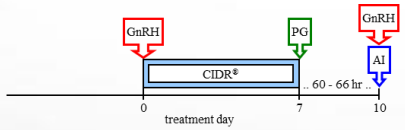
Heat detect & AI days 0 to 3. Administer CIDR to non-responders & heat detect and AI days 9 to 12. TAI non-responders 72 - 84 hr after CIDR removal with GnRH at AI. Protocol may be used in heifers.



Fixed-time AI (TAI)*

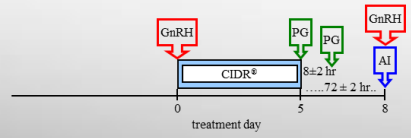
7-day CO-Synch + CIDR®

Perform TAI at 60 to 66 hr after PG with GnRH at TAI.



5-day CO-Synch + CIDR®

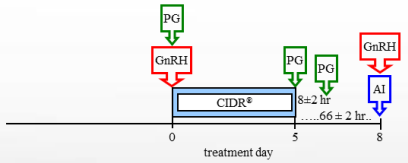
Perform TAI at 72 ± 2 hr after CIDR removal with GnRH at TAI.
Two injections of PG 8 ± 2 hr apart are required for this protocol.



Fixed-time AI (TAI)* for *Bos Indicus* cows only

PG 5-day CO-Synch + CIDR®

Perform TAI at 66 ± 2 hr after CIDR removal with GnRH at TAI.
Two injections of PG 8 ± 2 hr apart are required for this protocol.



* The time listed for "Fixed-time AI" should be considered as the approximate average time of insemination. This should be based on the number of cows to inseminate, labor, and facilities.

GnRH Cystorelin®, Factrel®, Fertagyl®, OvaCyst®, GONABreed®

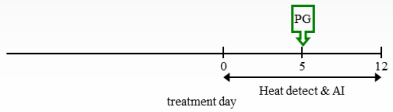
PG estroPLAN®, Estrumate®, In-Synch®, Lutalyse®, ProstaMate®

Approved 8-16-2015 *Beef Reproduction Task Force*

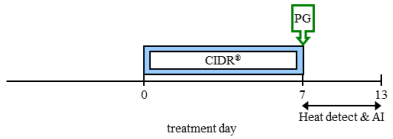
Beef Heifer Protocols - 2016

Heat Detection

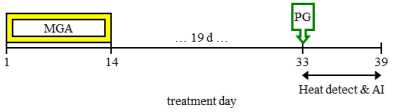
1 Shot PG



7-day CIDR®-PG



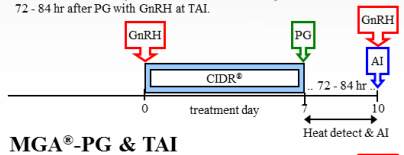
MGA®-PG



Heat Detect & Time AI (TAI)

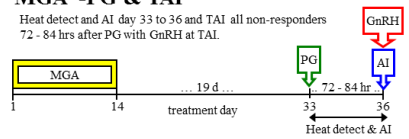
Select Synch + CIDR® & TAI

Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



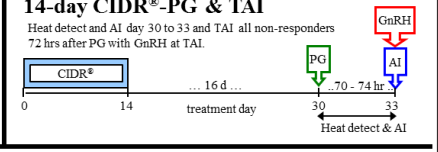
MGA®-PG & TAI

Heat detect and AI day 33 to 36 and TAI all non-responders 72 - 84 hrs after PG with GnRH at TAI.



14-day CIDR®-PG & TAI

Heat detect and AI day 30 to 33 and TAI all non-responders 72 hrs after PG with GnRH at TAI.

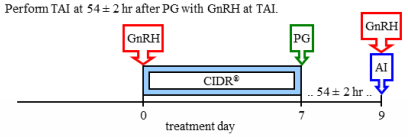


Fixed-time AI (TAI)*

Short-term Protocols

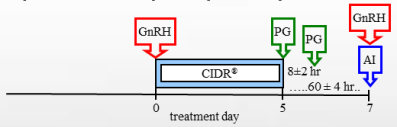
7-day CO-Synch + CIDR®

Perform TAI at 54 ± 2 hr after PG with GnRH at TAI.



5-day CO-Synch + CIDR®

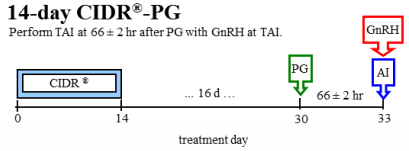
Perform TAI at 60 ± 4 hr after CIDR removal with GnRH at TAI.
Two injections of PG 8 ± 2 hr apart are required for this protocol.



Long-term Protocols

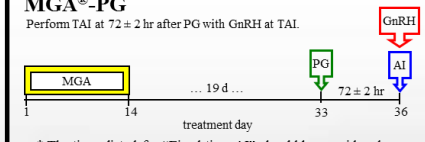
14-day CIDR®-PG

Perform TAI at 66 ± 2 hr after PG with GnRH at TAI.



MGA®-PG

Perform TAI at 72 ± 2 hr after PG with GnRH at TAI.



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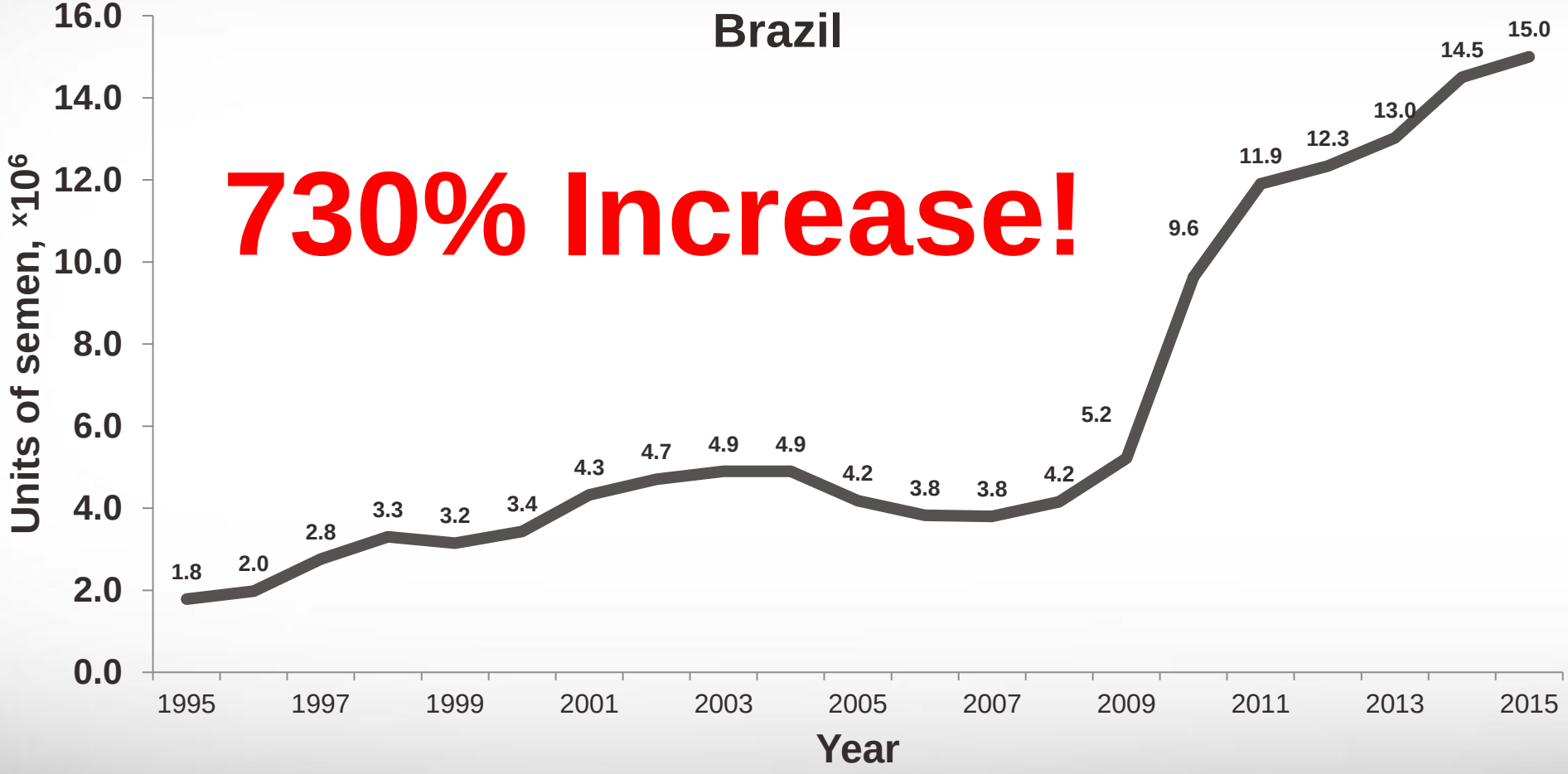
Approved 8-16-2015 *Beef Reproduction Task Force*

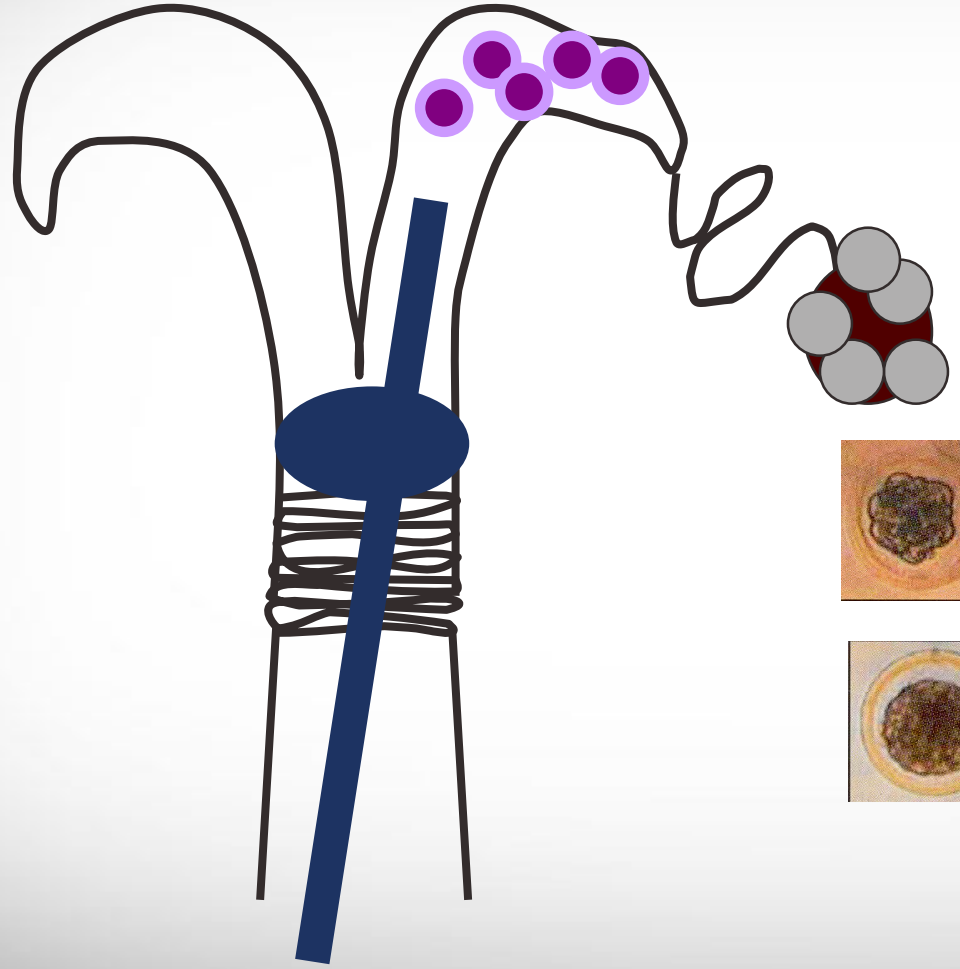
Semen Sales in Brazil from 1995 to 2014

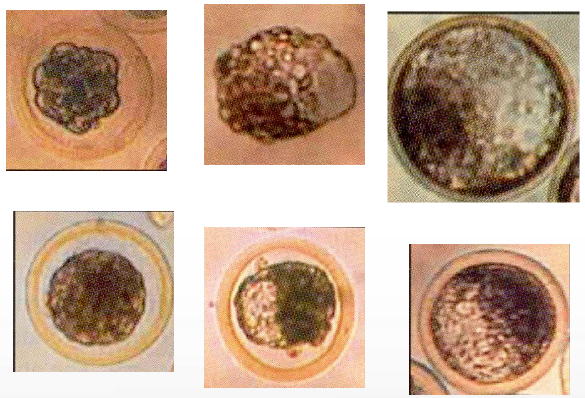


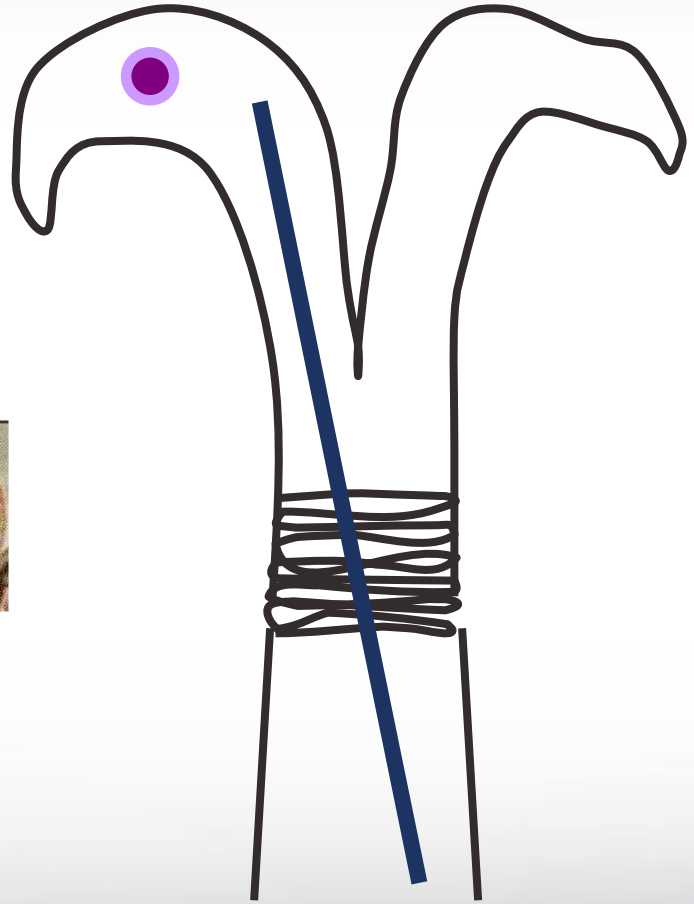
(ASBIA, 2014)

Brazil Beef Production System

Multiple Ovulation Embryo Transfer (MOET)





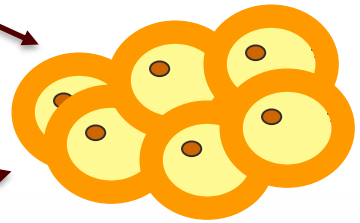


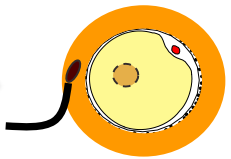
Embryo Collection

Embryo Transfer

In vitro Fertilization (IVF)

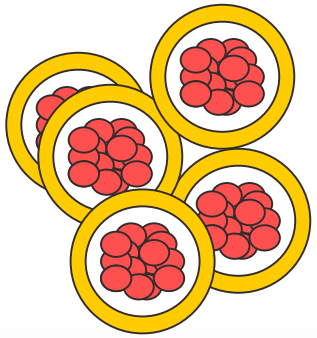
OPU
(oocyte pickup)





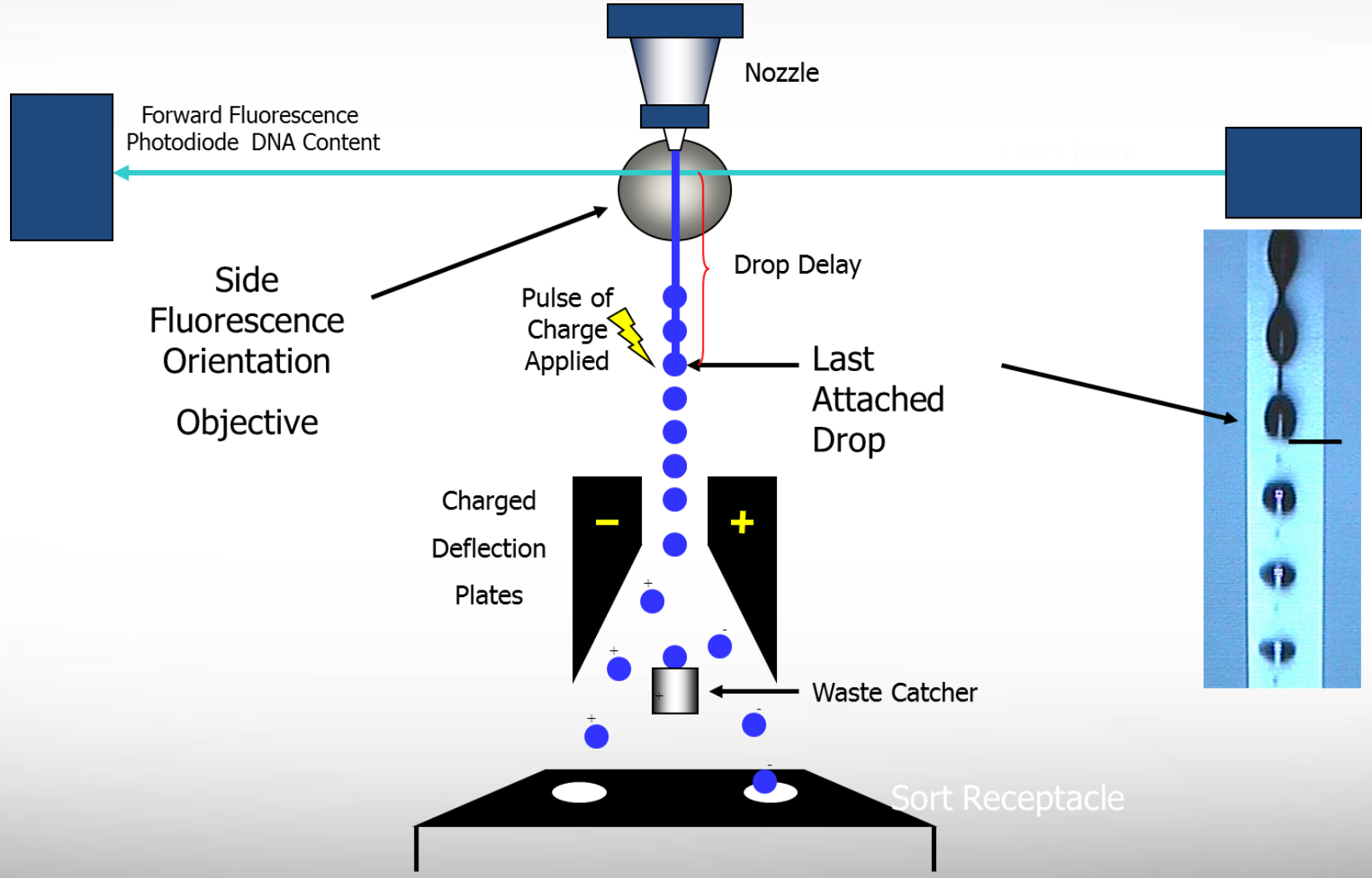
IVF
(In vitro fertilization)

Embryo

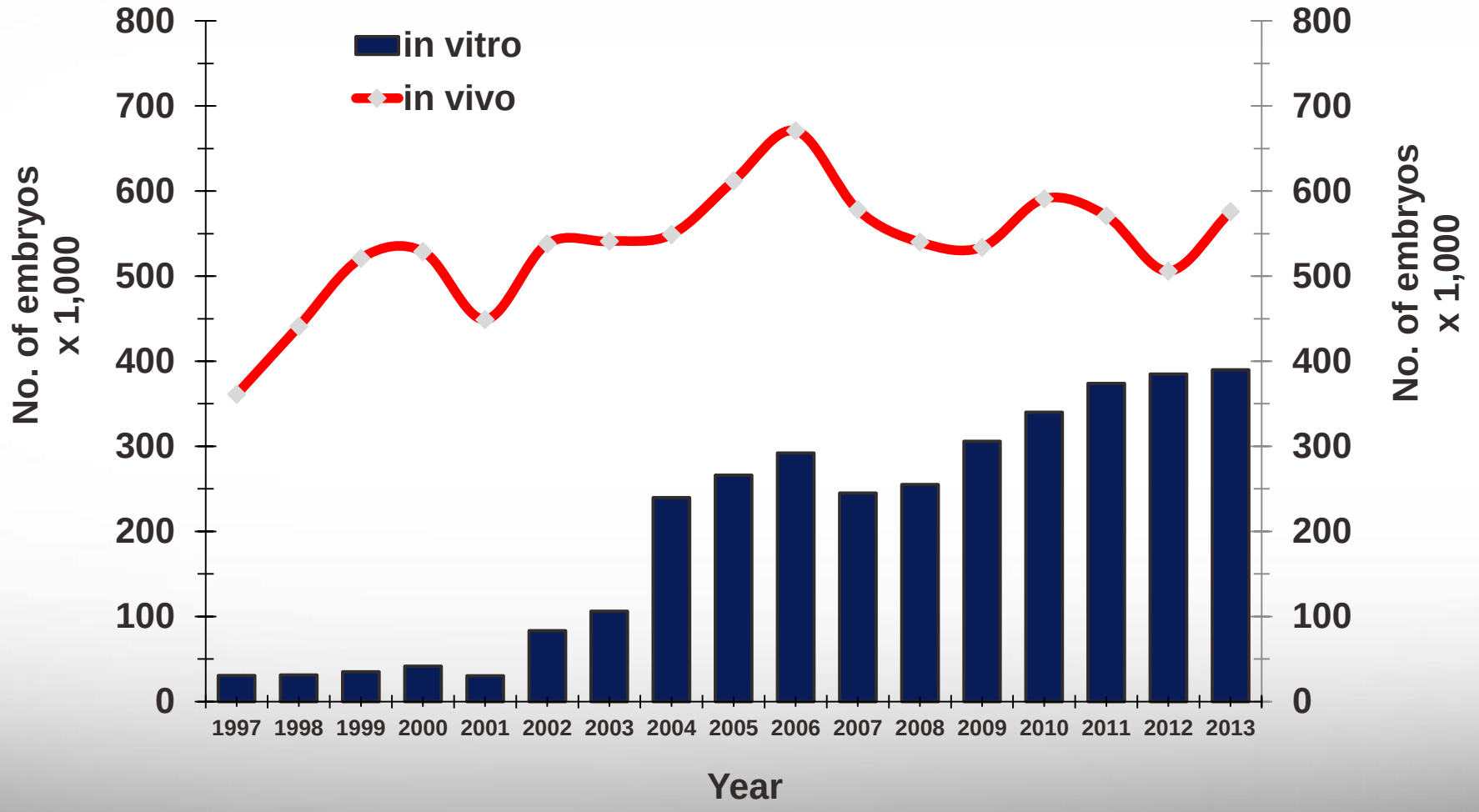


Abattoir recovery

Sexed Semen Technology



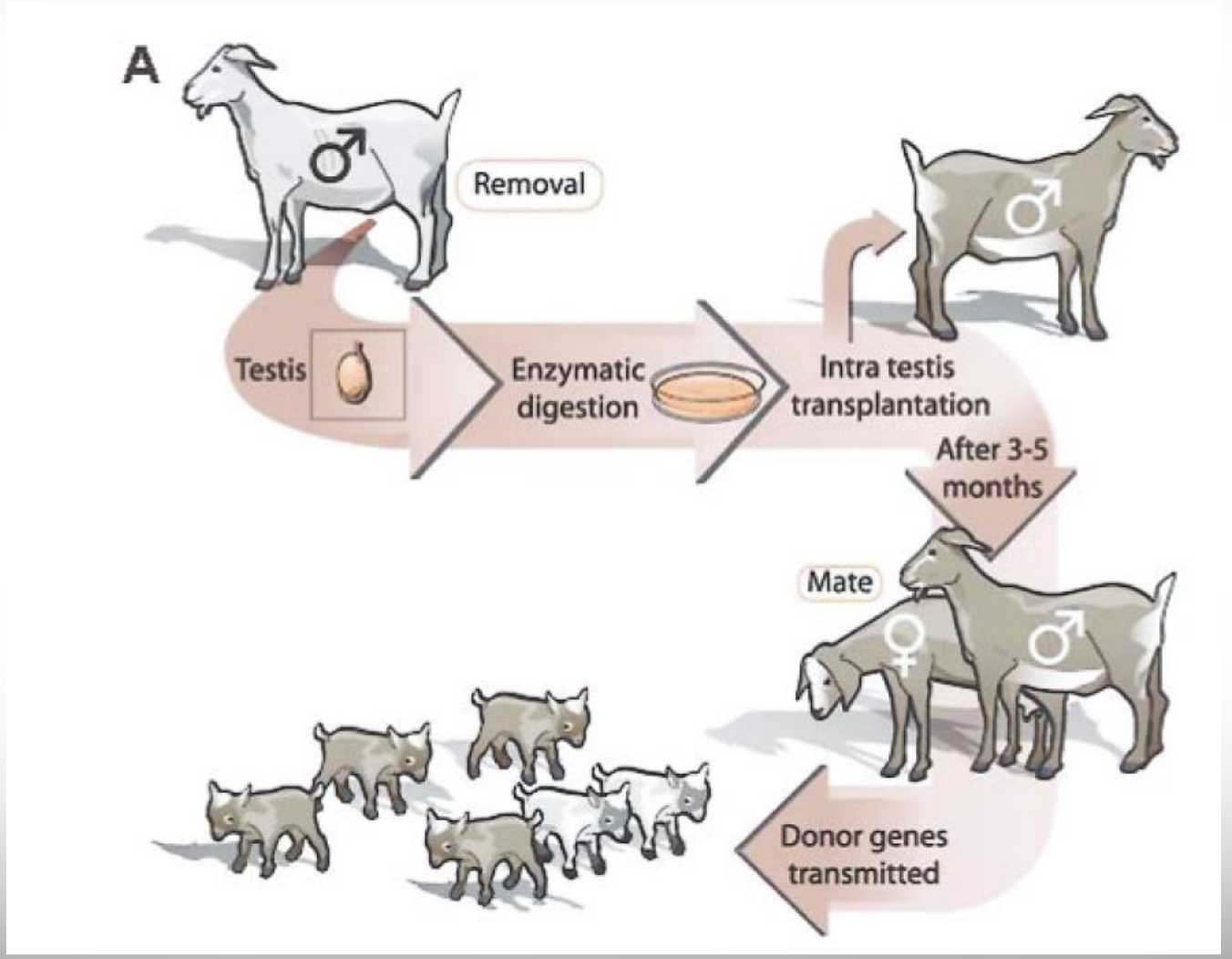
Transfer of Embryos



(IETS, 2014)

Advanced Reproductive Management Developments

Opportunities for Stem Cell Technology



(Honaramooz et al., 2013)

Opportunities for Stem Cell Technology

- **Use stem cells from genetically superior bull transplanted into testis of less desirable bulls**

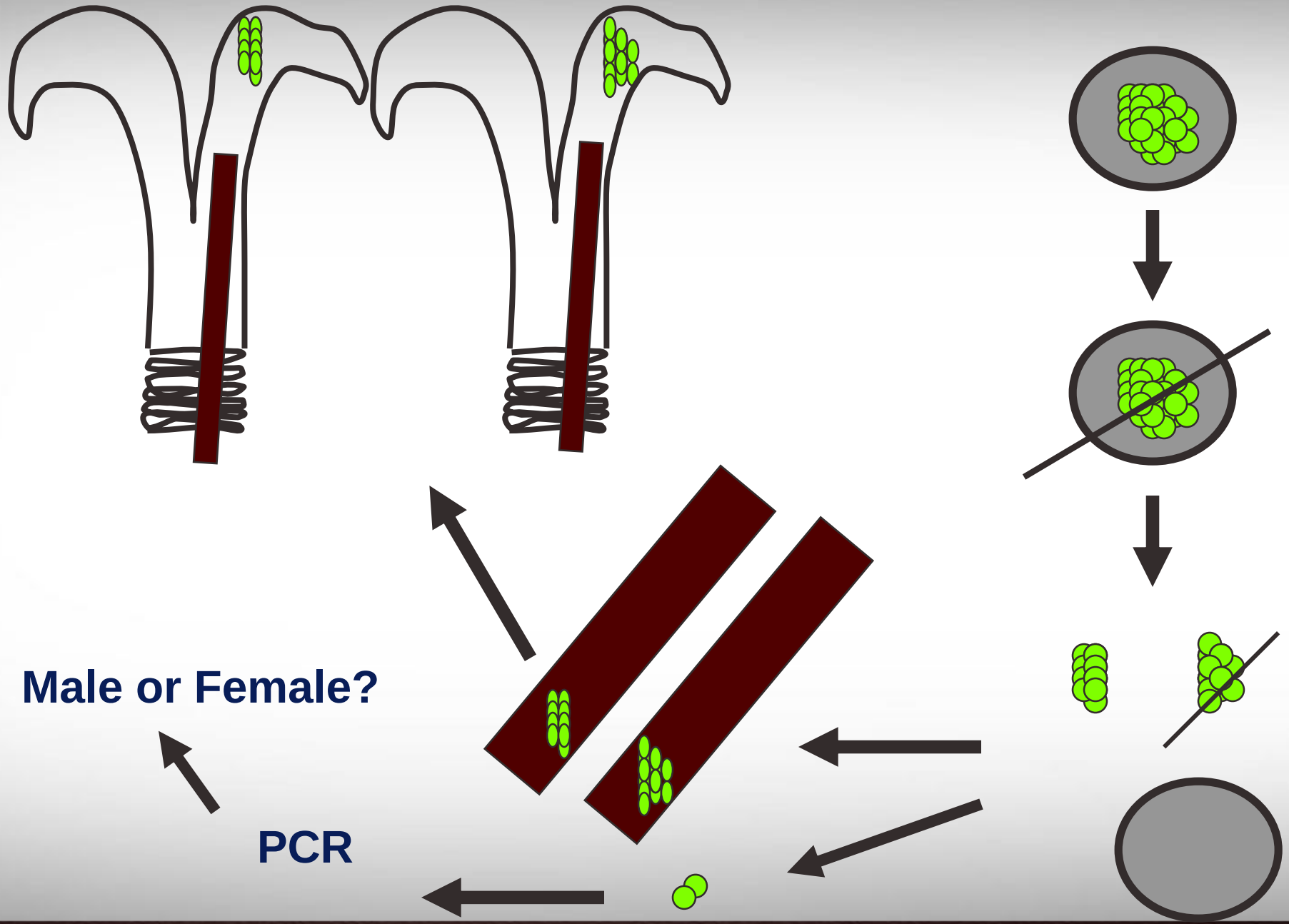
- **Use stem cells from bulls in bulls that are adapted to tolerate tough climatic conditions (i.e., heat stress)**

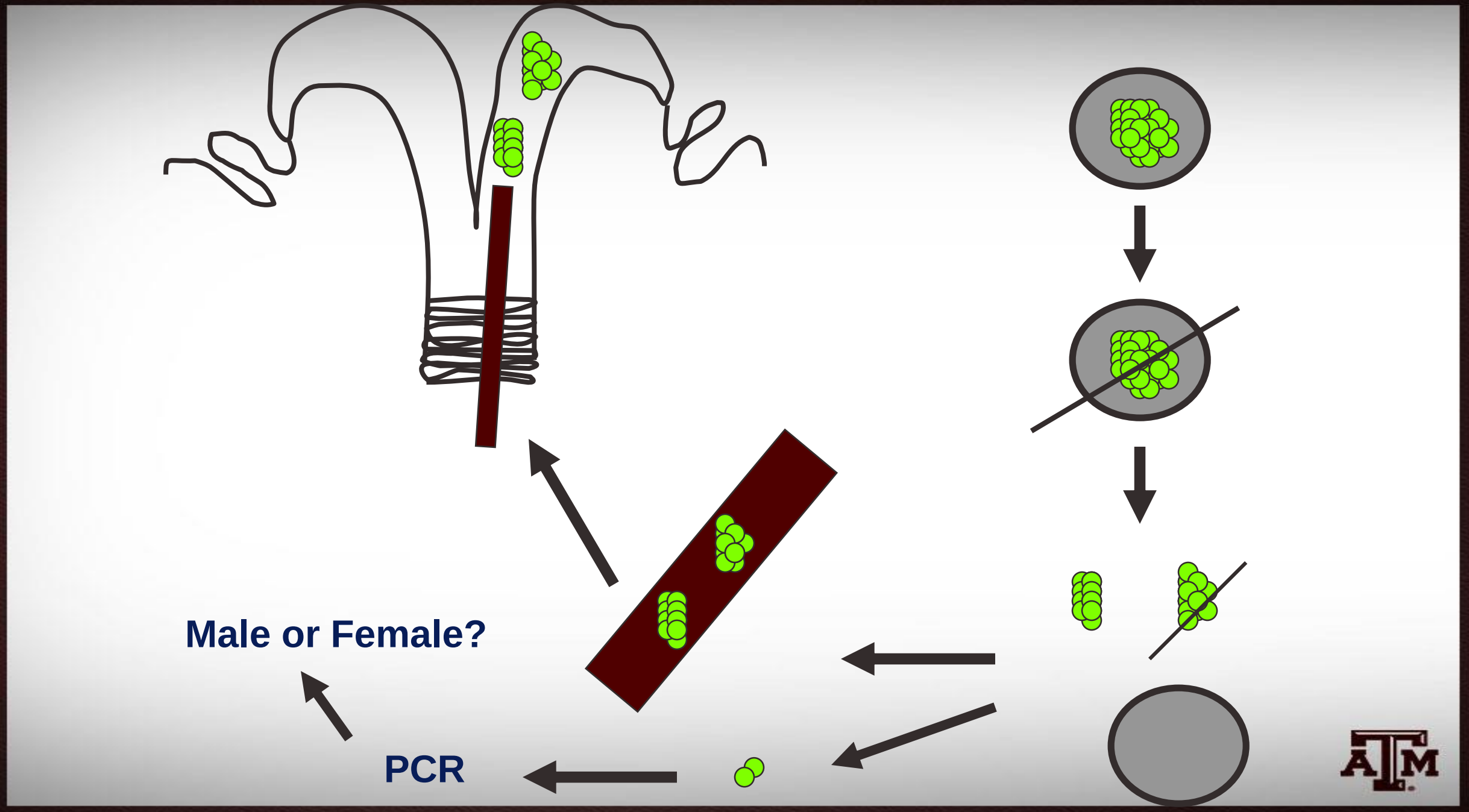
Opportunities for Transgenic Technology

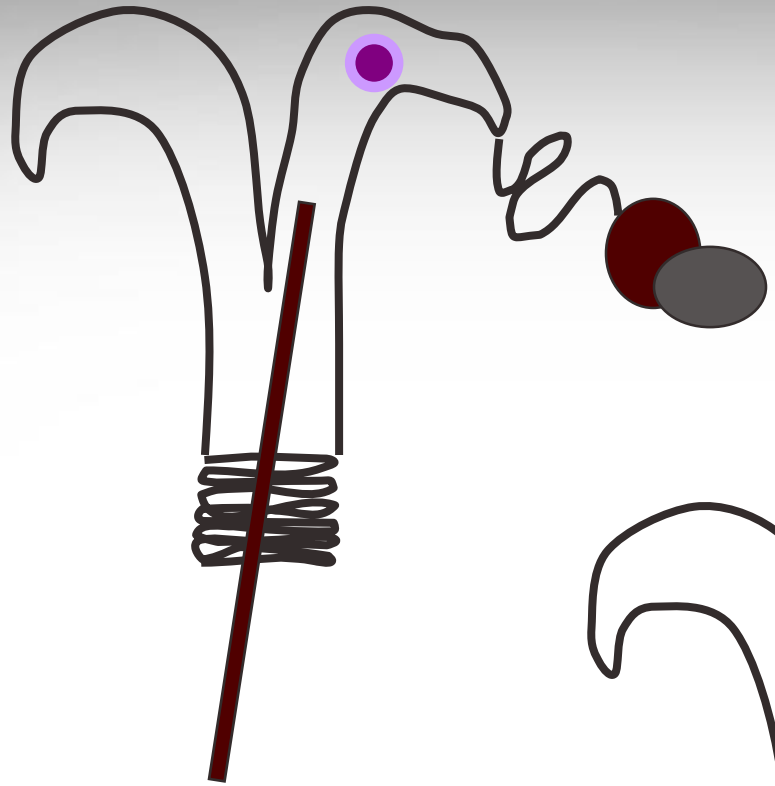
Transmission of sex from males carrying Tcr transgene					
Trt	No. of sires	Males	Females	Total	% male
Tcr	7	217	114	331	65.5
No Tcr	5	231	240	471	49

(Herrman et al., 1999)

Are reproductive technologies developing at a faster rate than they can be implemented into production systems, and are they culturally accepted by the general population?

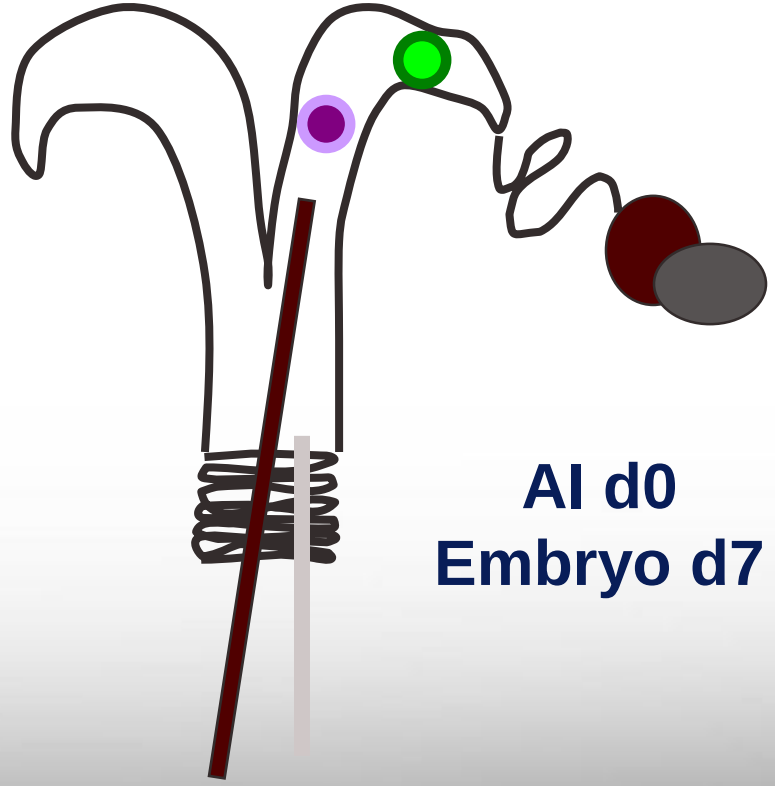

Male or Female?
PCR


Male or Female?
PCR



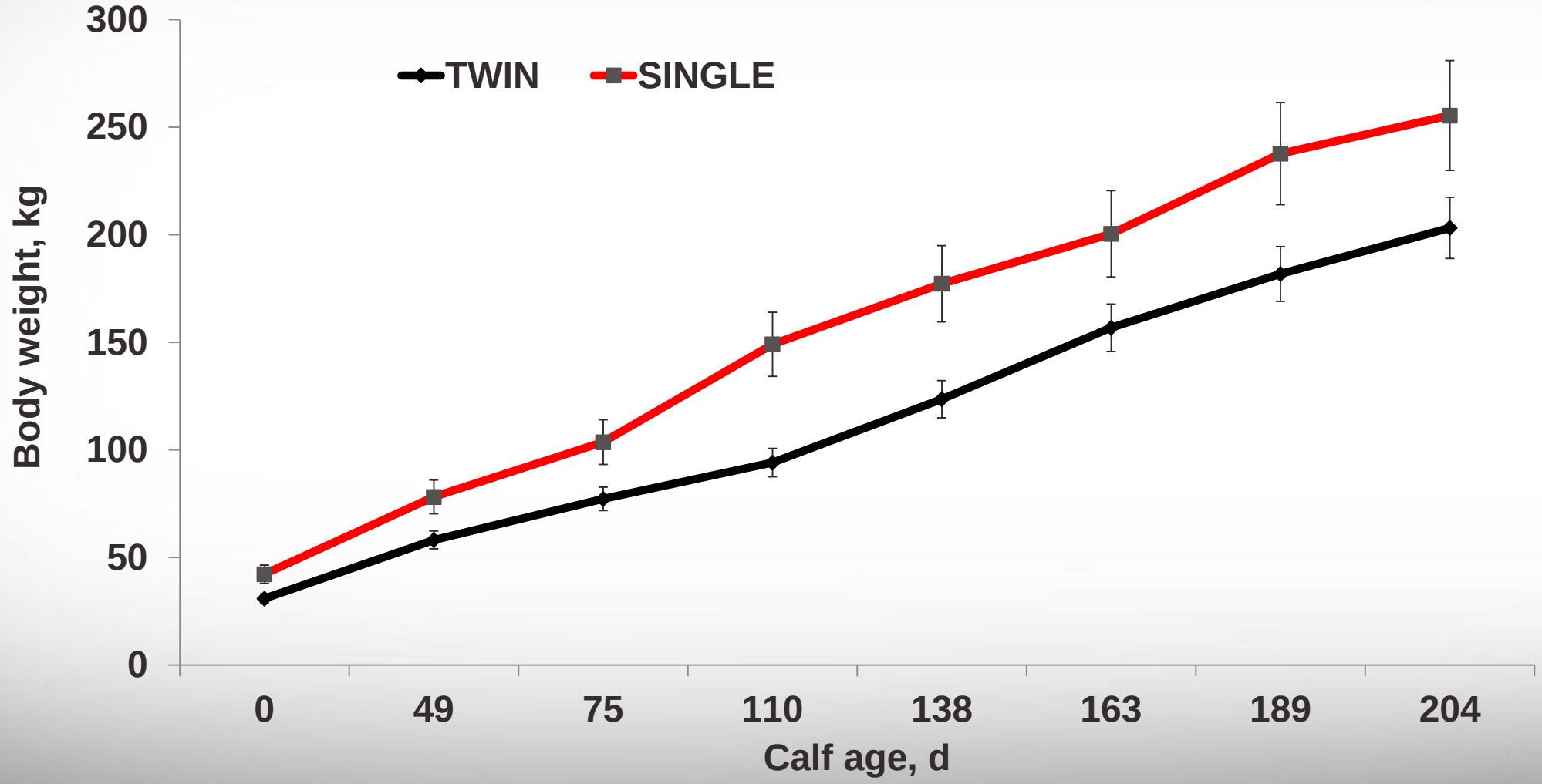
Embryo d7

AI d0



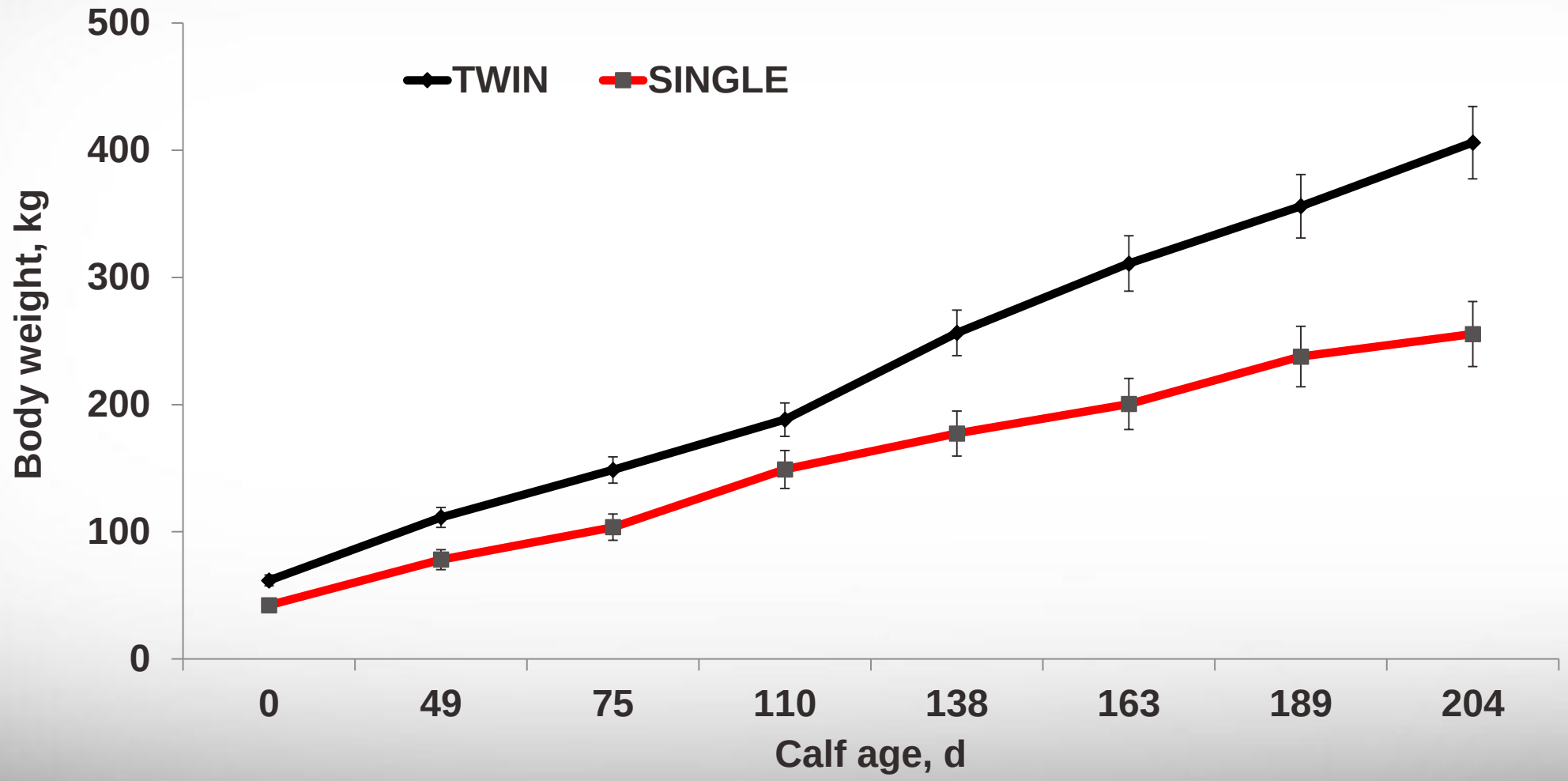
AI d0
Embryo d7

Performance of Calves Born and Raised as a Singleton or as Twins



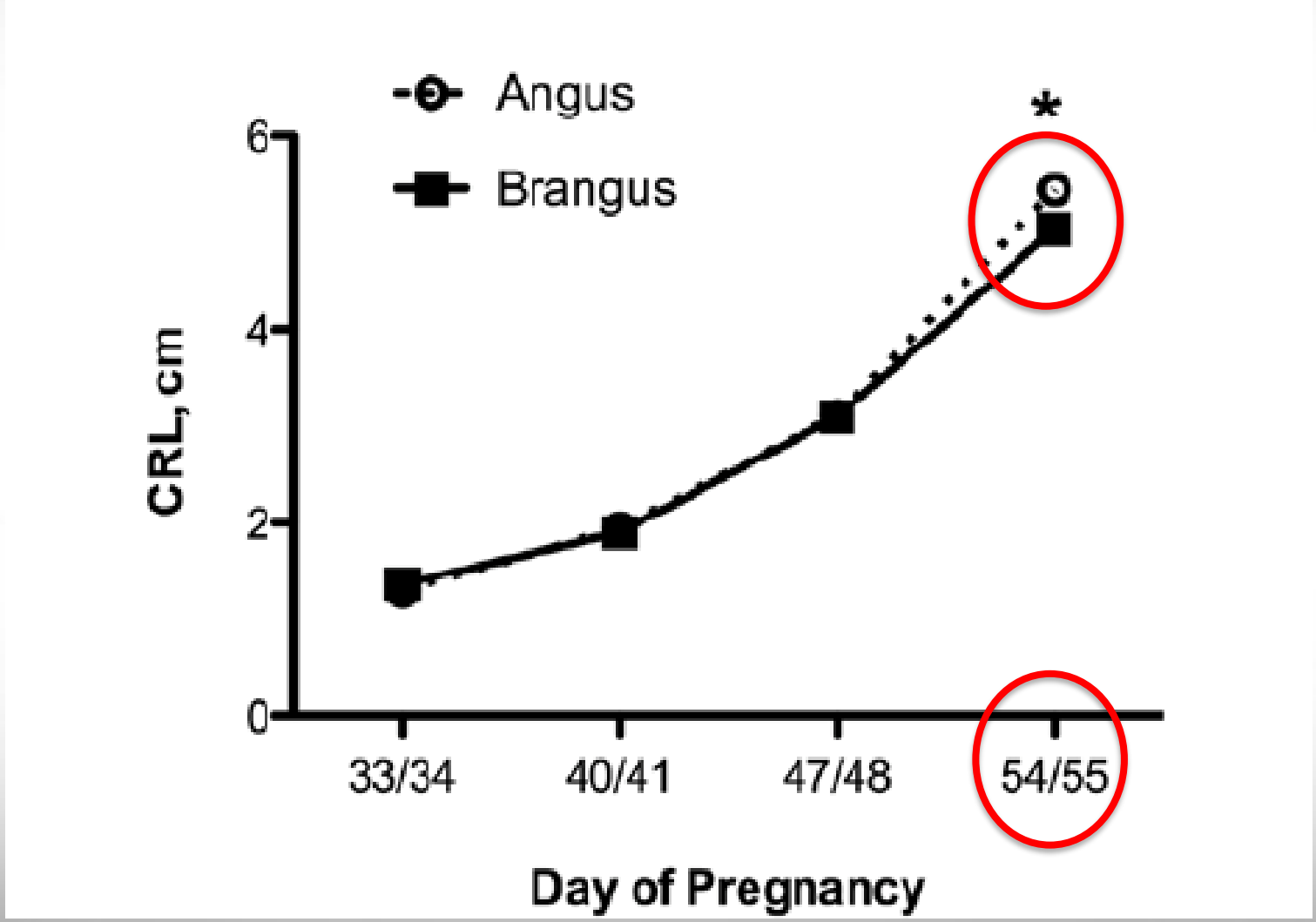
(Dahlen et al., 2010)

Performance of Calves Born and Raised as a Singleton or as Twins

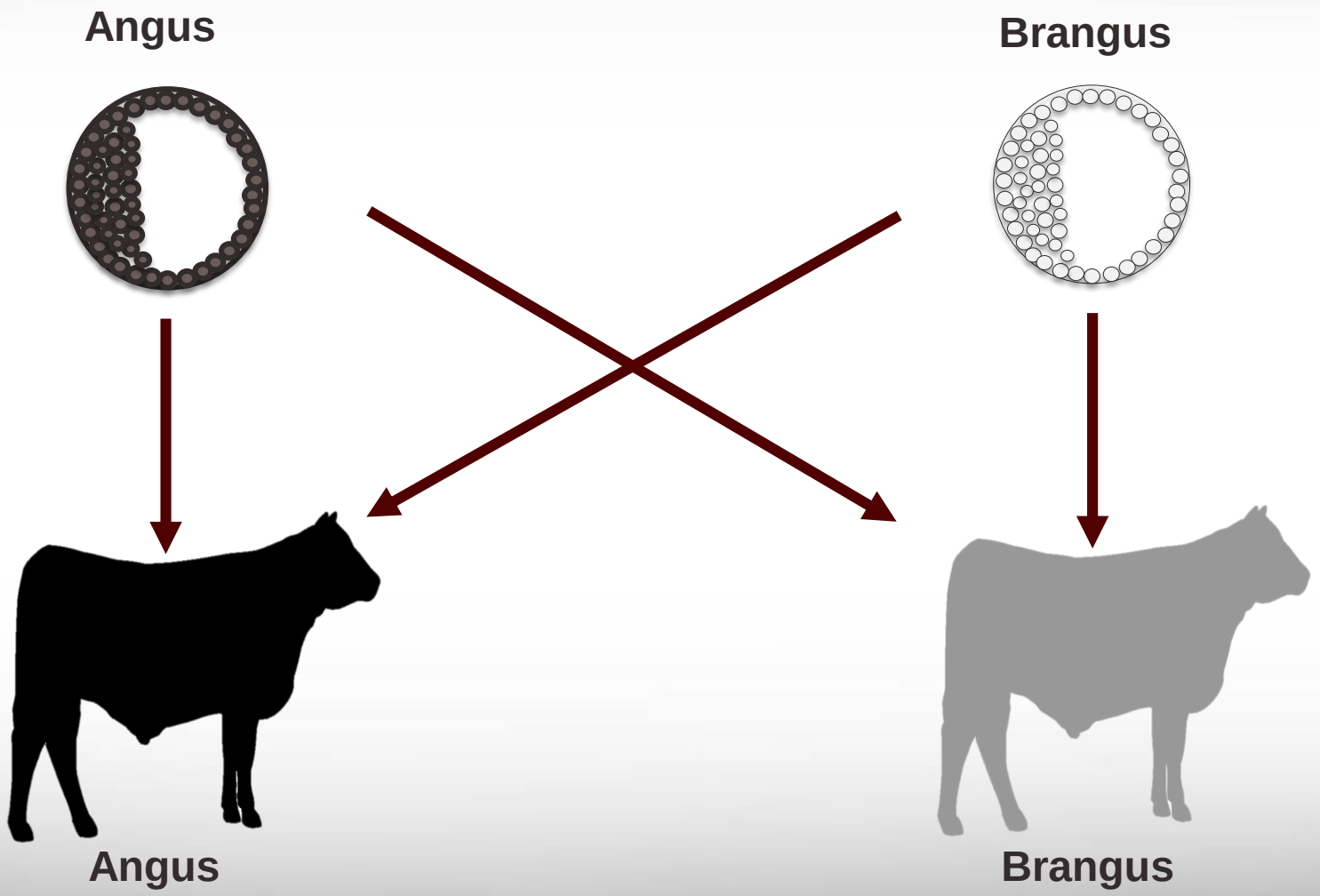


(Dahlen et al., 2010)

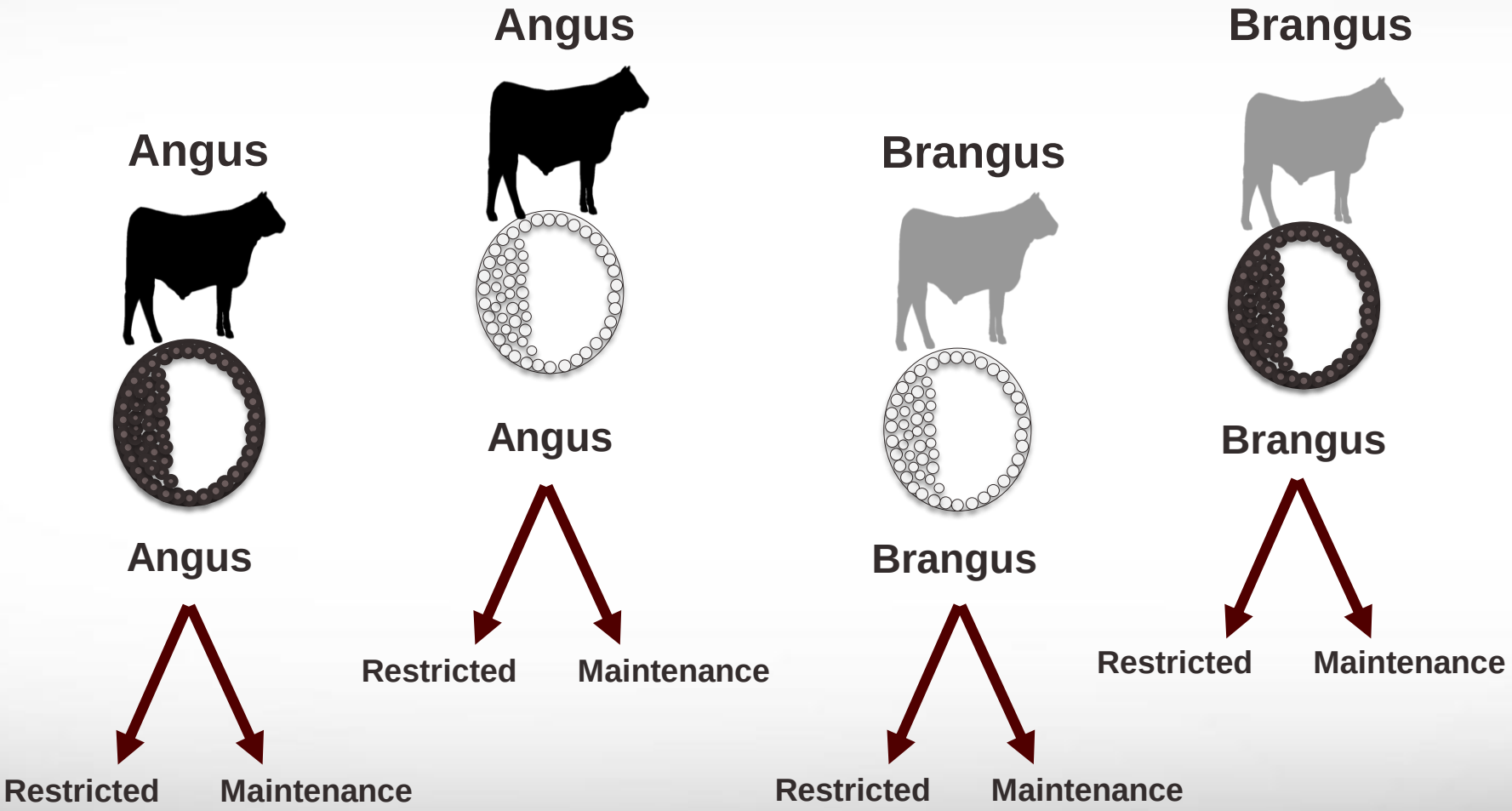
Differences During Early Embryo Development



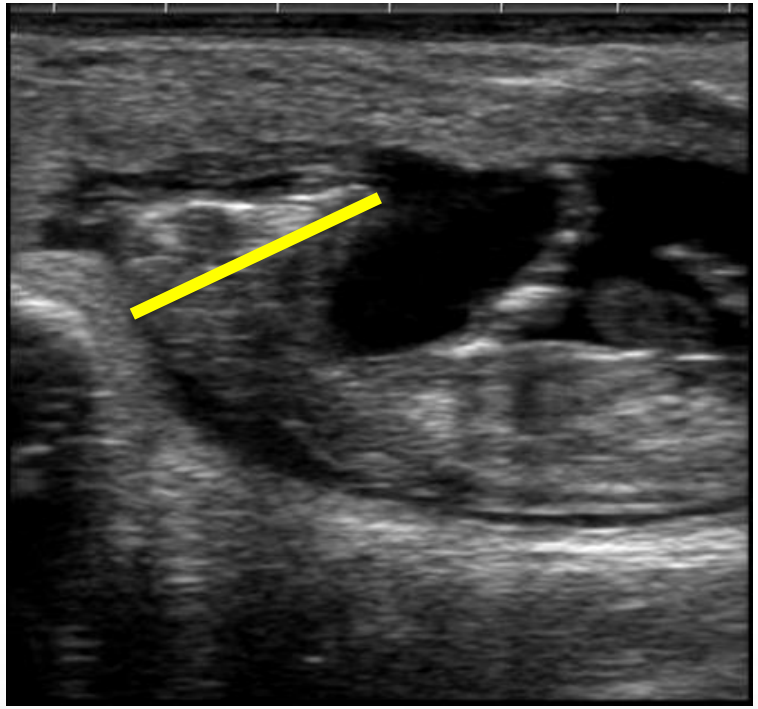
Reciprocal Embryo Transfer Approach



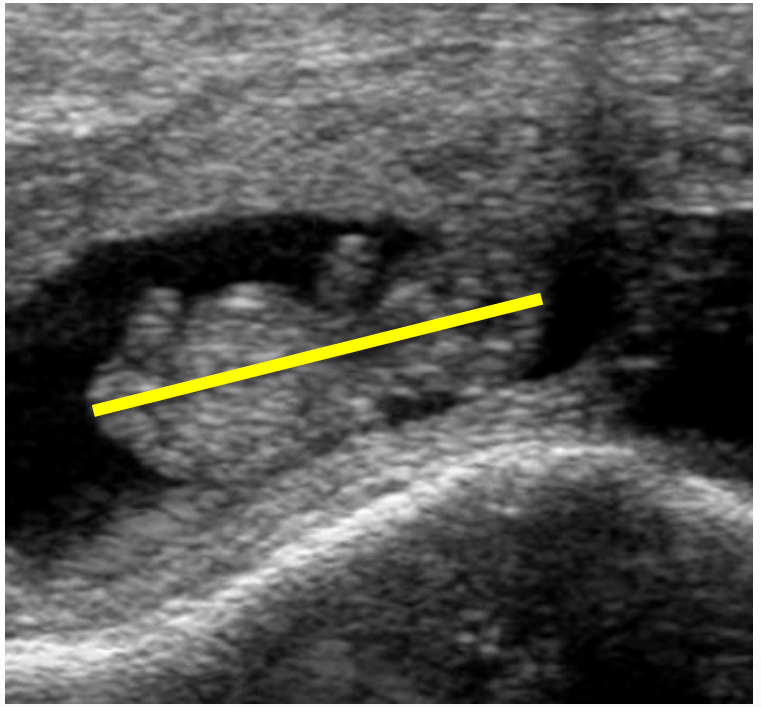
Feeding Scheme



Embryo Morphometries

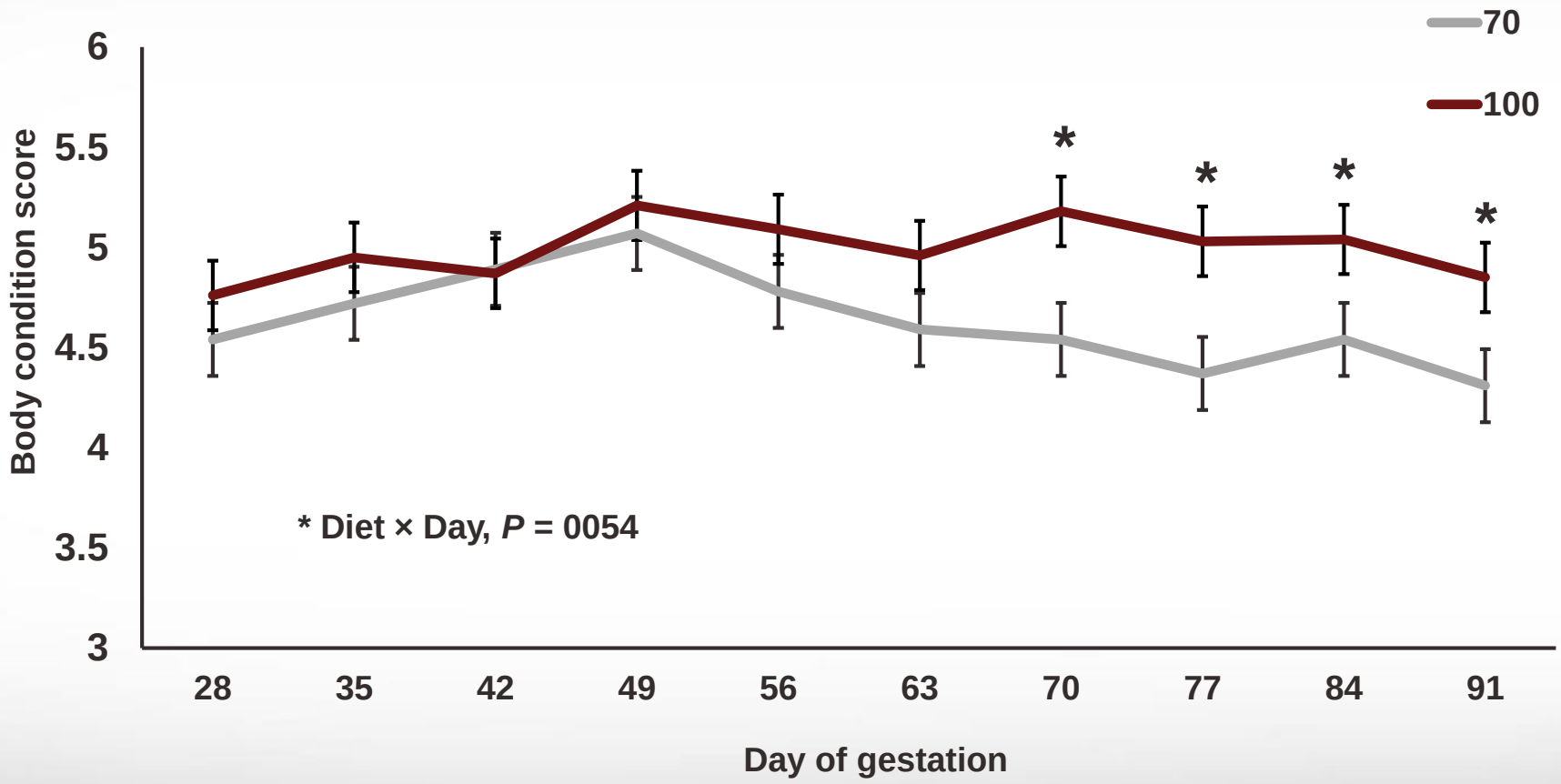


Crown to nose length



Crown to rump length

Recipient Body Condition Score



Effects of Recipient Breed on Early Embryo Loss

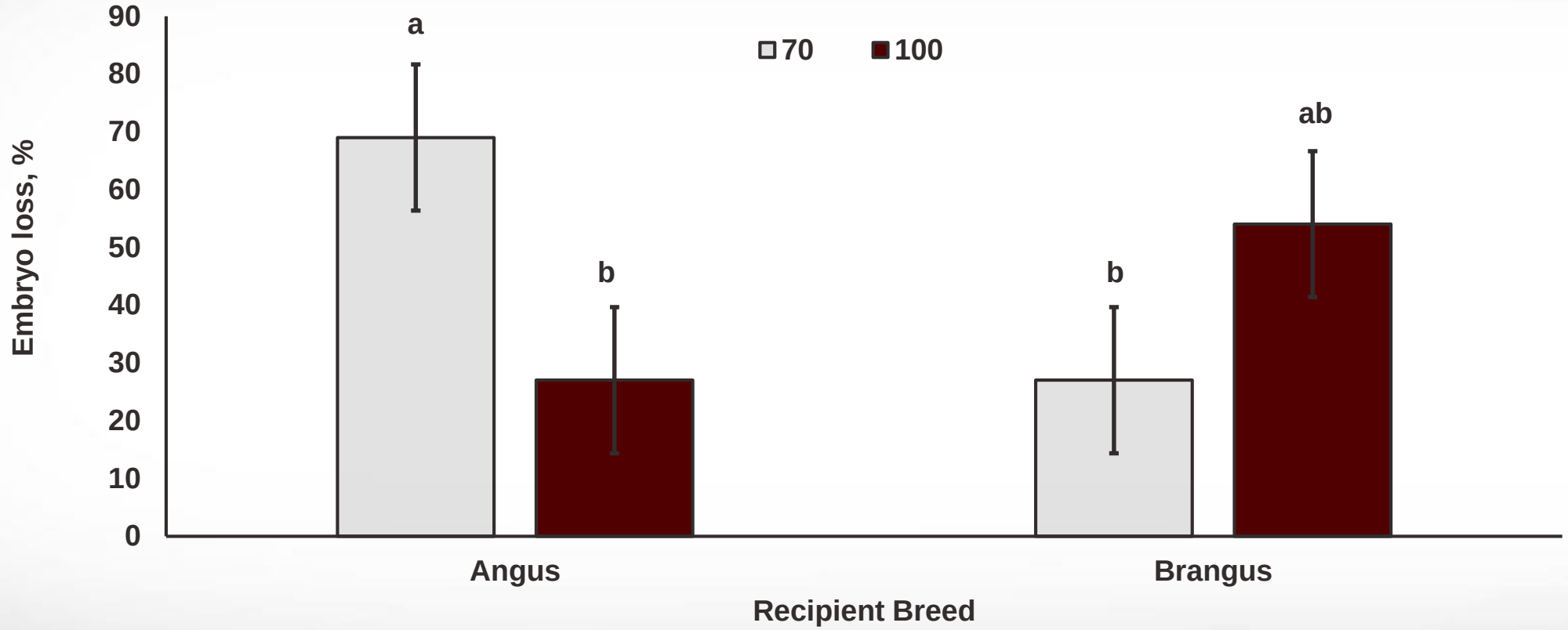


Figure 1. Effect of recipient breed and diet on early embryonic loss (Breed × Diet interaction, uncommon superscripts differ, *P* < 0.05).

Final Thought!

Even today, simple technologies such as castration, breeding season management, or weaning may be more appropriate than more developed reproductive technologies and provide a significant improvement in production efficiency.

However, continued improvement in new reproductive technologies will provide opportunities that will affect beef production in the future.

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Thank you!

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