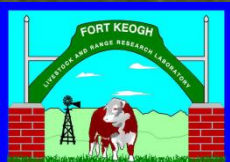
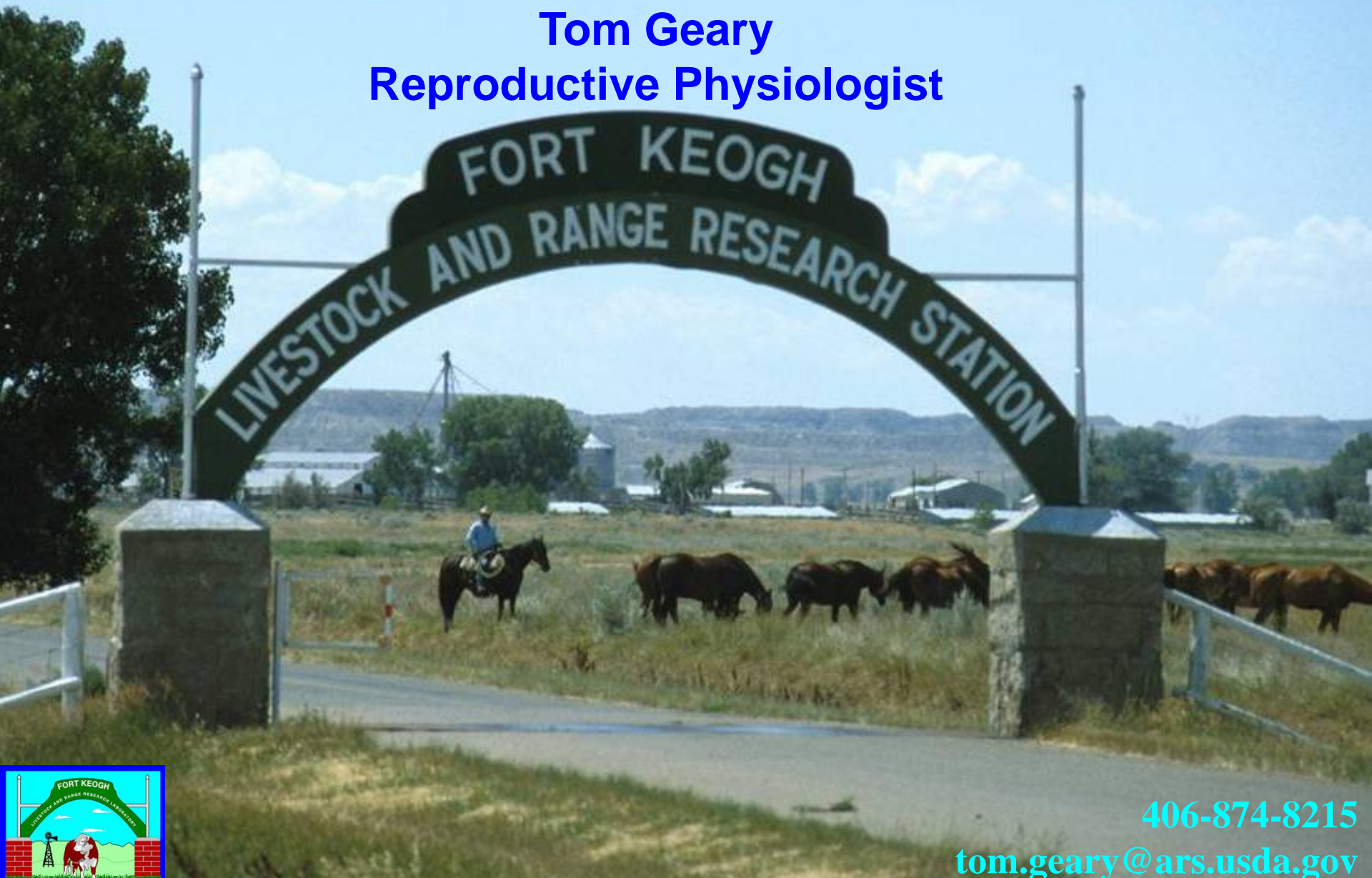


# Recent Developments in Cattle Fertility

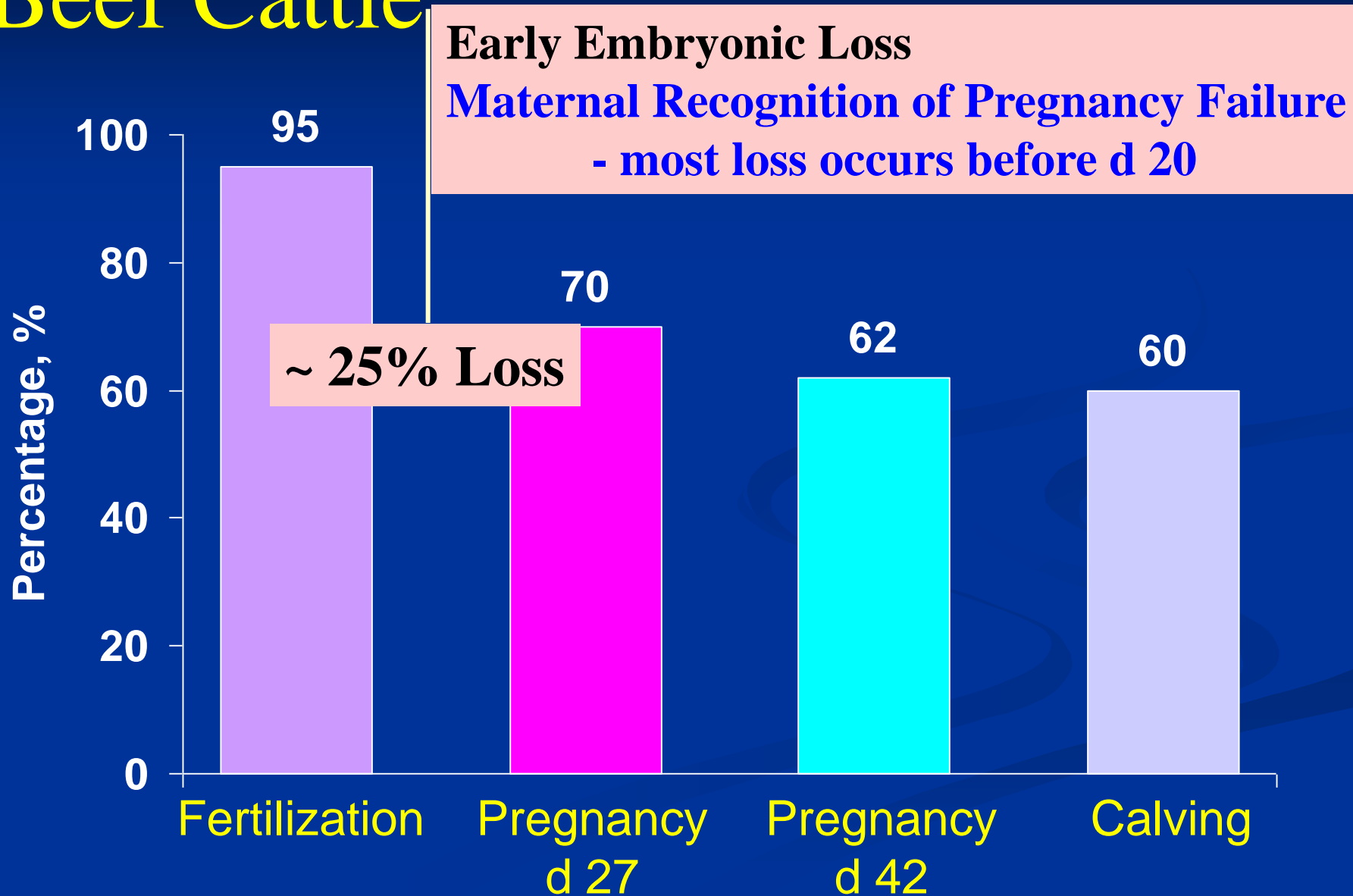
**Tom Geary**  
**Reproductive Physiologist**



406-874-8215

[tom.geary@ars.usda.gov](mailto:tom.geary@ars.usda.gov)

# Fertility of a Single Service: Beef Cattle

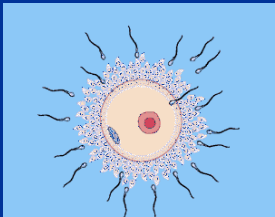


# Early pregnancy diagnosis to identify causes of pregnancy failure at Fort Keogh.

Day 1

95%

Oocyte Competence



Oviductal support

d 1 - 4

Endometrial  
Elongation

d 5 - 14

**Current Technology (d 27)**  
 Ultrasound  
 Blood – Pregnancy specific proteins

d 15 - 17

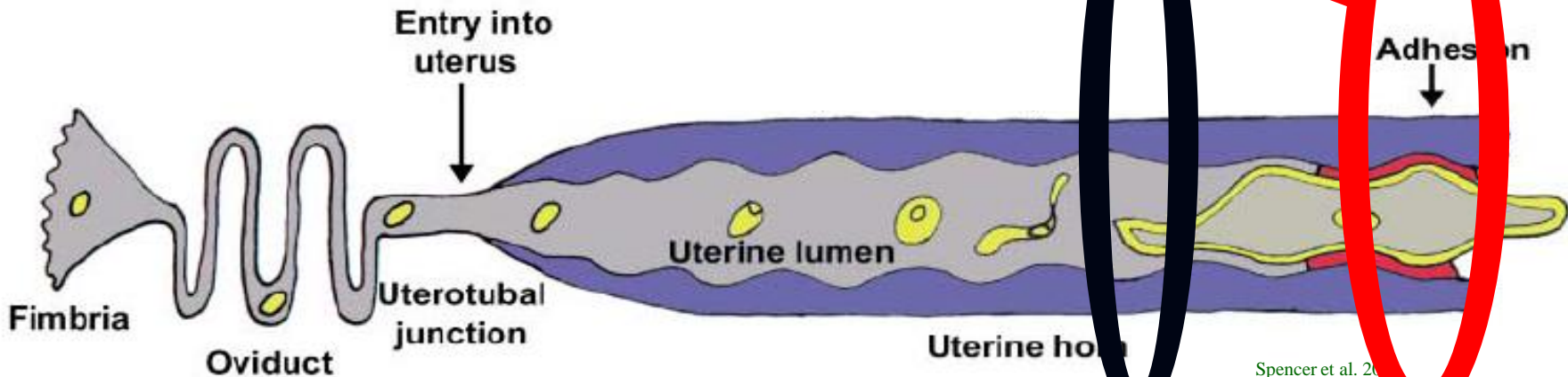
d 28

Day 30

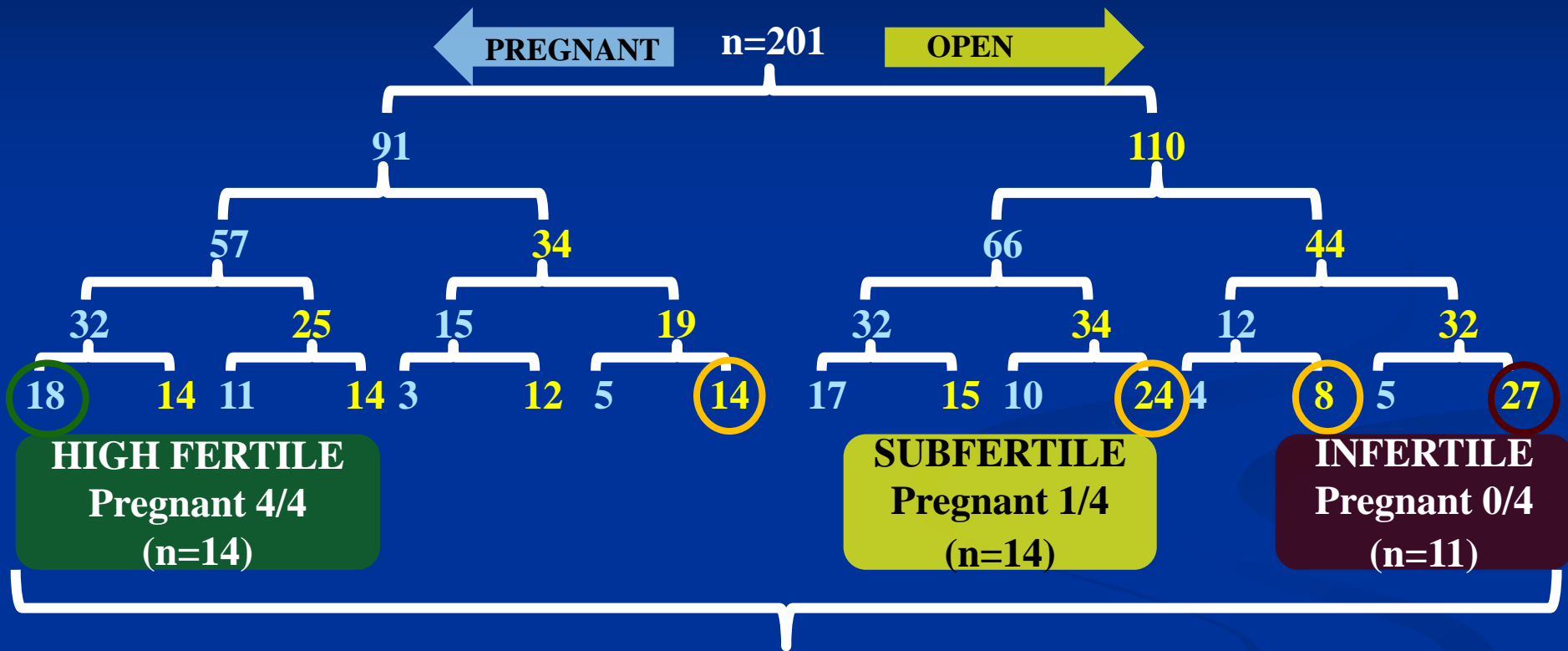
70%

Adhesion

Oviduct/Uterus position



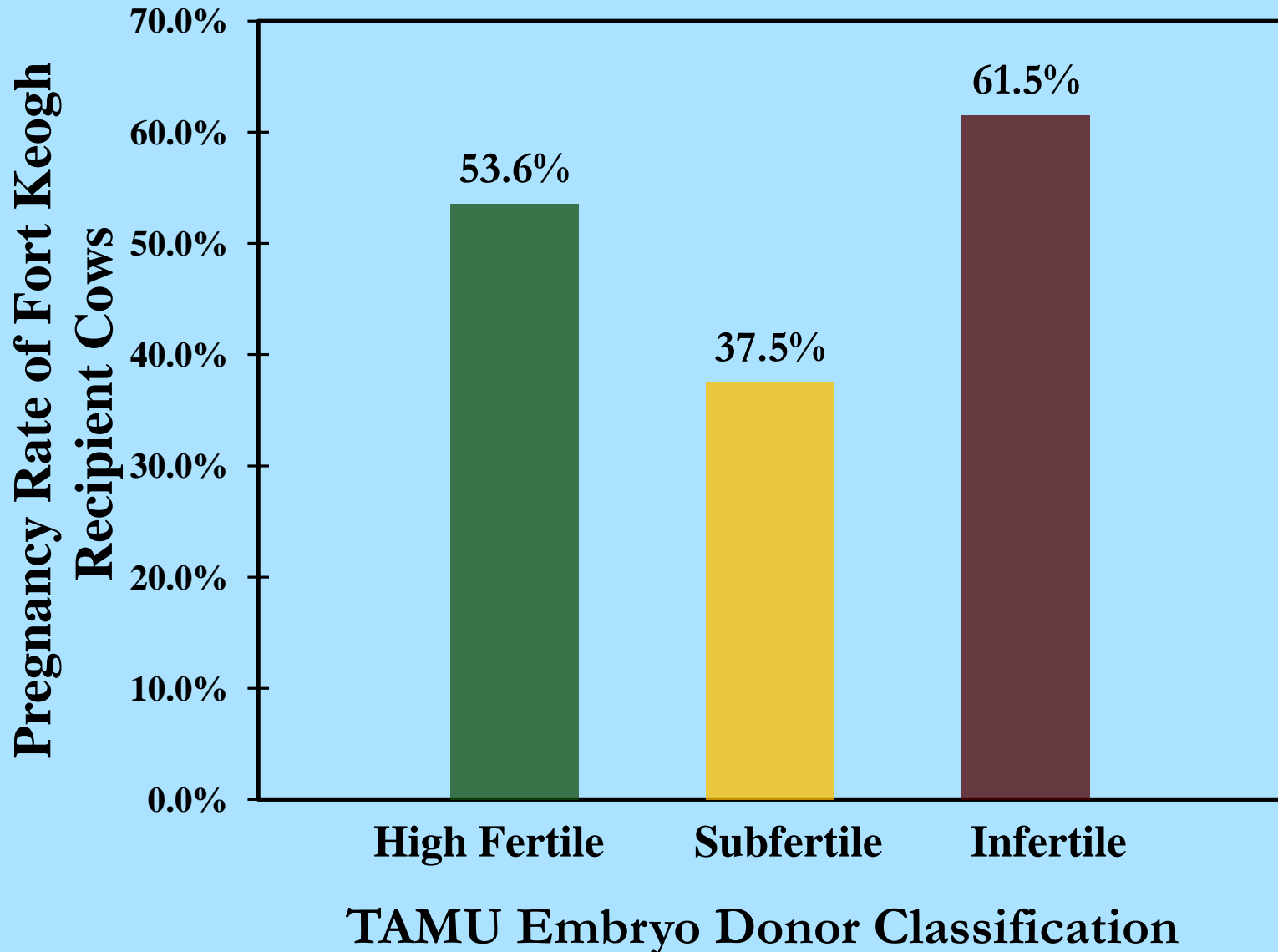
# Heifer Fertility: Genetic Markers?



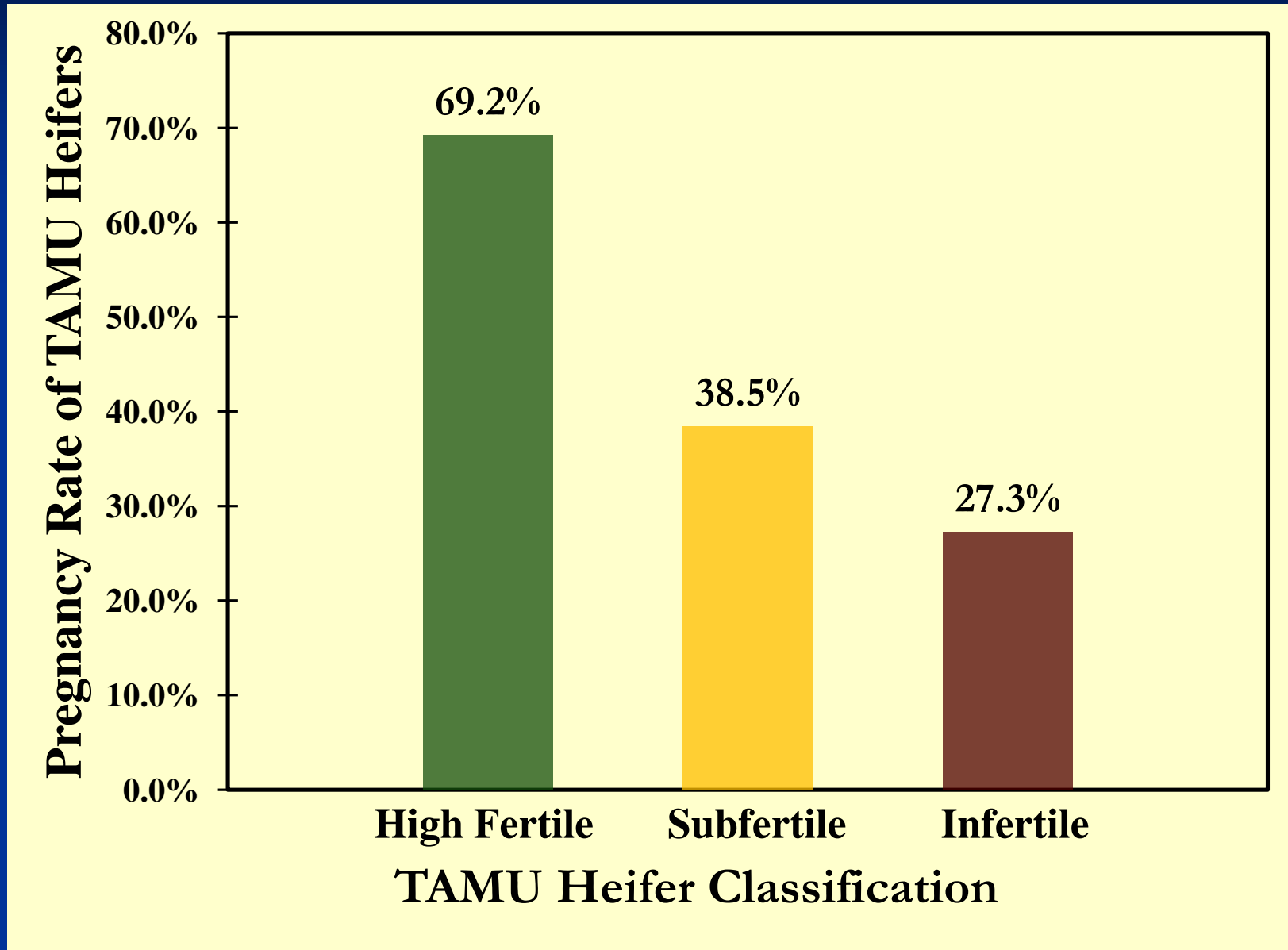
## TAMU Heifers to Fort Keogh

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

# TAMU Heifers as Embryo Donors



# TAMU Heifers as Embryo Recipients

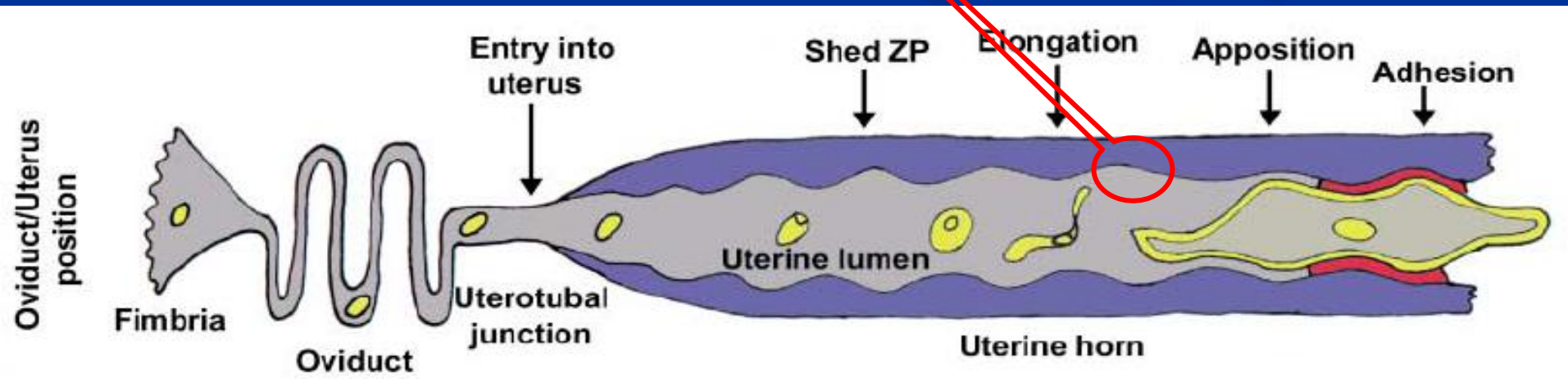


# TAMU Heifers

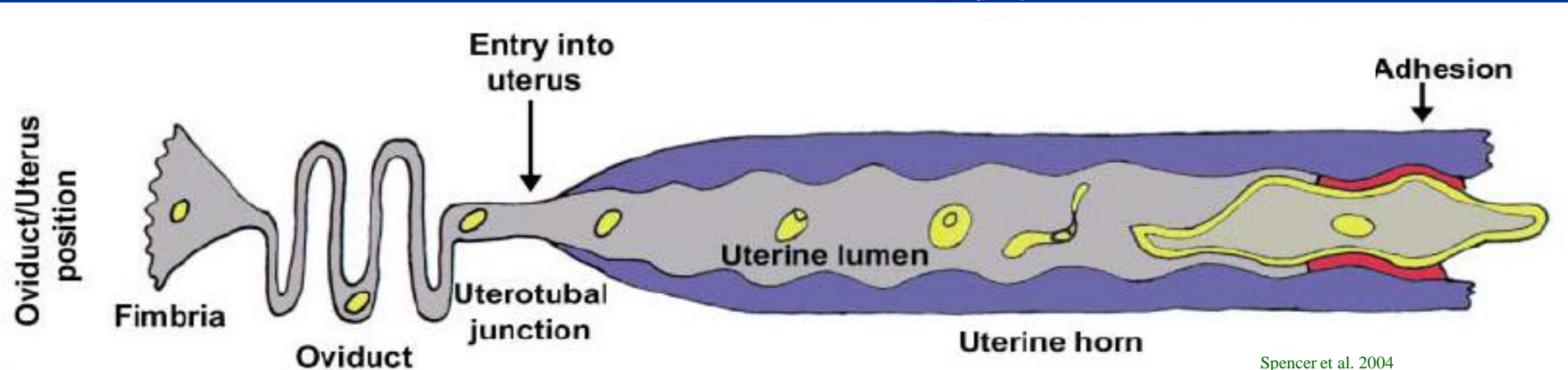
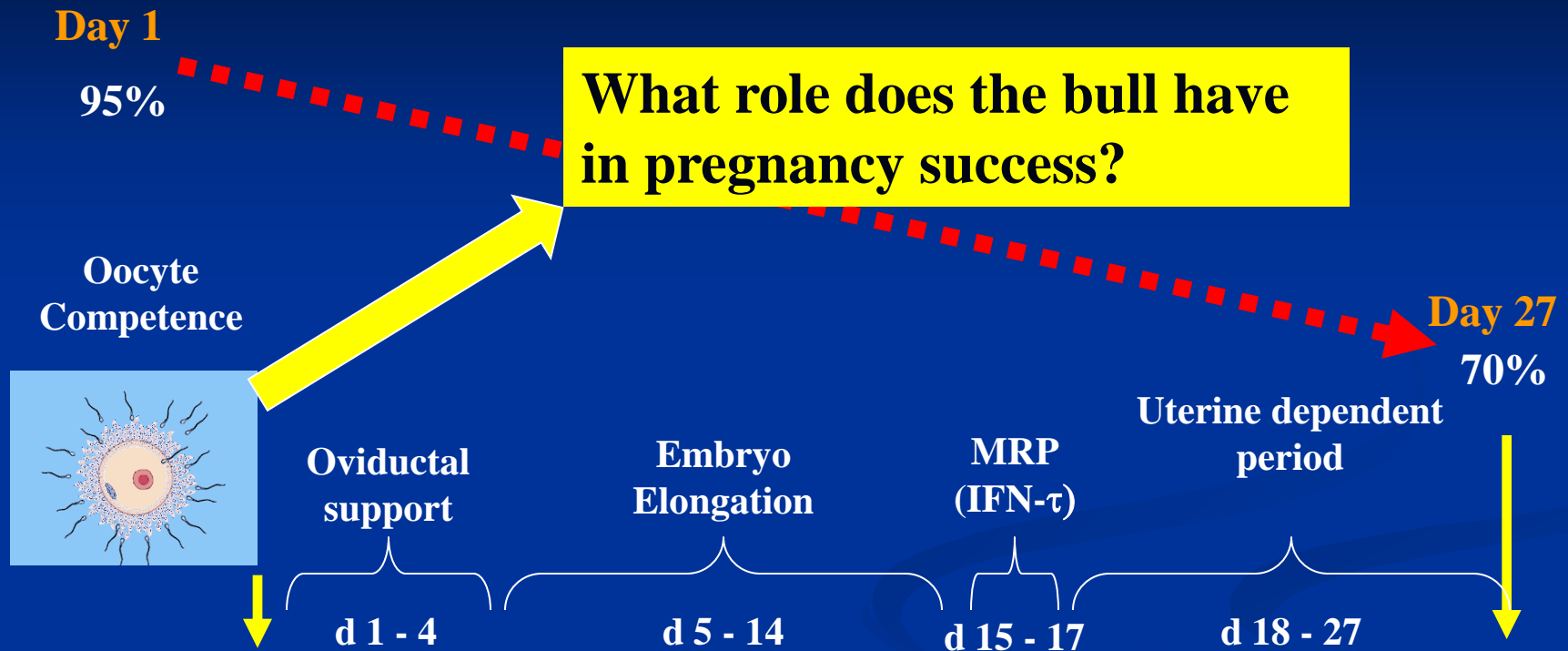
## Sent to WSU

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

High Fertile  
Subfertile  
Infertile



# Why / Where is pregnancy failing?





# 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

**MITOCHONDRIAL STATUS (4)**  
•INFLUENCE MOTILITY

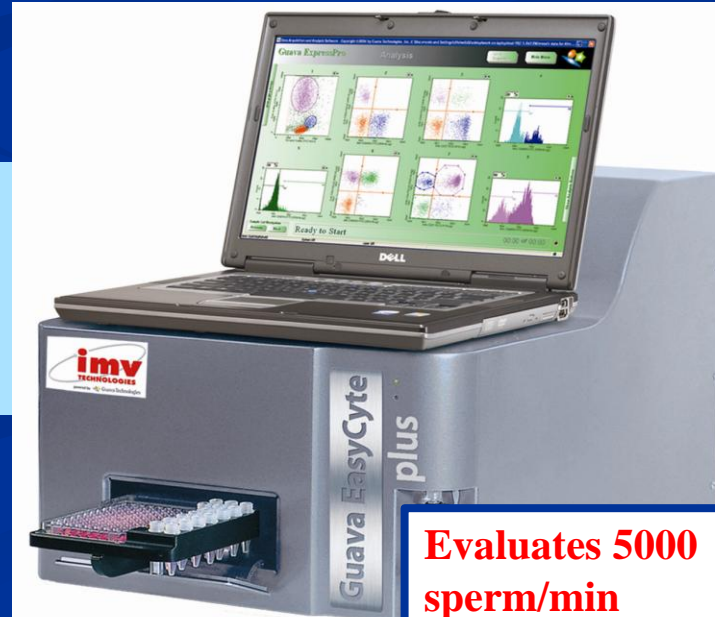
**DNA CONTENT (2)**  
•CONTROL DNA FRAGMENTATION

**Bacterial count**  
•CONTAMINATION  
ALTERS FERTILITY



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

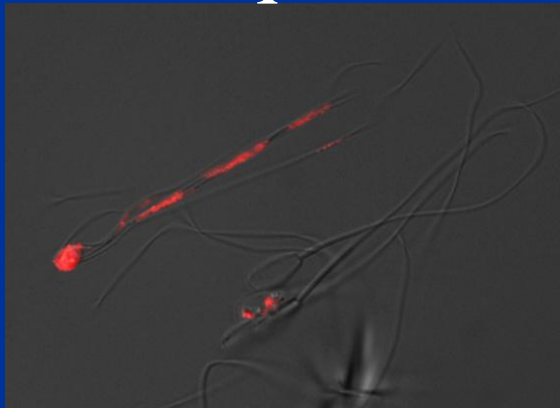
**EasyCyte Flow Cytometer**



**Evaluates 5000 sperm/min**

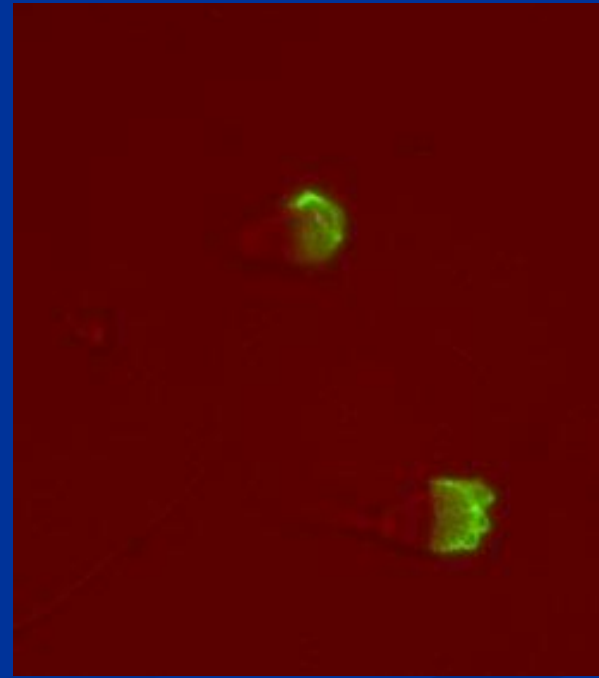
# Biological Markers Associated with Fertility

Ubiquitin



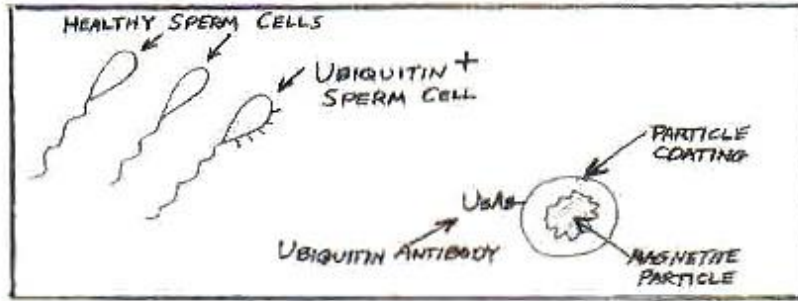
Cellular damage

PNA

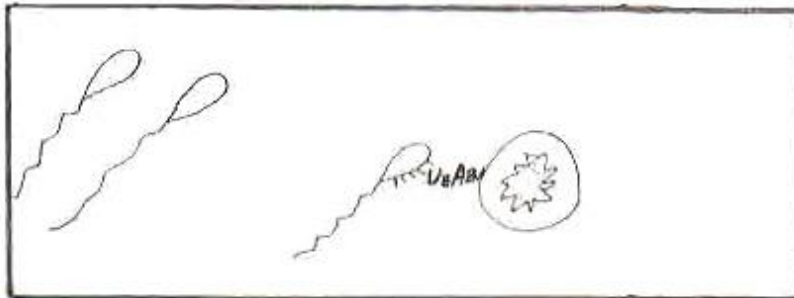


Acrosome reacted sperm

# IVF Using Magnetic Sperm Depletion



Magnetic particle containing ubiquitin antibodies are added to semen sample



Ubiquitin antibody recognizes and attaches to Ubiquitin+ sperm cells



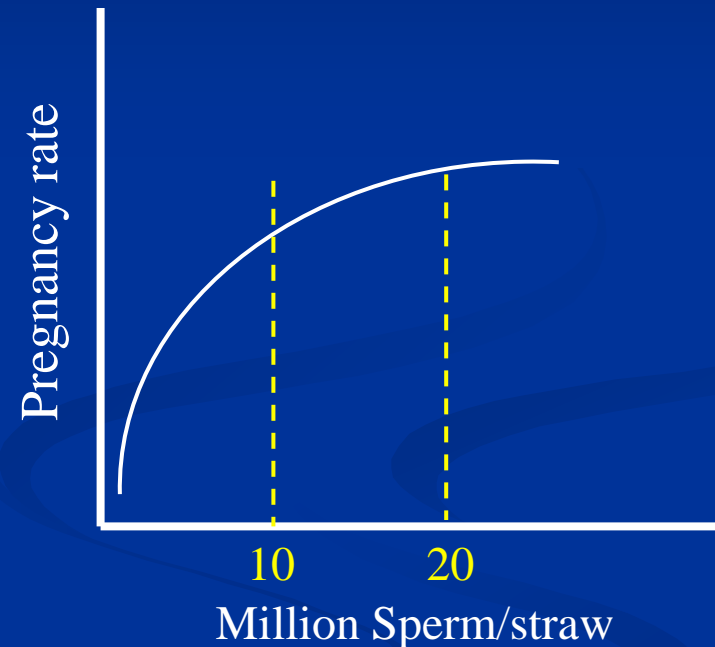
Ubiquitin+ cells removed by external application of permanent magnet

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

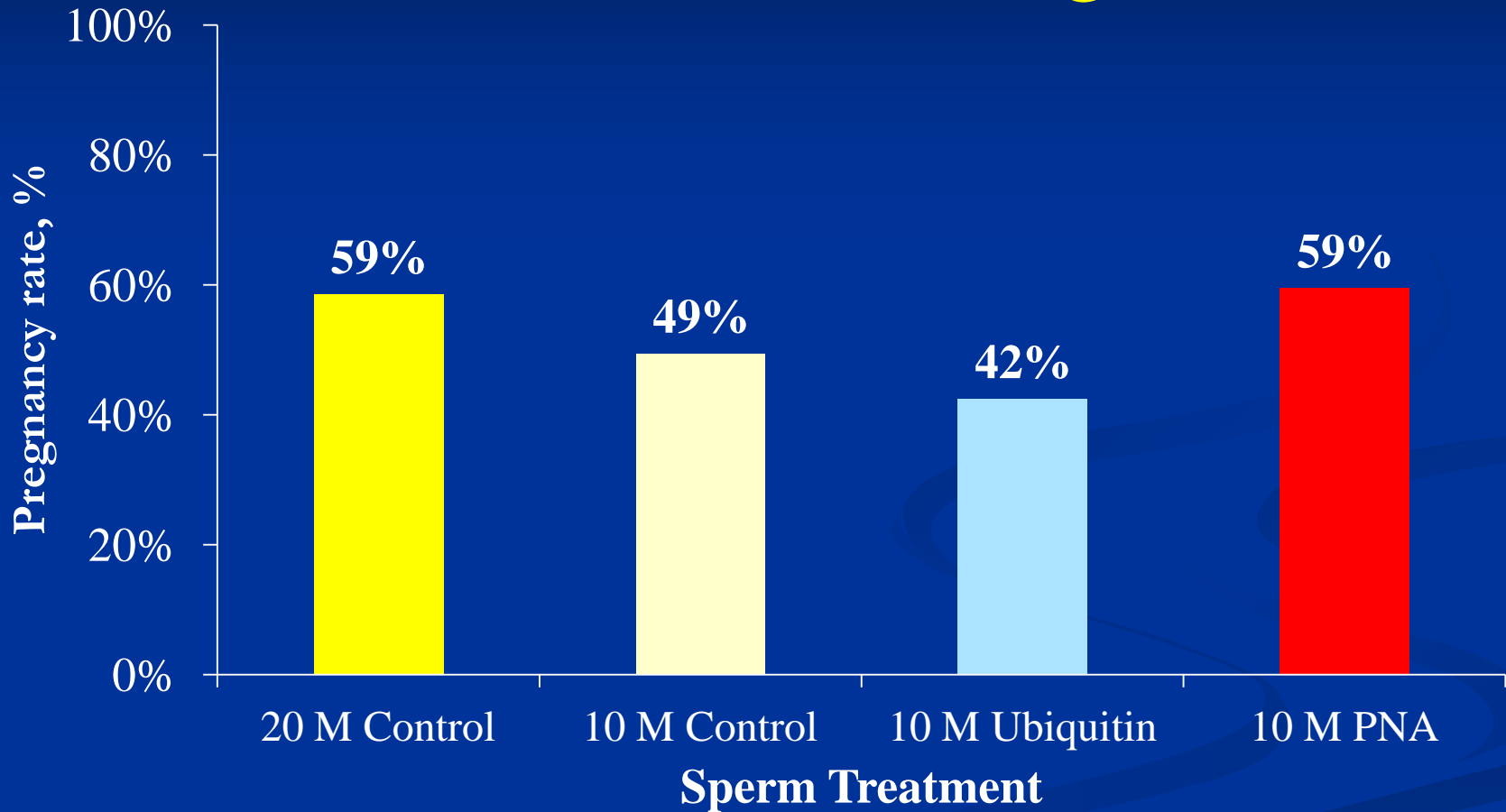
Peter Sutovsky  
University of Missouri

# Ubiquitin / PNA Microbead Field Trial – Fort Keogh

- 390 Cows + 110 Heifers
- 3 Sires
- 4 Treatments
  - Control 20 x 10<sup>6</sup> Sperm
  - Control 10 x 10<sup>6</sup> Sperm
  - Ubiquitin Sorted 10 x 10<sup>6</sup> Sperm
  - PNA Sorted 10 x 10<sup>6</sup> 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?

