Recent Developments in Cattle Fertility

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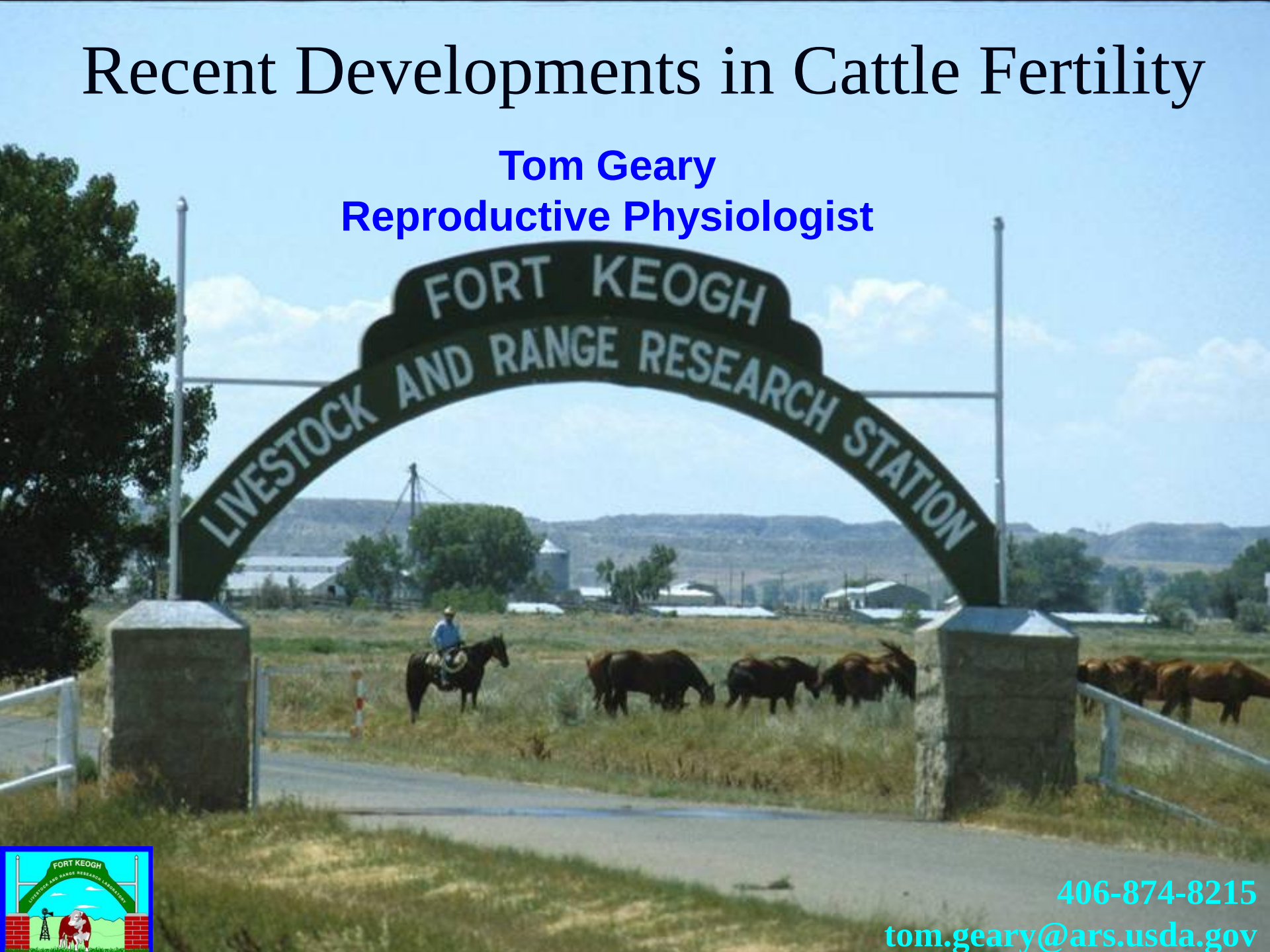

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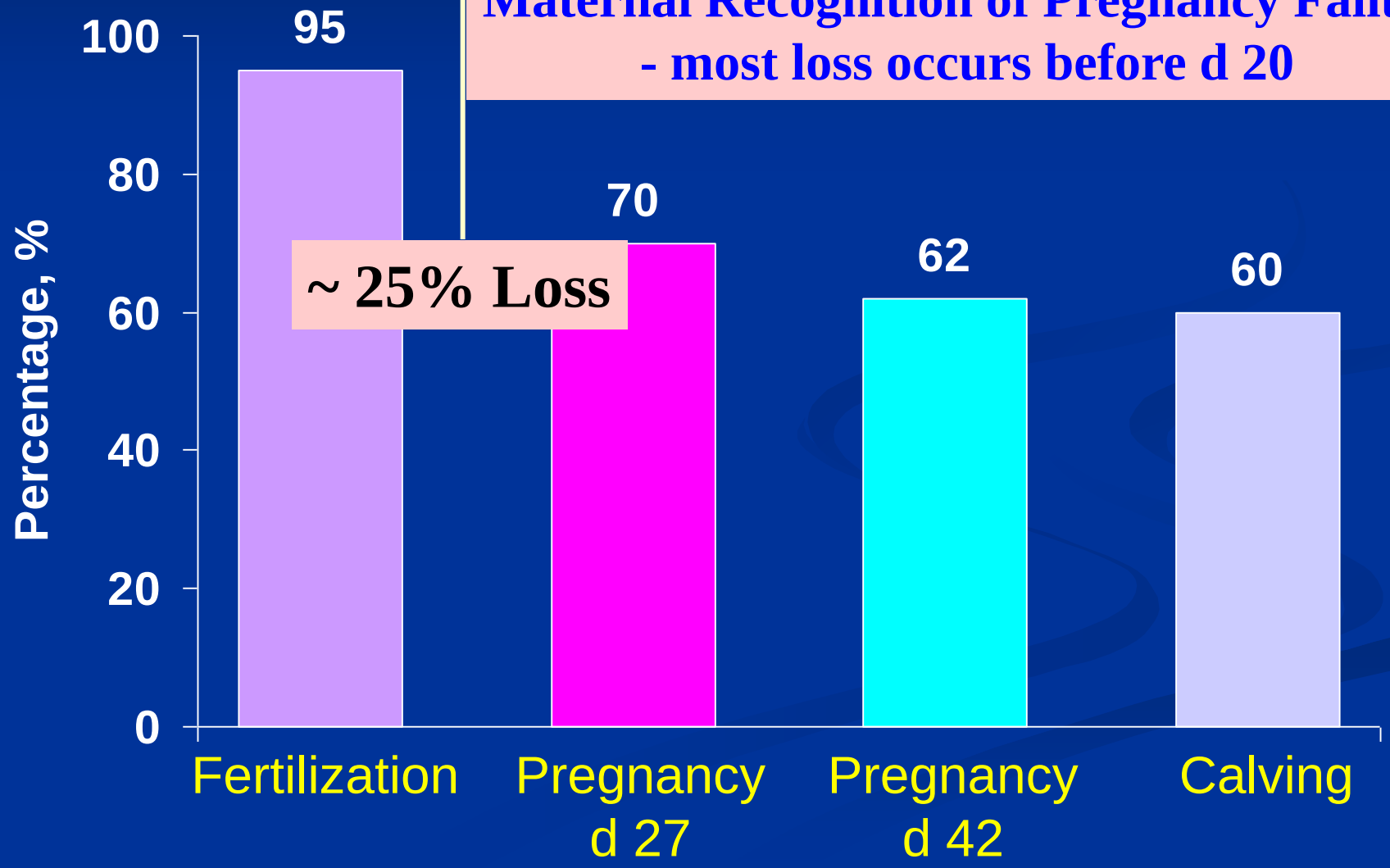
Fertility of a Single Service: Beef Cattle

Early Embryonic Loss

Maternal Recognition of Pregnancy Failure

- most loss occurs before d 20



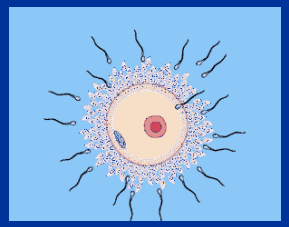
Early pregnancy diagnosis to identify causes of pregnancy failure at Fort Keogh.

Day 1

95%

- d 19 with very good accuracy
  - Endometrial echotexture
  - CL blood flow

Oocyte Competence



Oviductal support

d 1 - 4

d 5 - 14

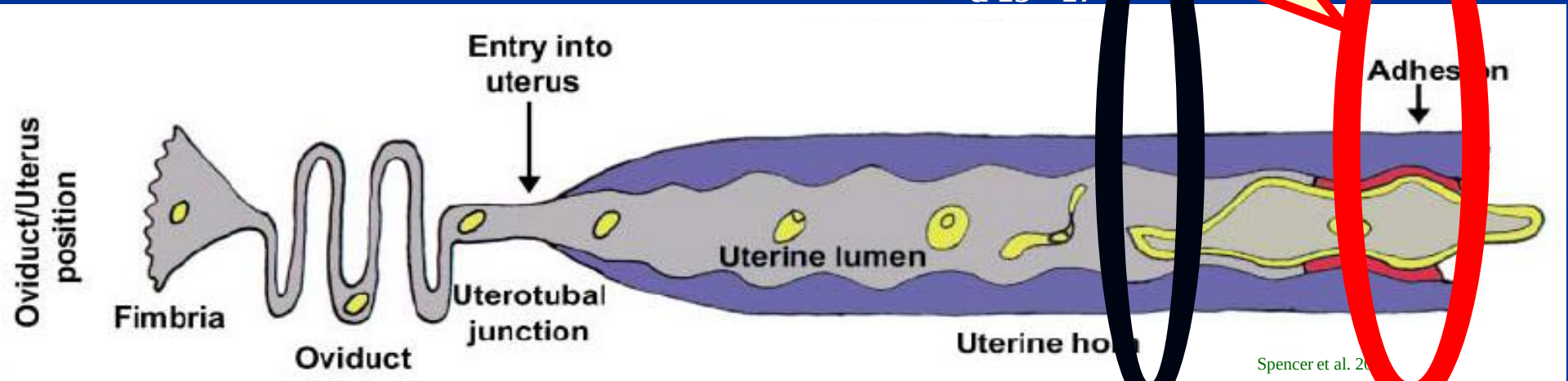
d 15 - 17

Current Technology (d 27)
Ultrasound
Blood – Pregnan specific proteins

ndent

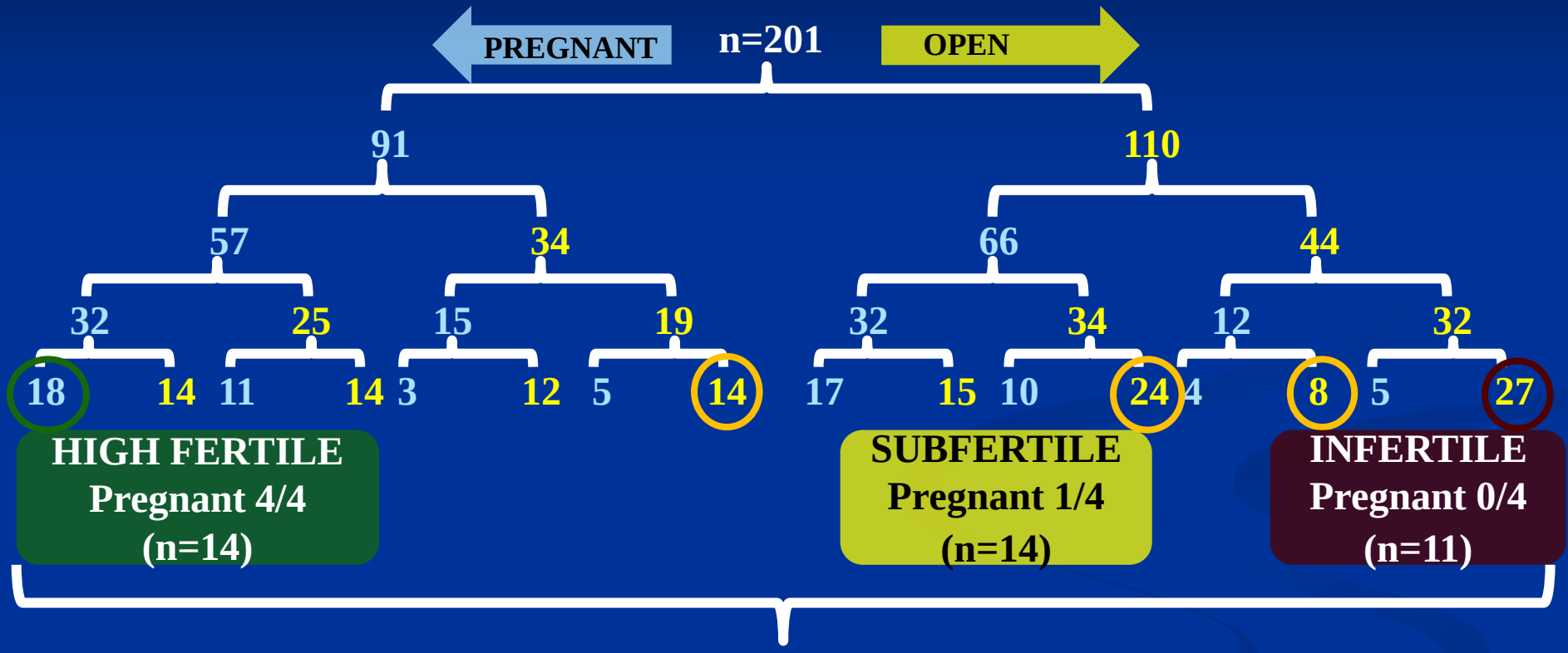
Day 30

70%



Spencer et al. 2

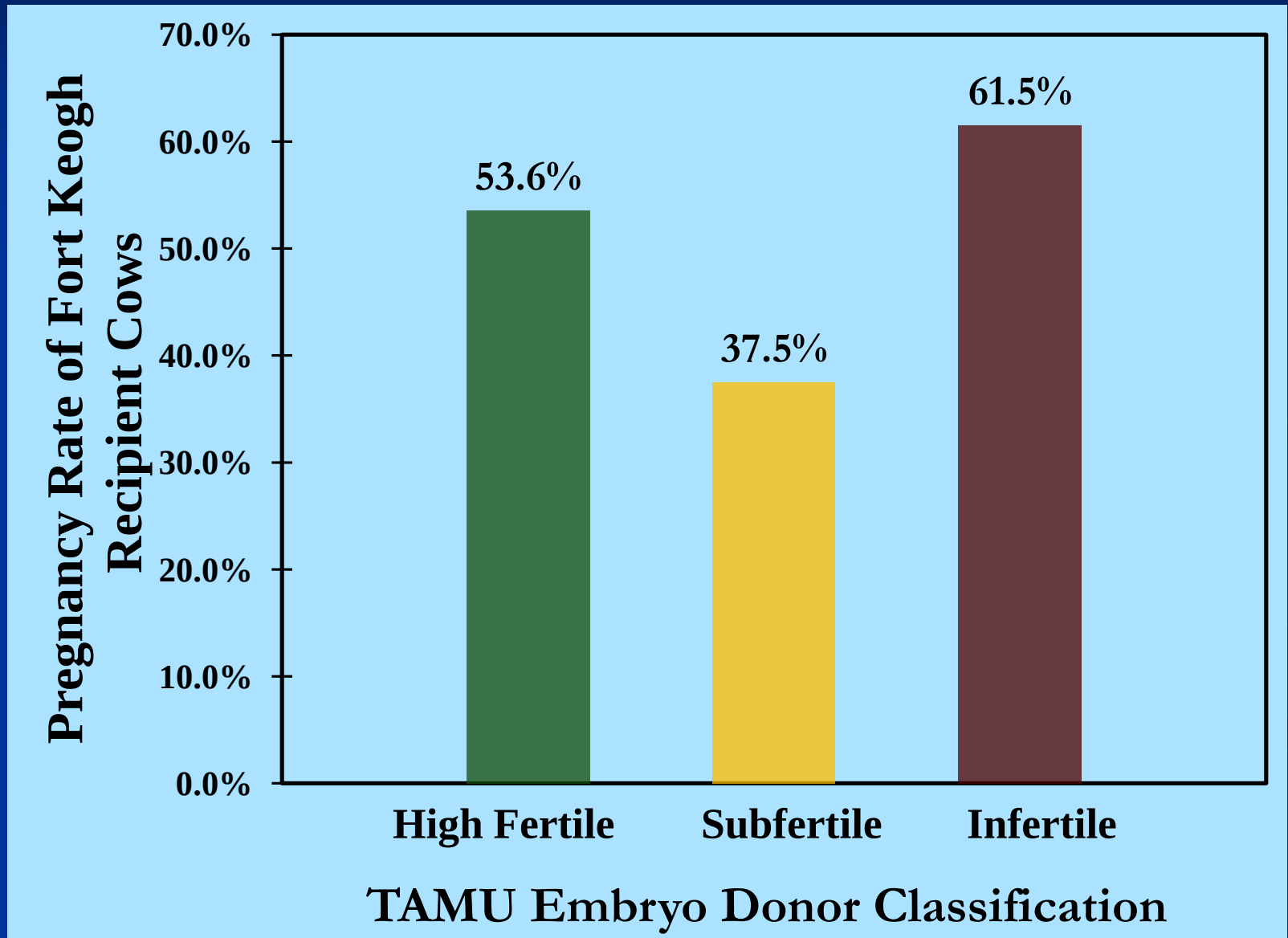
Heifer Fertility: Genetic Markers?



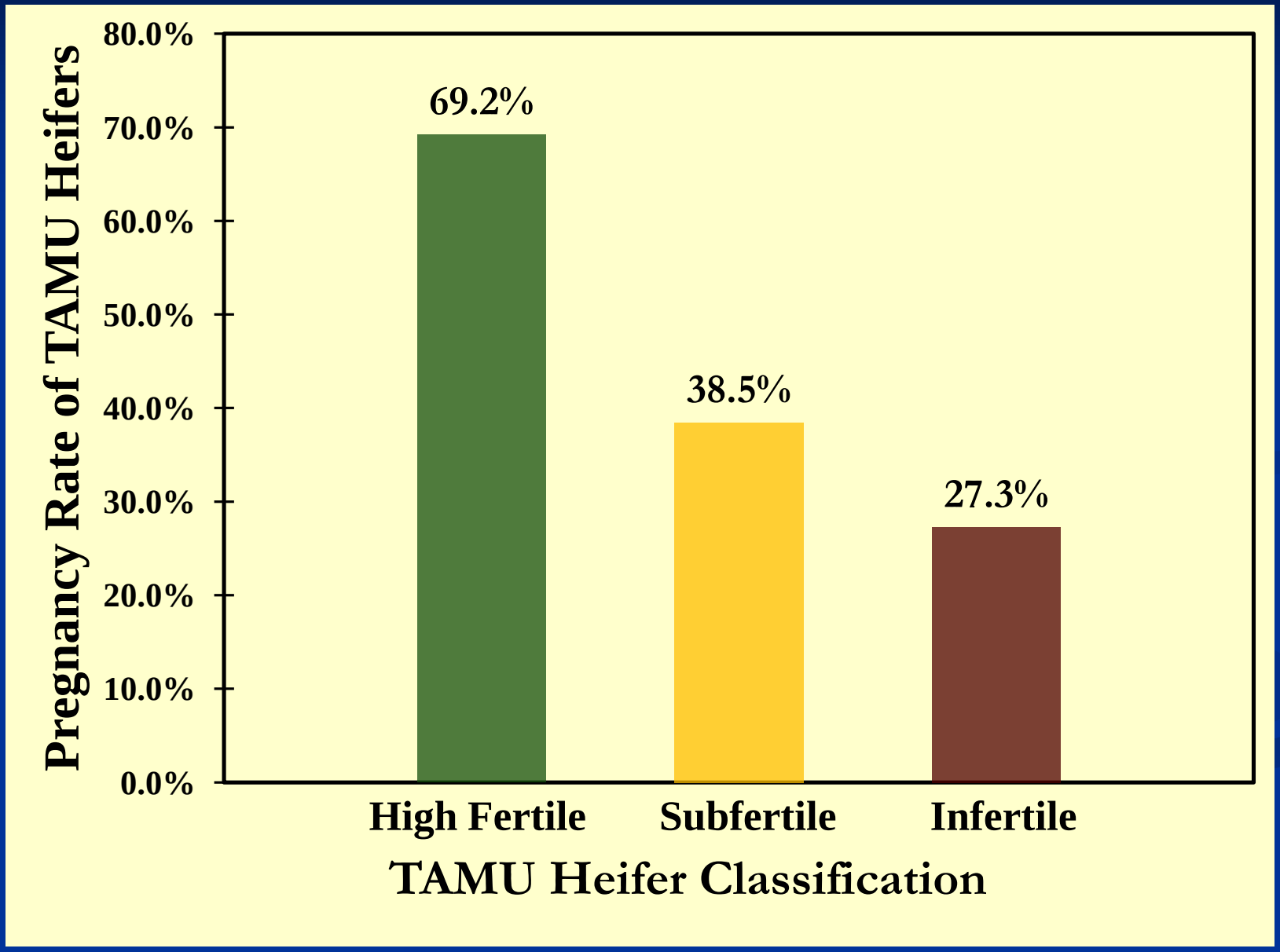
TAMU Heifers to Fort Keogh

1. Embryo donors – oocyte problem
2. Embryo recipients – uterine problem

TAMU Heifers as Embryo Donors



TAMU Heifers as Embryo Recipients

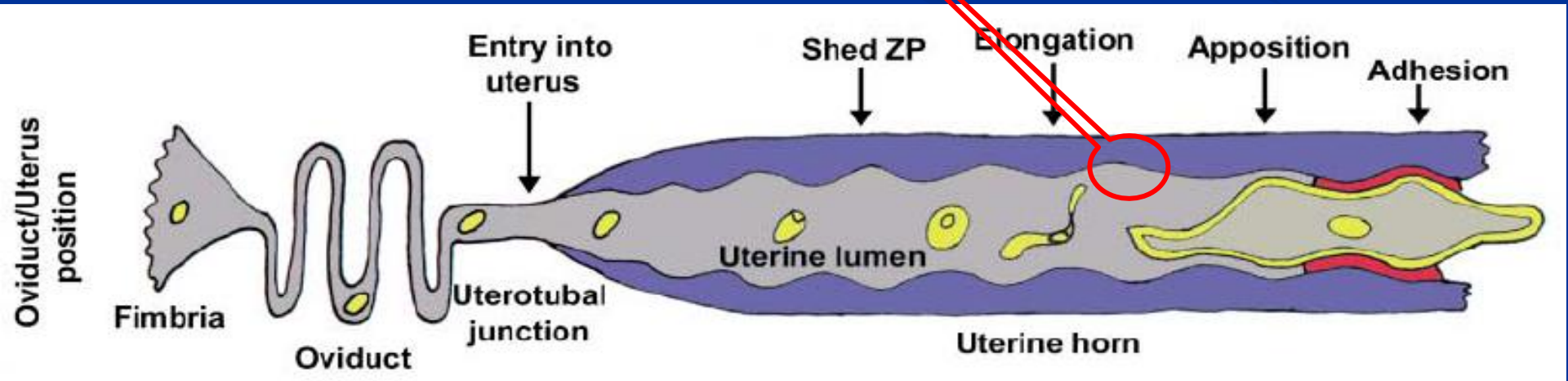


TAMU Heifers

Sent to WSU

1. Uterine Biopsies – expression profiles
2. Genetic Markers?

High Fertile
Subfertile
Infertile



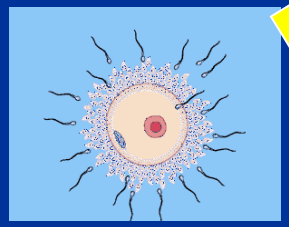
Why / Where is pregnancy failing?

Day 1

95%

What role does the bull have in pregnancy success?

Oocyte Competence



Day 27

70%

Oviductal support

Embryo Elongation

MRP (IFN-τ)

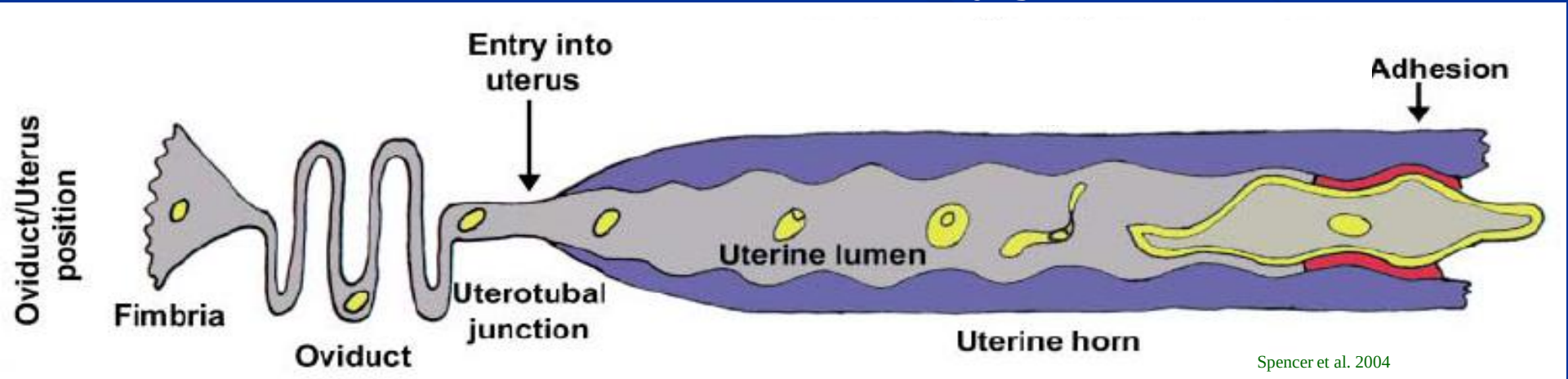
Uterine dependent period

d 1 - 4

d 5 - 14

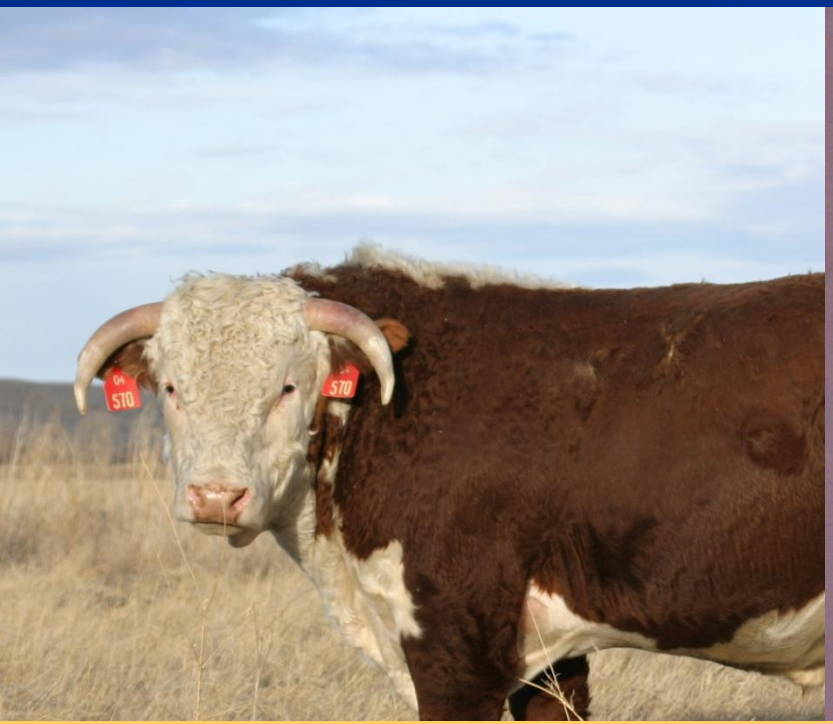
d 15 - 17

d 18 - 27



Spencer et al. 2004

Single most important measure of fertility for cow/calf producer?



Each bull is expected to contribute to the production

Limitations: Fertility measure on that given day

Only about 1/3 of the "Fertility Picture"

Key Parameters of Sperm Fertility

MEMBRANE INTEGRITY (1)
•BROKEN, OPENS THE DOOR TO DNA

CAPACITATION (5)
•PREPARE SPERM TO FERTILIZE

ACROSOME (3)
KEY ROLE IN FERTILIZATION

DNA CONTENT (2)
•CONTROL DNA FRAGMENTATION

MITOCHONDRIAL STATUS (4)
•INFLUENCE MOTILITY

Bacterial count
•CONTAMINATION ALTERS FERTILITY

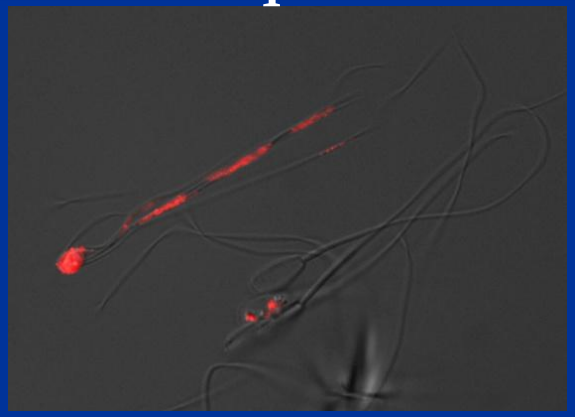
Measuring these key physiological functions provides insight into the fertilization potential of sperm.

EasyCyte Flow Cytometer

Evaluates 5000 sperm/min

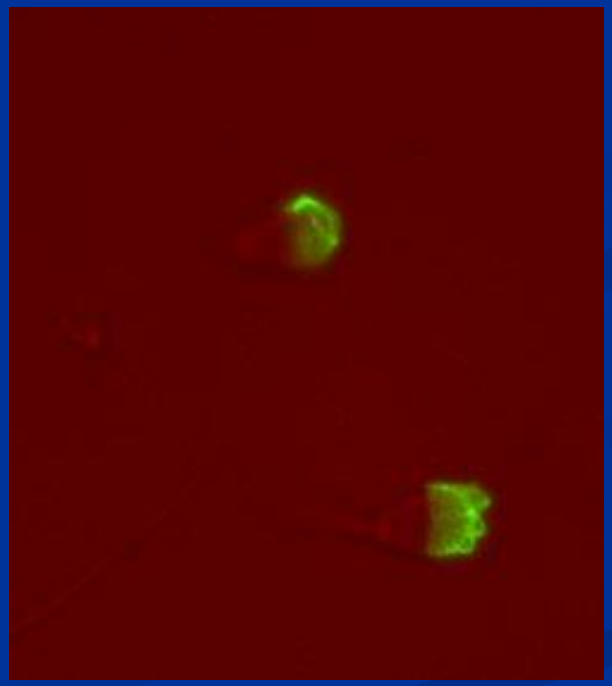
Biological Markers Associated with Fertility

Ubiquitin



Cellular damage

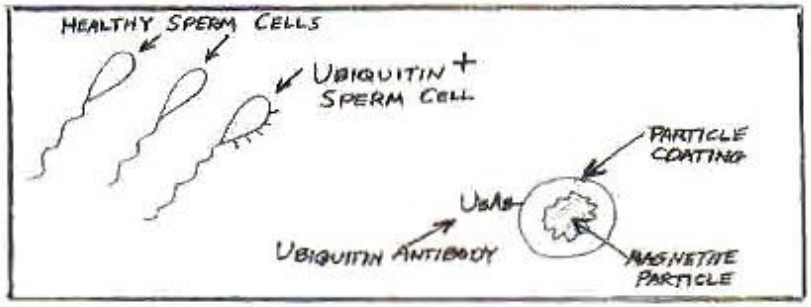
PNA



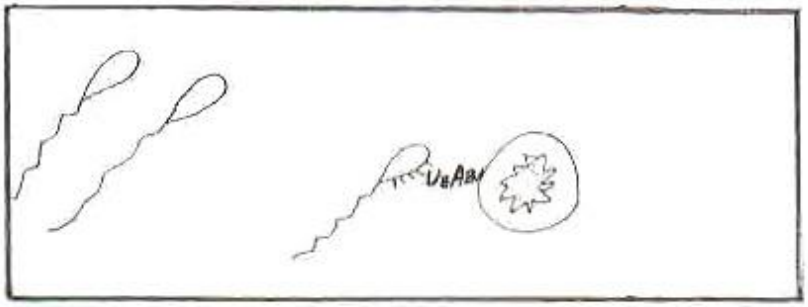
Acrosome reacted sperm

Peter Sutovsky
University of Missouri

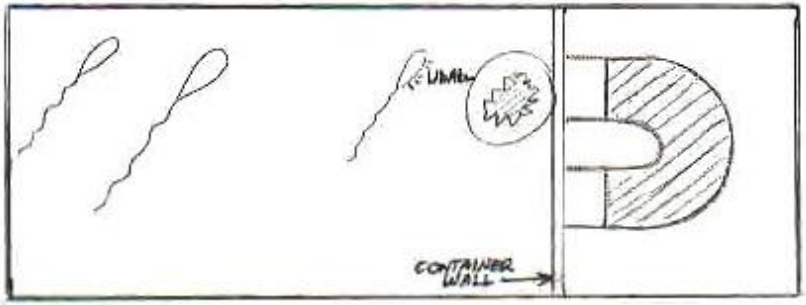
IVF Using Magnetic Sperm Depletion



Magnetic particle containing ubiquitin antibodies are added to semen sample



Ubiquitin antibody recognizes and attaches to Ubiquitin+ sperm cells



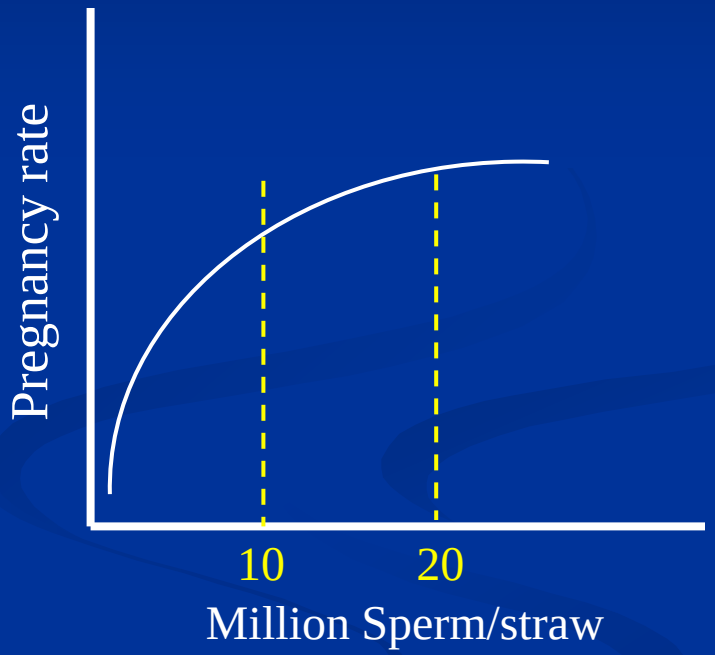
Ubiquitin+ cells removed by external application f permanent magnet

Sperm sorted with Ubiquitin antibody resulted in 2 to 4x higher fertilization rate.

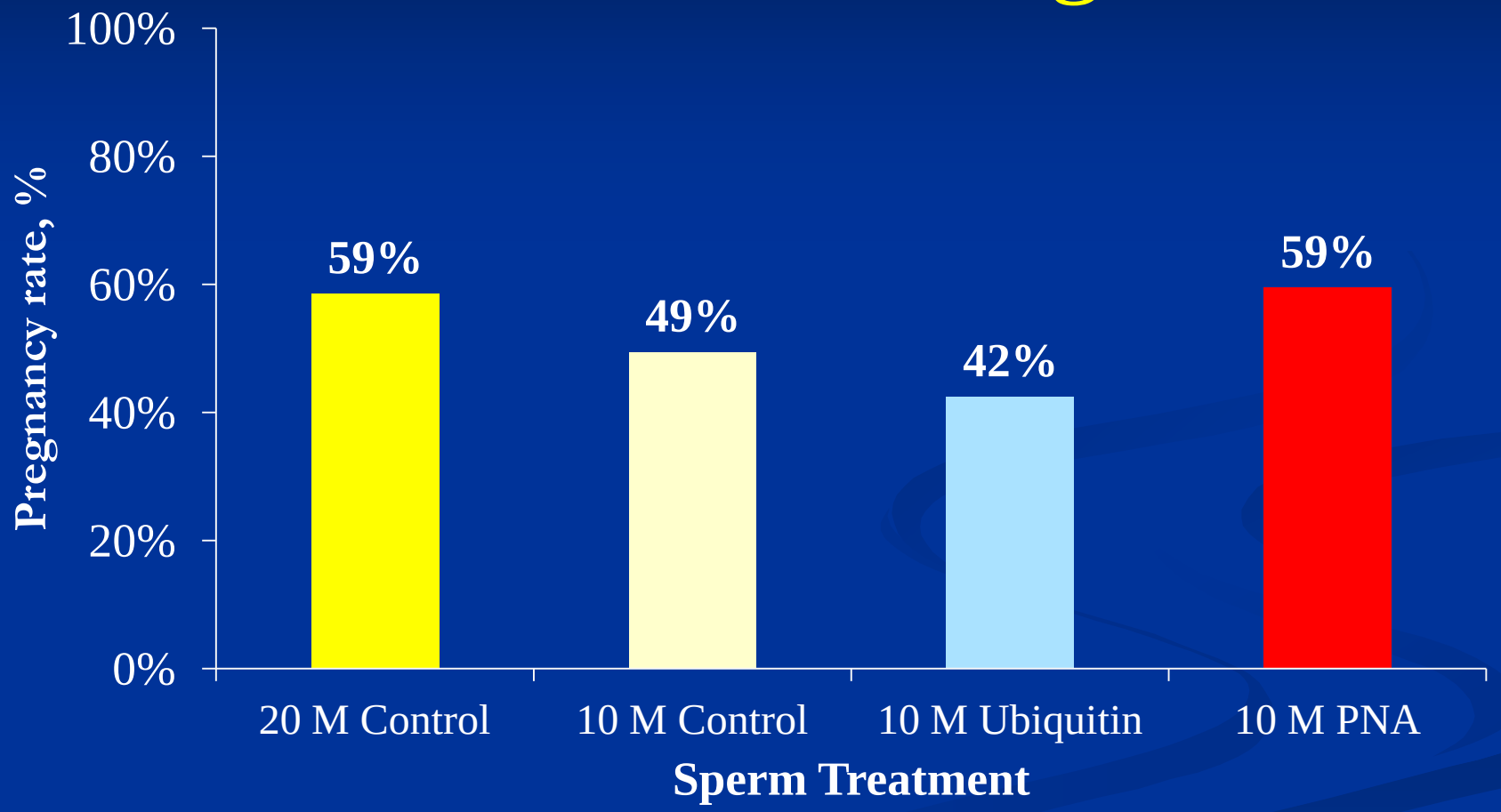
Peter Sutovsky
University of Missouri

Ubiquitin / PNA Microbead Field Trial – Fort Keogh

- 390 Cows + 110 Heifers
- 3 Sires
- 4 Treatments
  - Control 20 x 10^6 Sperm
  - Control 10 x 10^6 Sperm
  - Ubiquitin Sorted 10 x 10^6 Sperm
  - PNA Sorted 10 x 10^6 Sperm



Ubiquitin / PNA Microbead Field Trial – Fort Keogh



Male fertility may account for more than 10% of pregnancy failures. 10% of the time, fertilization achieved by less optimal sperm.

Future CRIS Research

- Continue investigations of phenotypes/genotypes associated with fertility.
  - Cows
  - Bulls
- Earlier pregnancy diagnosis to identify causes of failure.

Fertility – Questions?