

# *Sterilization Vaccine For Cattle*



**Amplicon Express**

Pullman, Washington

[www.amplicon-express.com](http://www.amplicon-express.com)

March 2004

# Presentation Contents



- Historical Information about LHRH researchers
- Patents and Intellectual Property
- Basic Description of LHRH Function and Fusion Protein Construct
- Data from Heifer Study Performed in the U.S.
- Data from Two Bull Studies Performed in Brazil
- Conclusions
- Acknowledgments

## **Dr. Andrew Schally, Dr. Roger Guillemin and Dr. Jerry Reeves**



- After a 21 year race, Dr. Schally and Dr. Guillemin were awarded The Nobel Prize for Medicine in 1977.
- They were awarded the Nobel Prize for identifying a variety of 'Releasing Factors' including LHRH (Luteinizing Hormone Releasing Hormone).
- As a member of Dr. Schally's team, Dr. Reeves worked on LHRH during this time.
- Dr. Reeves' career long vision has been to use LHRH for control of reproduction and improving meat quality in domestic animals.

## Dr. Jerry Reeves (continued)

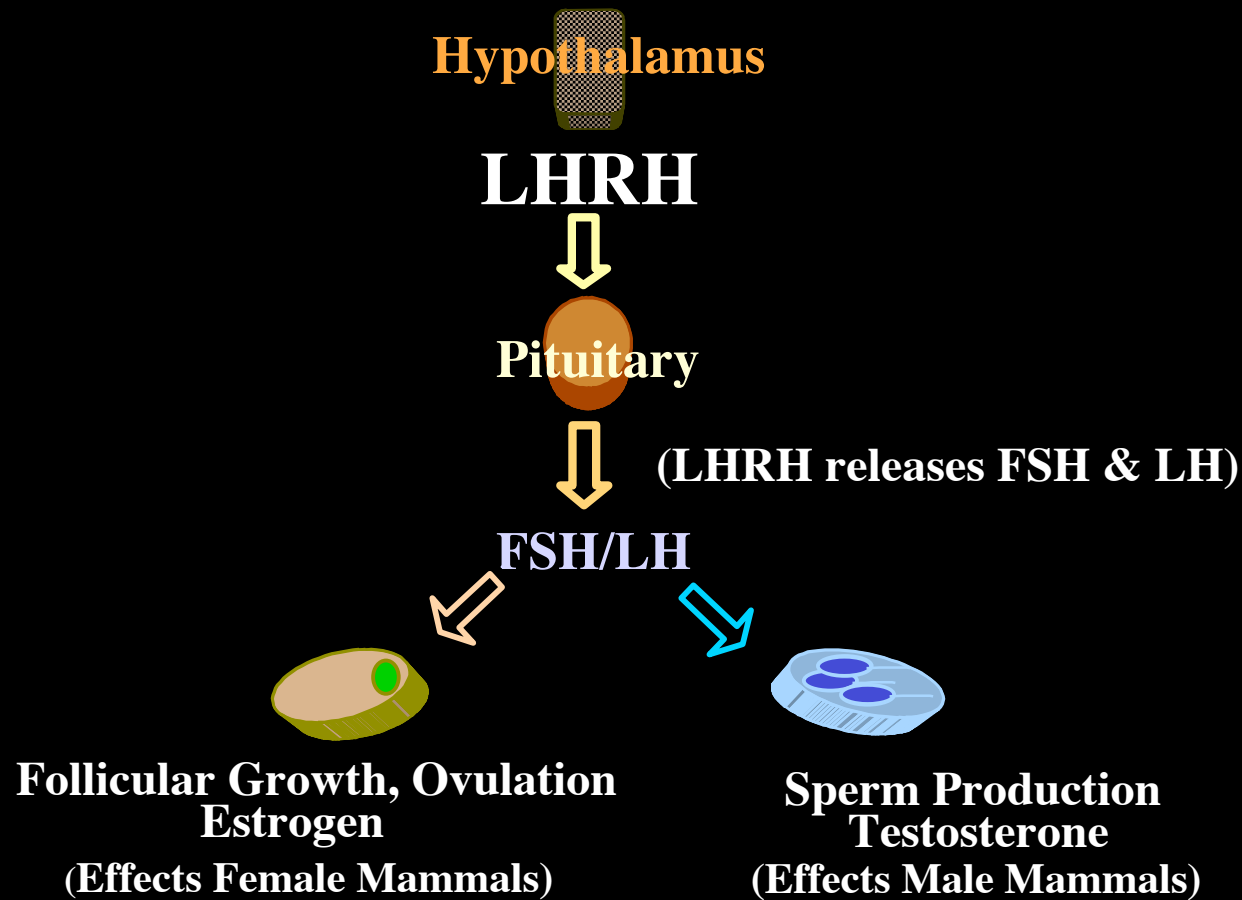


- Dr. Reeves' team has been developing fusion protein constructs using LHRH for nearly 30 years.
- He has mentored 31 Master students and 18 PhD students, many working on LHRH and associated hormones.
- His publication record includes more than 100 peer reviewed manuscripts on LHRH and related subjects.
- He is currently at Washington State University, Department of Animal Sciences.

## Patents and Intellectual Property

- U.S. Patent No. 6,013,770, “Chimeric Contraceptive Vaccines,” Jerry J. Reeves, Kevin P. Bertrand, and Yuzhi Zhang, issued January 11, 2000 (WSURF #363)
- U.S. Patent No. 6,045,799, “Chimeric Contraceptive Vaccines,” Jerry J. Reeves, Kevin P. Bertrand, and Yuzhi Zhang, issued April 4, 2000 (WSURF #363)
- U.S. Patent Application Serial No. 09/524,974, “Chimeric Contraceptive Vaccines,” Jerry J. Reeves, Kevin P. Bertrand, and Yuzhi Zhang, filed March 14, 2000 (WSURF #363; this is a continuation application)
- All Intellectual Property associated with this vaccine is exclusively licensed to Amplicon.

# Natural Function of LHRH in Mammals

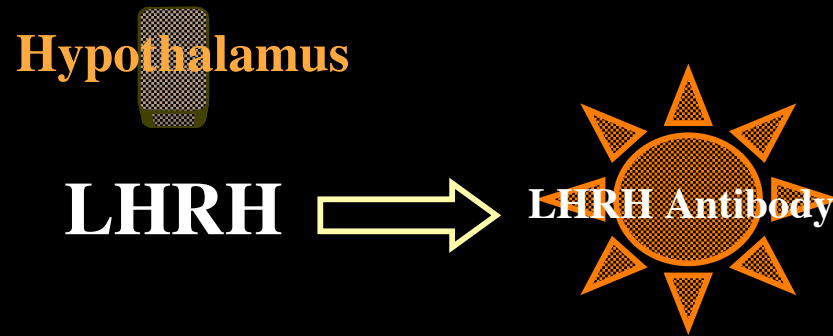


## Design of the Vaccine

- A series of LHRH genes are cloned into Ovalbumin carrier gene which is held in an *E. coli* based expression vector.
- This construct is expressed as a fusion protein, isolated and purified.
- The purified protein is added to an emulsifying agent, oil, dead *mycobacterium butyricum* and a urea + phosphate buffer.
- The vaccine is injected subcutaneous into animals to cause an immune response against LHRH.
- Antibodies to the LHRH fusion protein remove naturally occurring LHRH from the animal and prevent FSH/LH release.

# Action of LHRH Vaccine in Mammals

Antibodies to LHRH vaccine neutralize naturally occurring LHRH in the animal



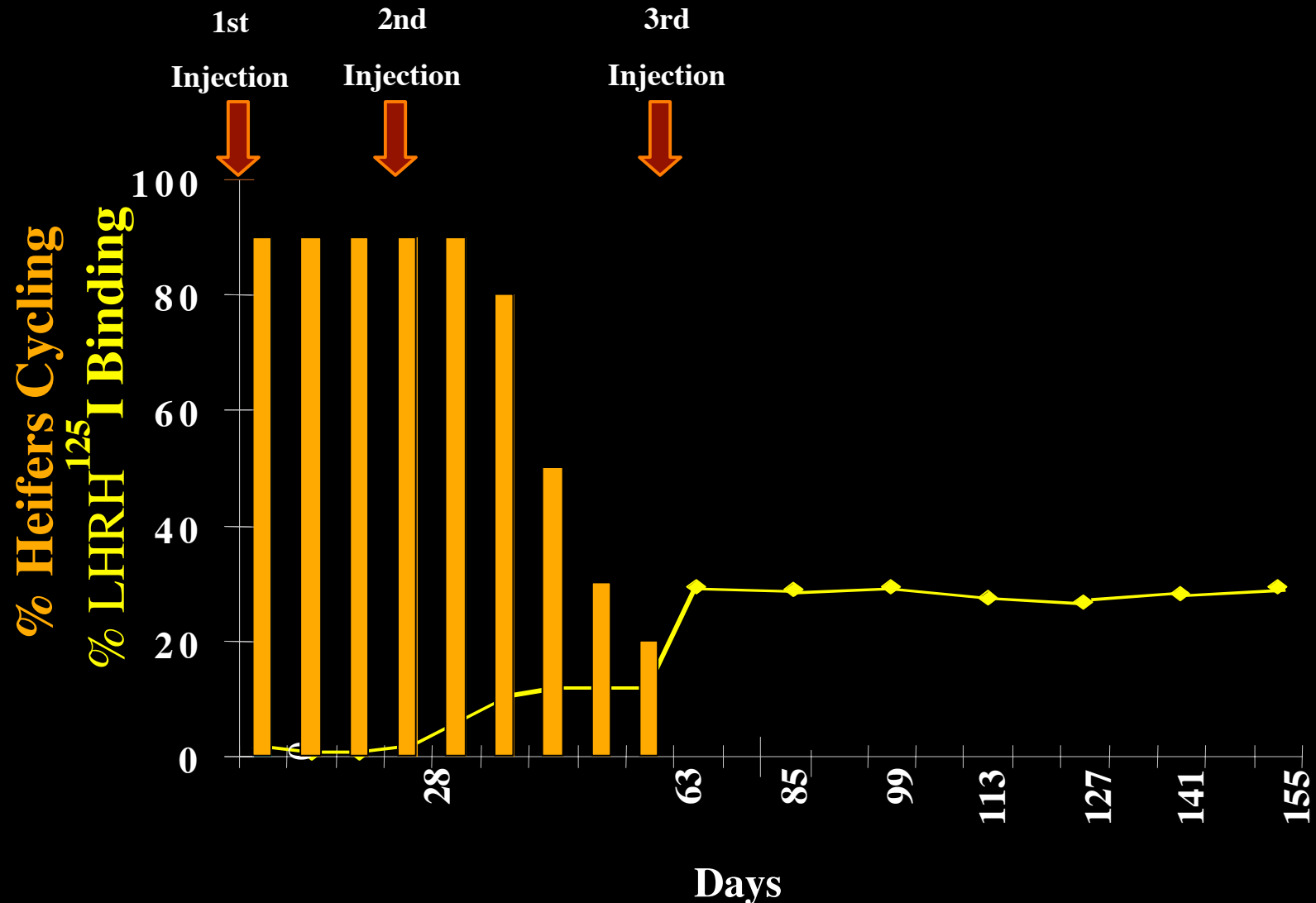
**Pituitary** (FSH & LH remain in the Pituitary)

**NO ESTROGEN OR TESTOSTERONE PRODUCTION**

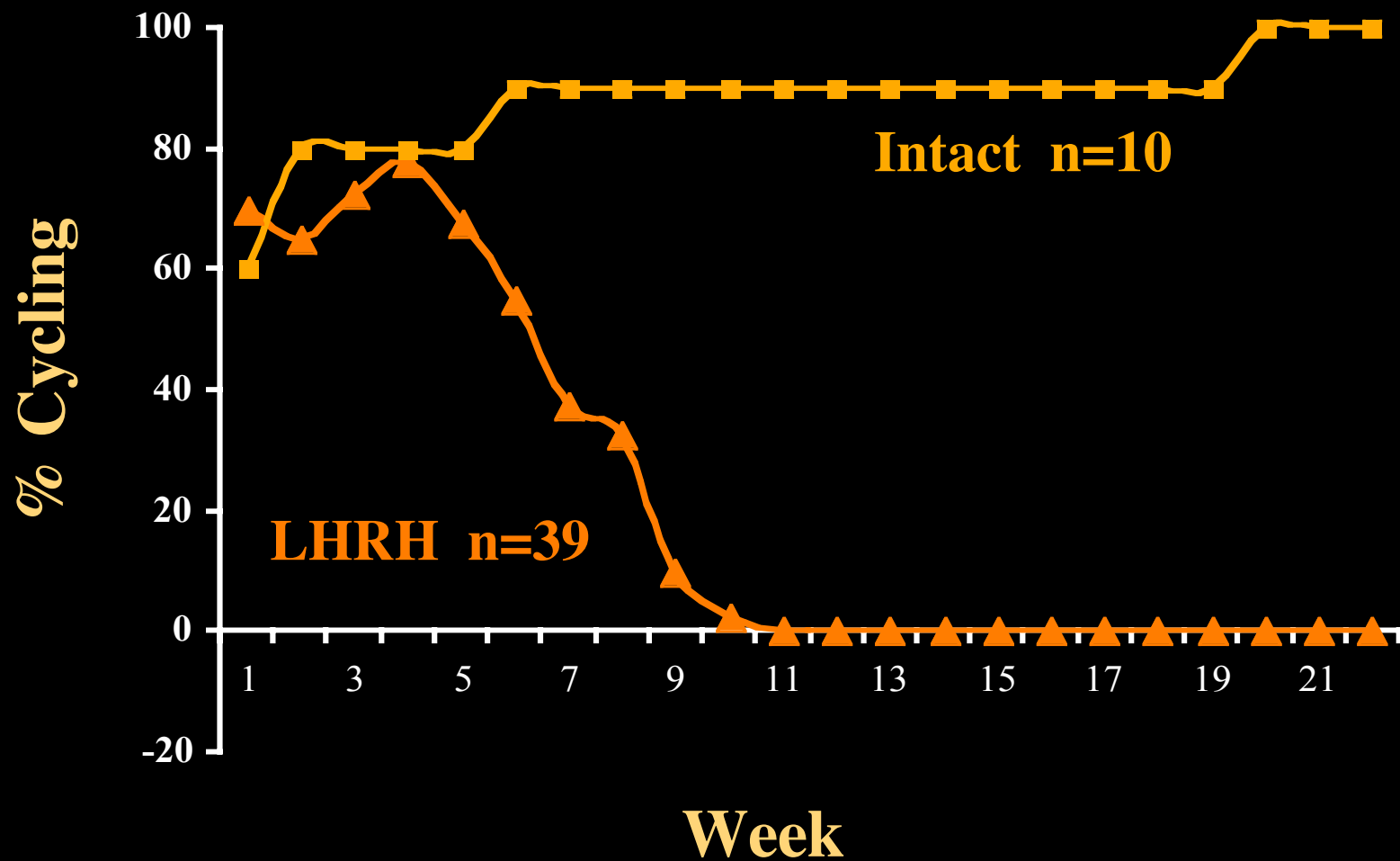
## Scientific Study: Heifers in the USA

- **Problem:** Prior to slaughter, US cattle ranchers move Heifers into expensive 'feed lots' to increase meat quality and quantity. Pregnant Heifers spend valuable resources on the fetus and not on meat production.
- **Hypothesis:** Heifers immunized with the LHRH vaccine will earn more money for the producers by not becoming pregnant.
- **Objective:** Prove the effectiveness of LHRH vaccine in preventing Heifers from cycling (required for becoming pregnant).
- **US Market Size:** 12 Million Heifers per year are slaughtered.

# LHRH Injection Timing and Percent Cycling Data



# LHRH Immunized Heifers vs. Intact Heifers



## Scientific Study: Heifers in the USA

- **Results:** All Heifers in the study stopped cycling after being immunized with the LHRH vaccine. Suppression of estrus is correlated to LHRH antibody titers.
- **Current Studies:** To quantify the increased meat quantity and quality from immunized Heifers.
- **Issues:** Obtaining FDA approval for the use of the LHRH vaccine (in US Heifers) will require years of clinical trials.



## Scientific Study: Bulls in Brazil

- **Problem:** Intact Brazilian bulls have low quality meat and are very aggressive (fighting and damaging property). Traditional castration creates a variety of problems including infection, screw worm infestation and possible death (1% to 3%).
- **Hypothesis:** LHRH immunized bulls will have a quality of meat and carcass weights similar to traditionally castrated bulls.
- **Objective:** To determine if the LHRH vaccine is a cost effective, humane alternative to castration.
- **Brazilian Cattle Market Size:** 176 Million cattle are slaughtered per year.

# Locations for Experiment: Brazilian Bull Study

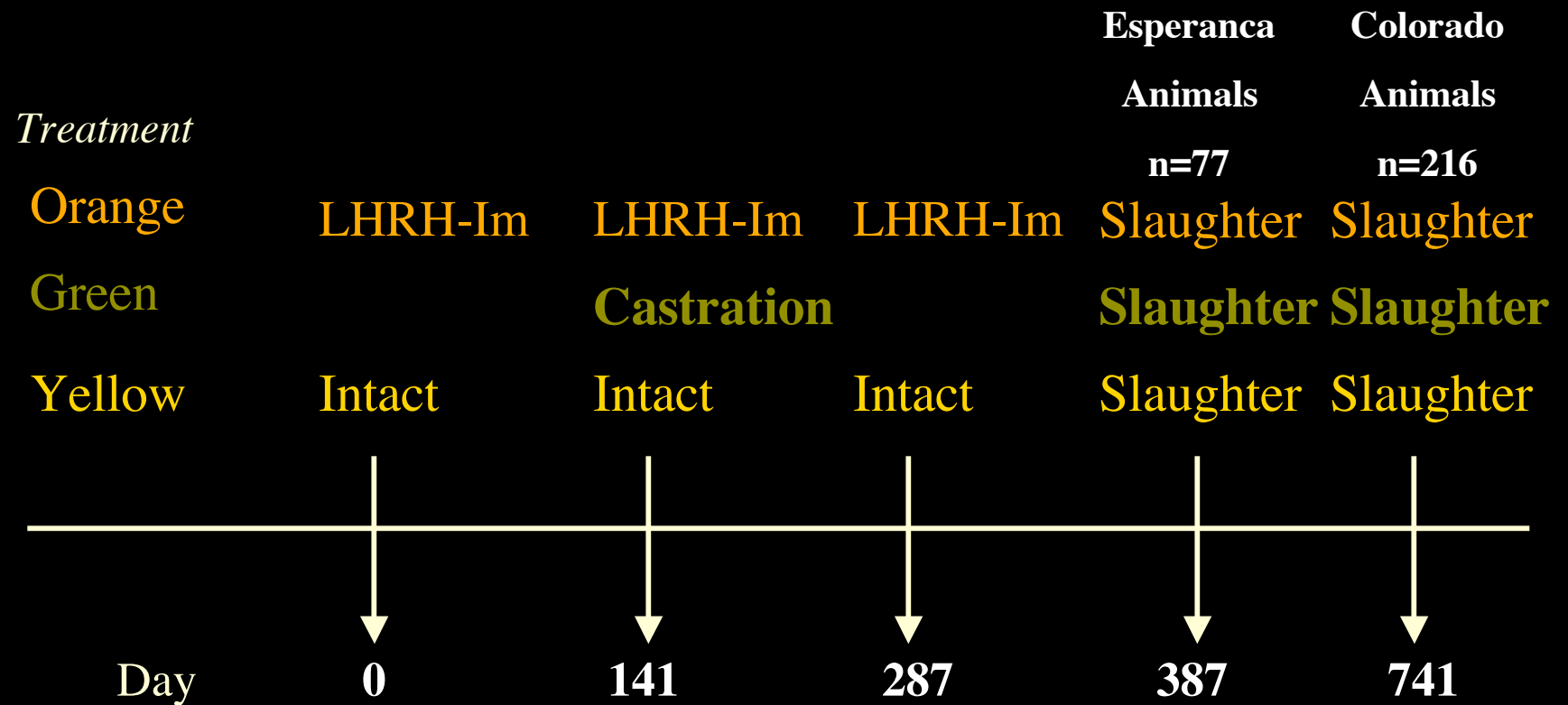
- **Two Ranches in Mato Grosso Region of Brazil**
  - John Carter (Esperanca Ranch) n=77 animals
  - Dr. Hugo (Colorado Ranch) n=216 animals
- **Esperanca Ranch animals were two years old when the study was started and were slaughtered 387 days after the initial immunization.**
- **Colorado Ranch animals were two years old when the study was started and were slaughtered 741 days after the initial immunization.**

## Methods: Brazilian Bull Study

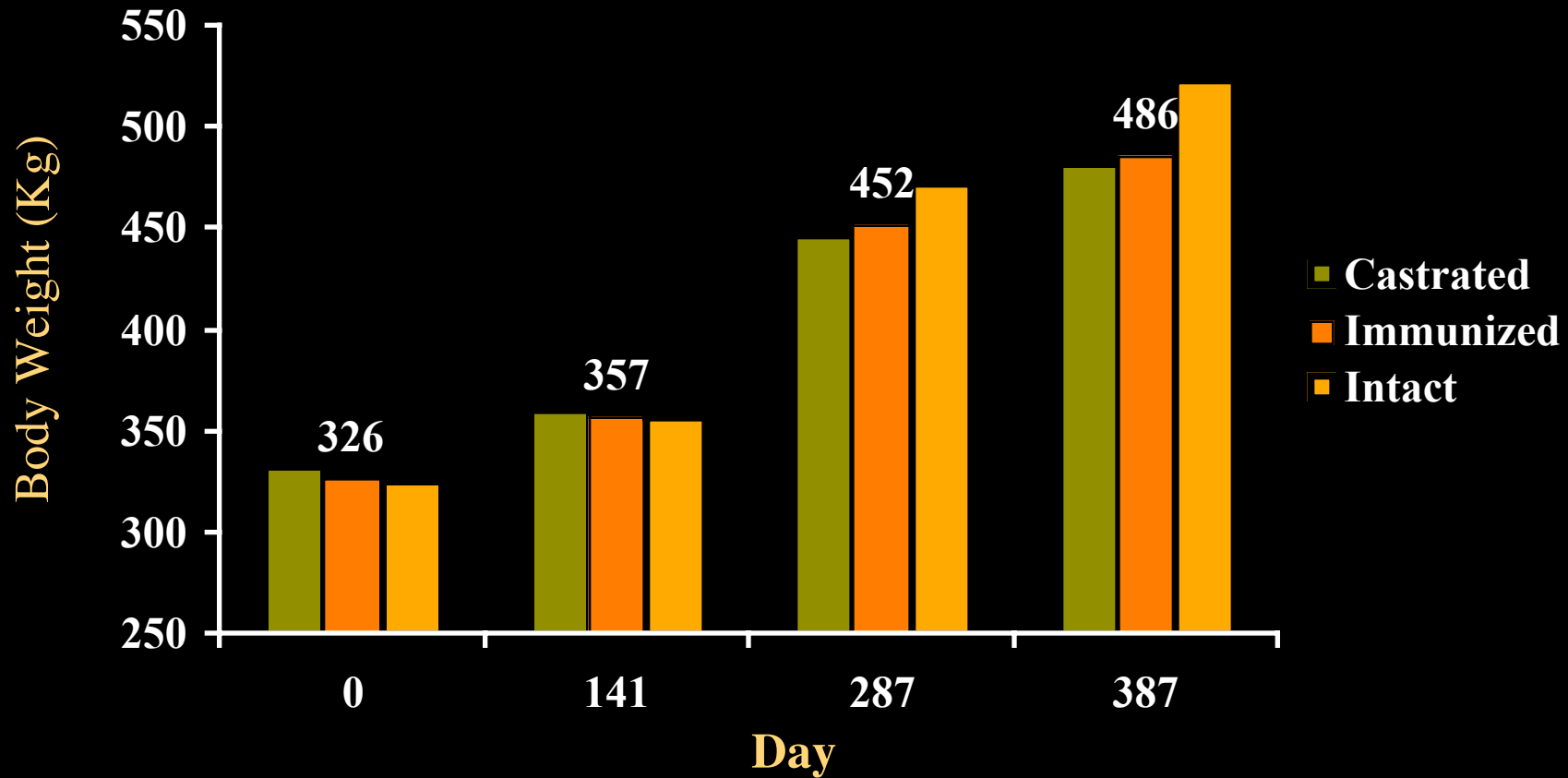
- **Three treatment groups**
  - LHRH immunized (n=98)
  - Castrated (n=98)
  - Intact Bulls Control (n=97)
- **Measure Body Weights**
- **Measure Scrotal Circumferences**
  - Decreased circumference indicates vaccine is functioning properly
- **Measure Testes and Epididymis Weights after slaughter**
  - Decreased weight indicates vaccine is functioning properly
- **Collect and Analyze Meat Quality Data**
  - Marbling, Fat Content, Tenderness, Flavor and Juiciness



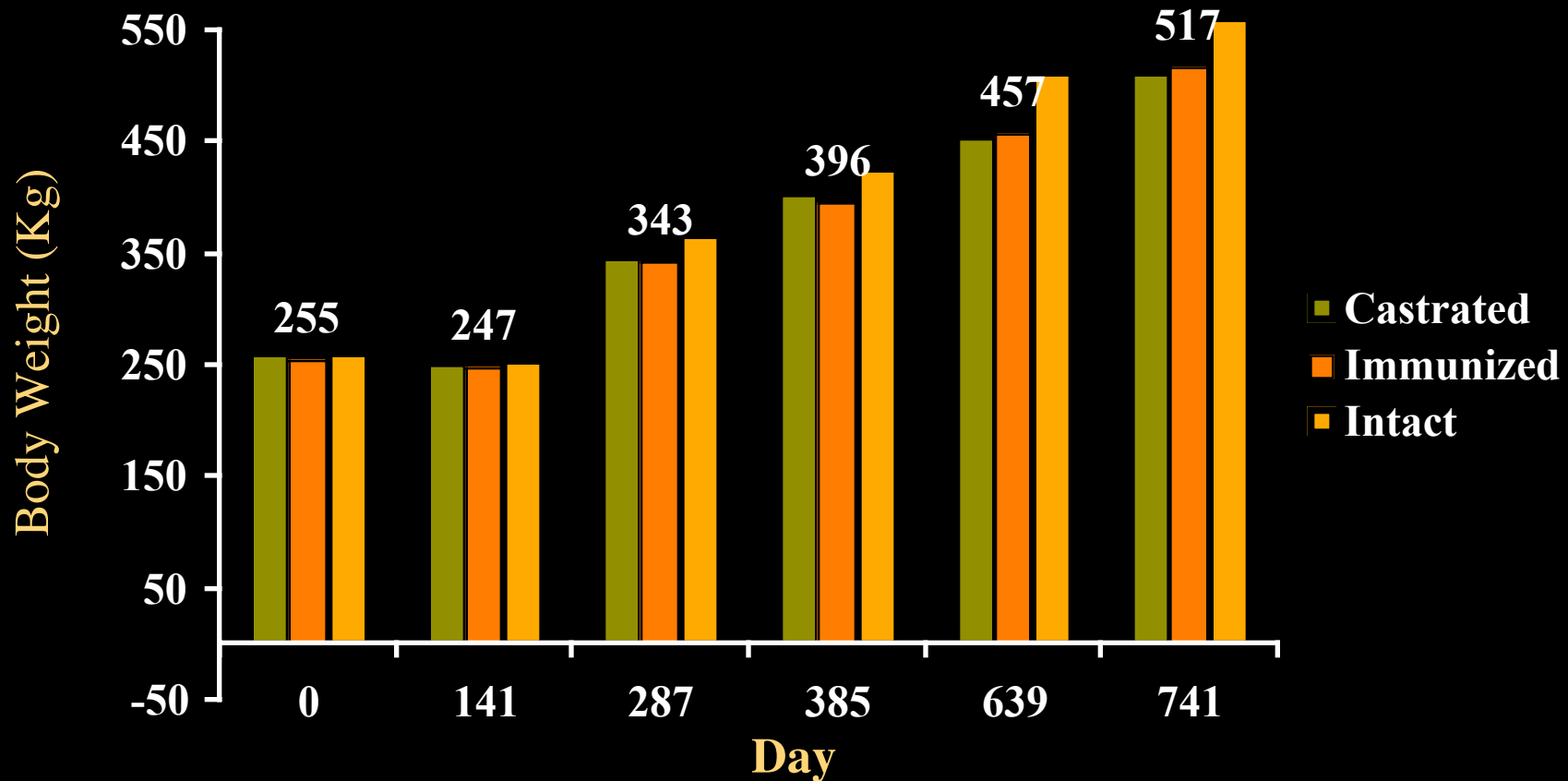
# Study Overview: Injection and Castration Dates



# Body Weight of Castrated, Immunized and Intact bulls Esperanca Animals (n=77)



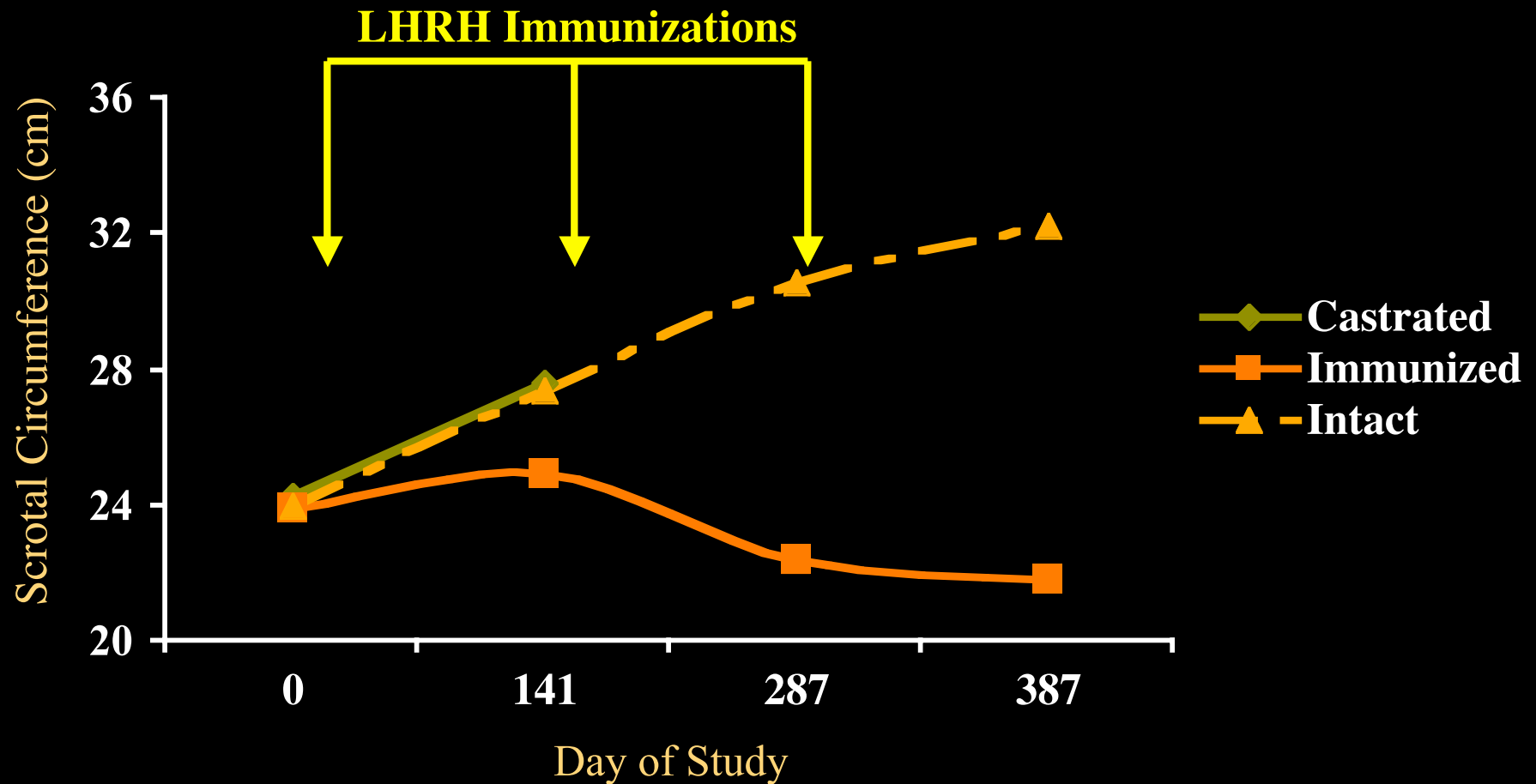
# Body Weight of Castrated, Immunized and Intact bulls Colorado Animals (n=216)





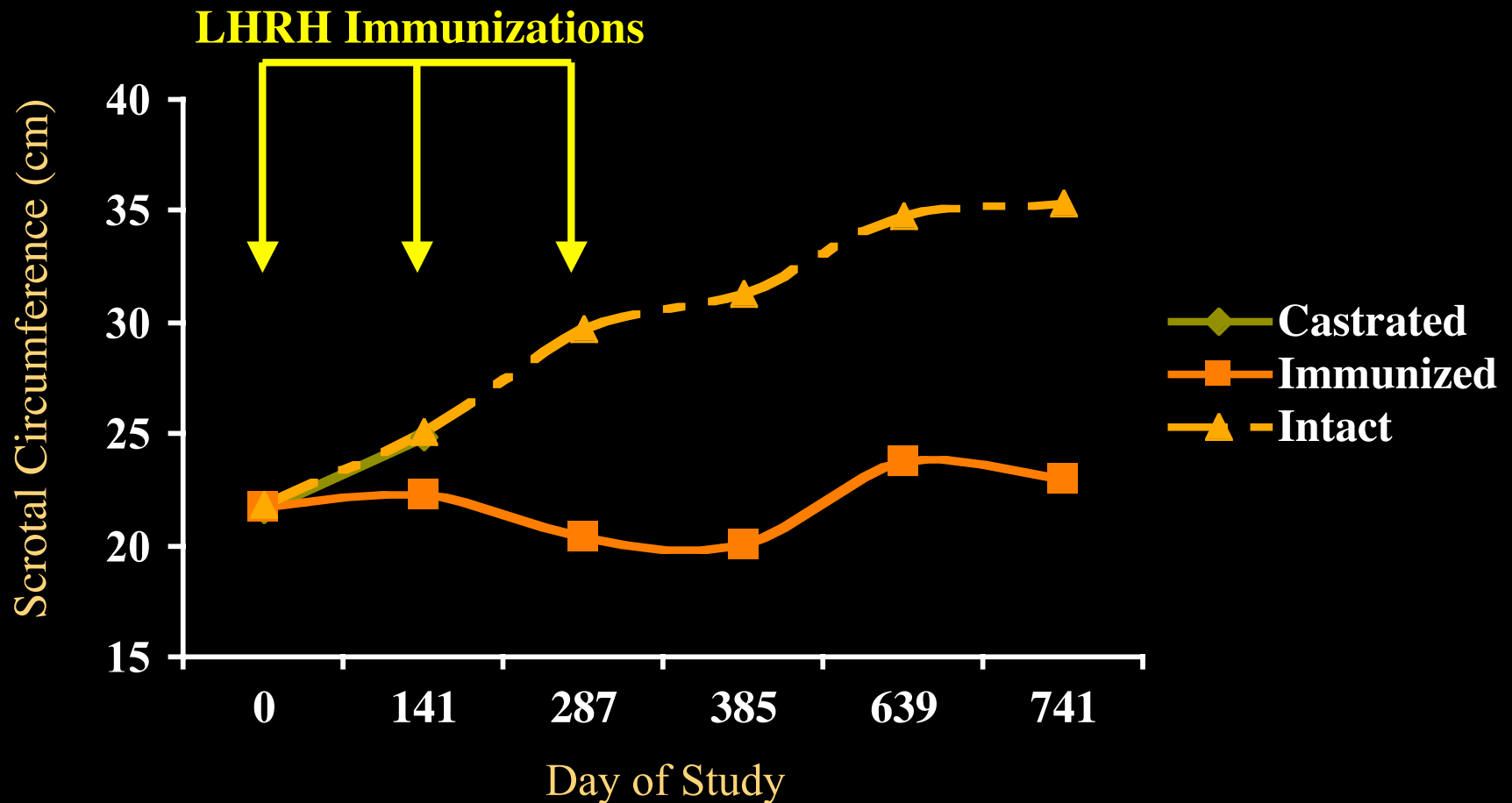
# Scrotal Circumferences of Castrated, Immunized and Intact bulls

Esperanca Animals (n=77)



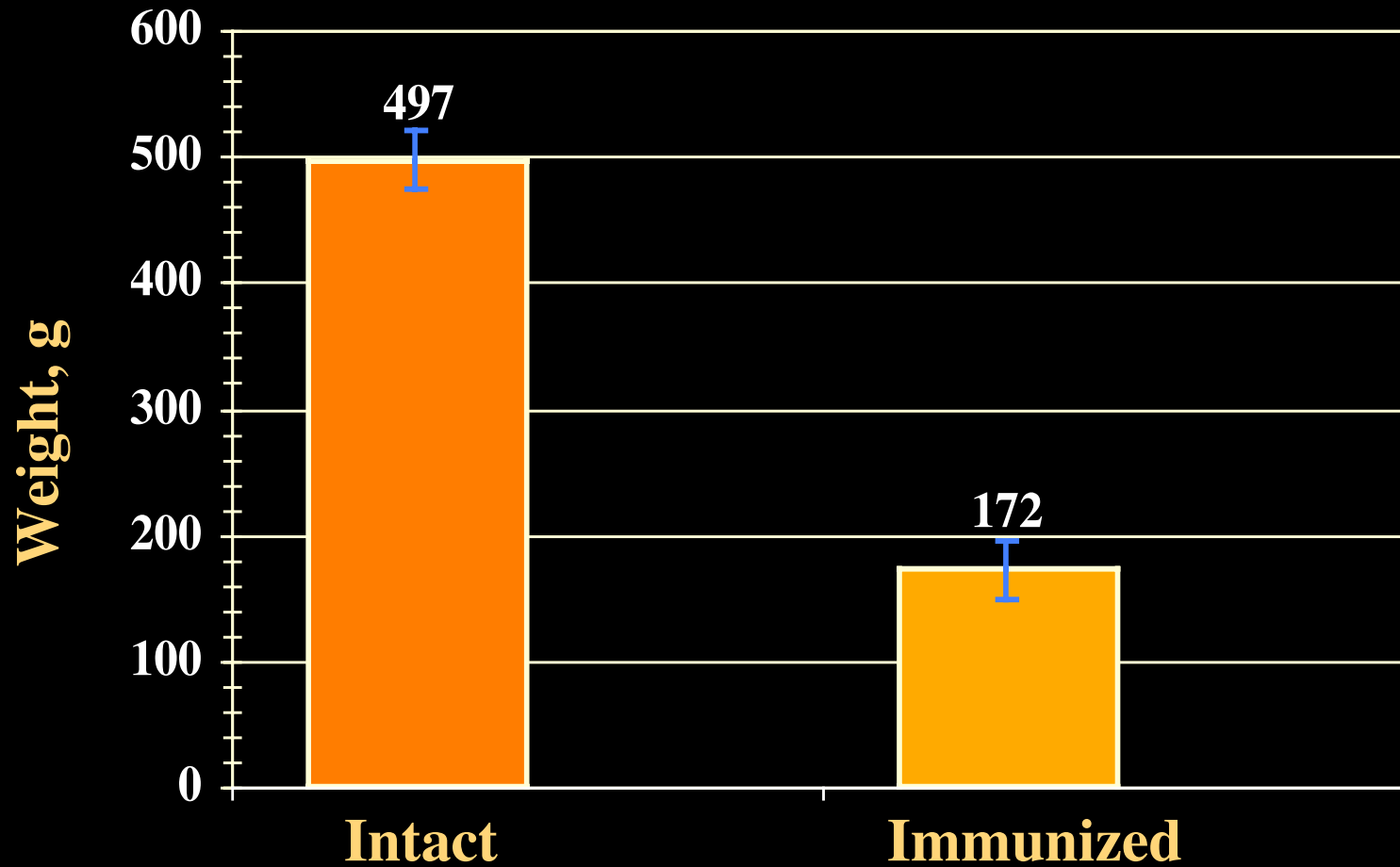
# Scrotal Circumferences of Castrated, Immunized and Intact bulls

Colorado Animals (n=216)



# Testes Weight\* on Day 387

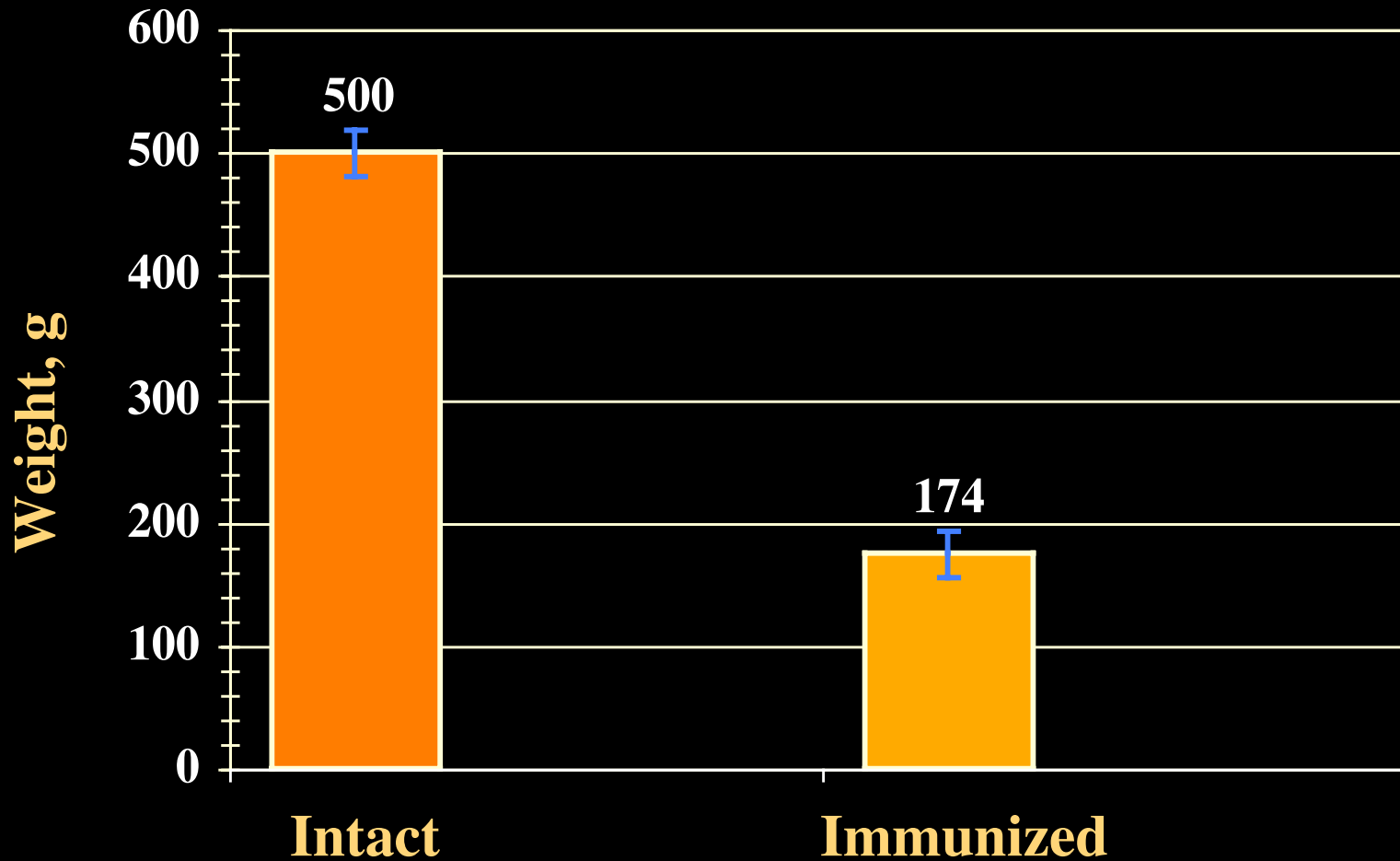
Esperanca Animals (n=77)



\*Lower Testes Weight indicates the vaccine is working

# Testes Weight\* on Day 741

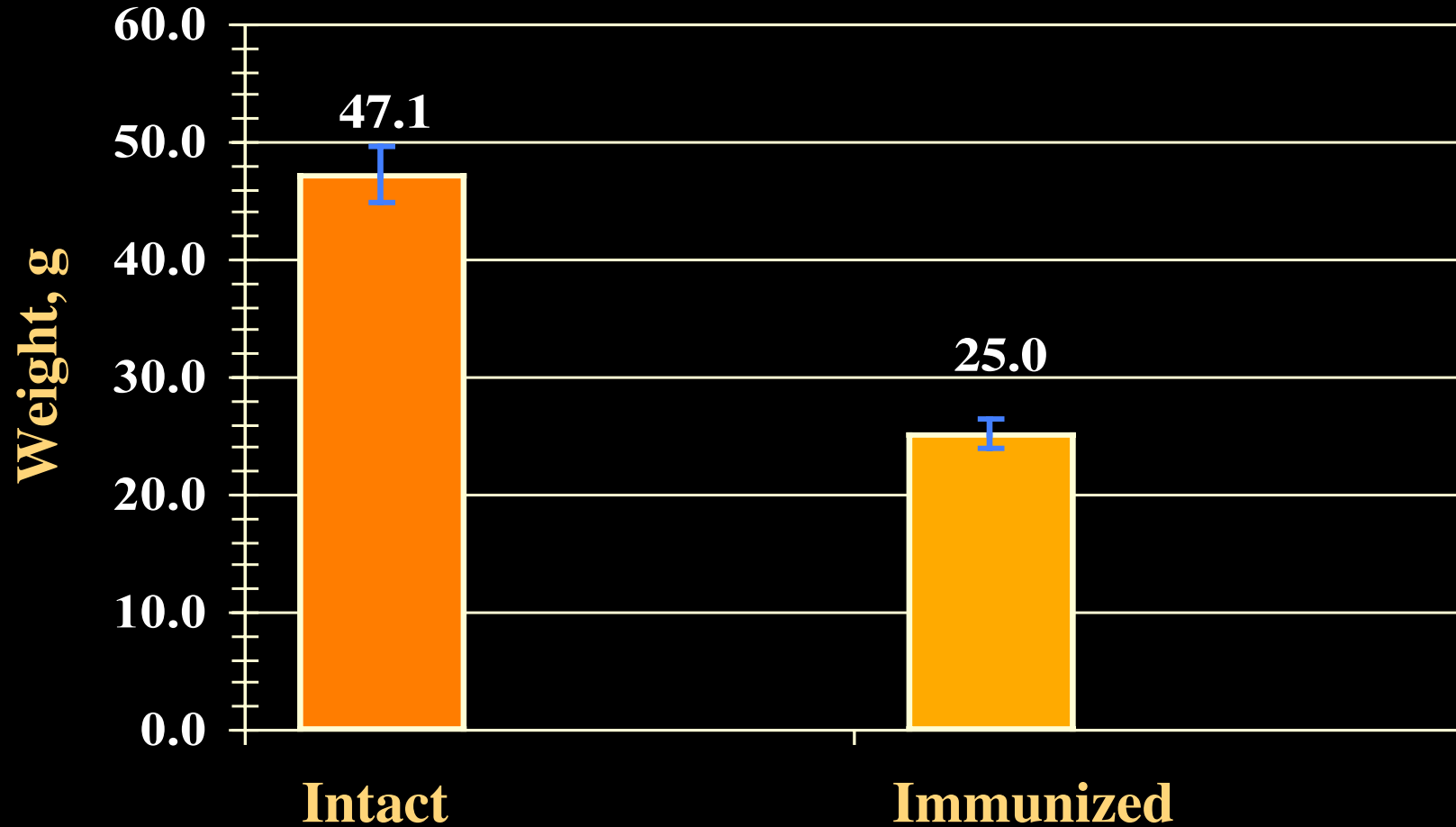
Colorado Animals (n=216)



\*Lower Testes Weight indicates the vaccine is working

# Epididymis Weight\* on Day 387

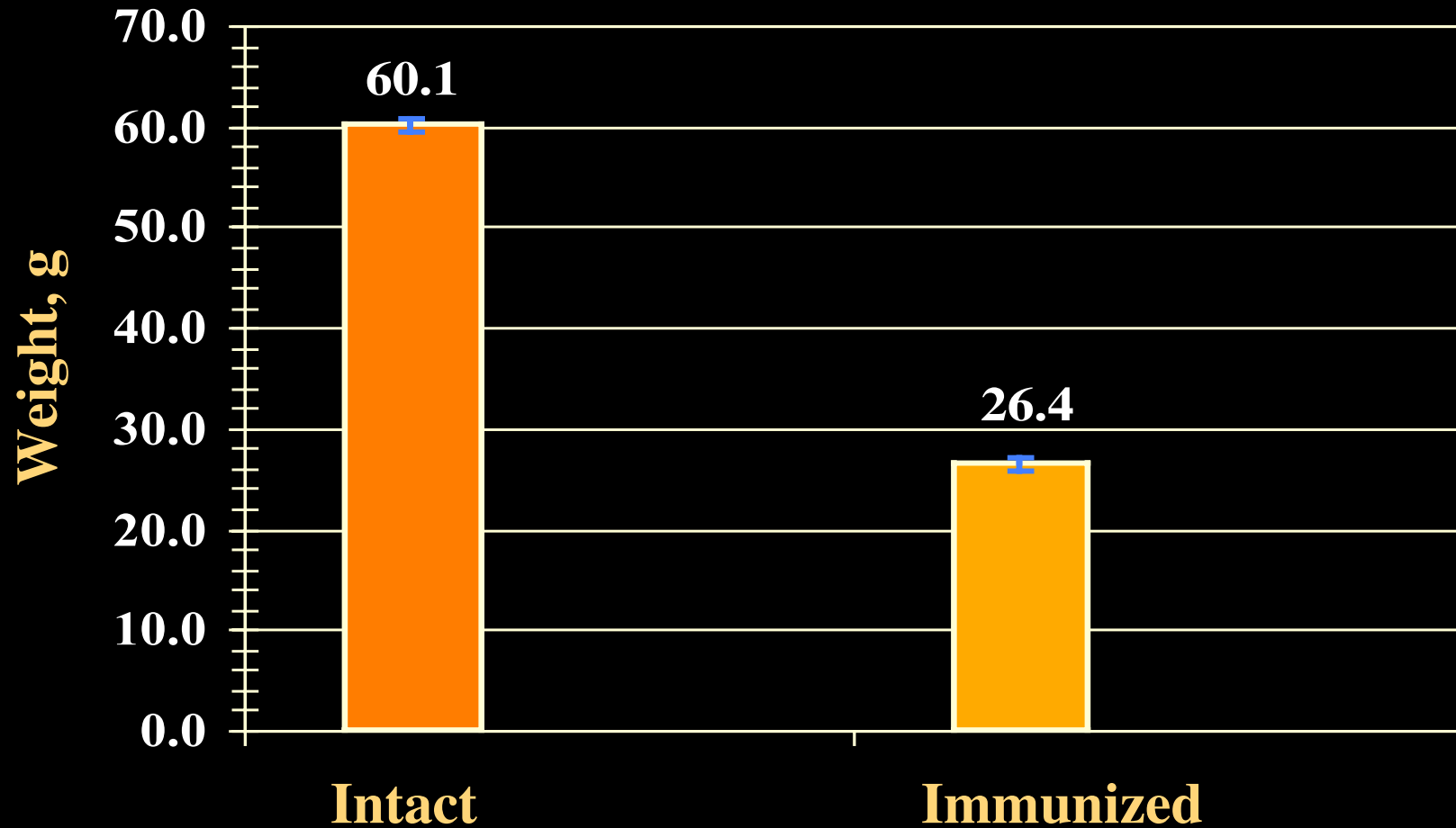
Esperanca Animals (n=77)



\*Lower Epididymis Weight indicates the vaccine is working

# Epididymis Weight\* on Day 741

Colorado Animals (n=216)



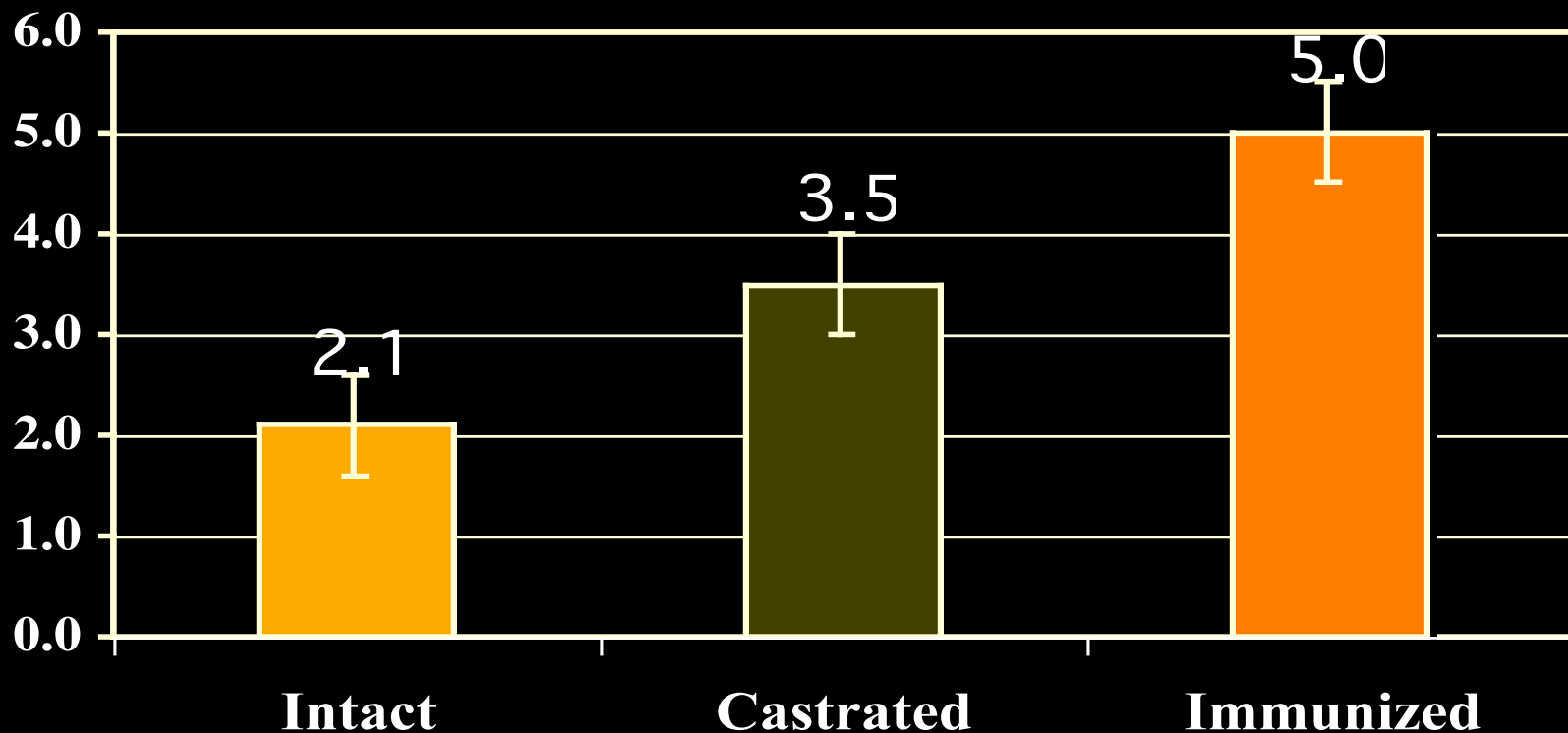
\*Lower Epididymis Weight indicates the vaccine is working

# Meat Quality Study Methods

- **Various cuts of meat were analyzed from 30 animals of the three treatment groups**
  - LHRH immunized (n=10)
  - Castrated (n=10)
  - Intact Bulls Control (n=10)
- **All meat grading and subjective evaluations were performed by an independent panel of meat experts.**
- **These Meat Quality data were recently submitted to “Meat Science” (a peer reviewed journal). The manuscript is included on the CD-ROM.**

# Meat Quality Data of Intact, Castrated, and LHRH immunocastrated Esperanca Animals Only (n=30)

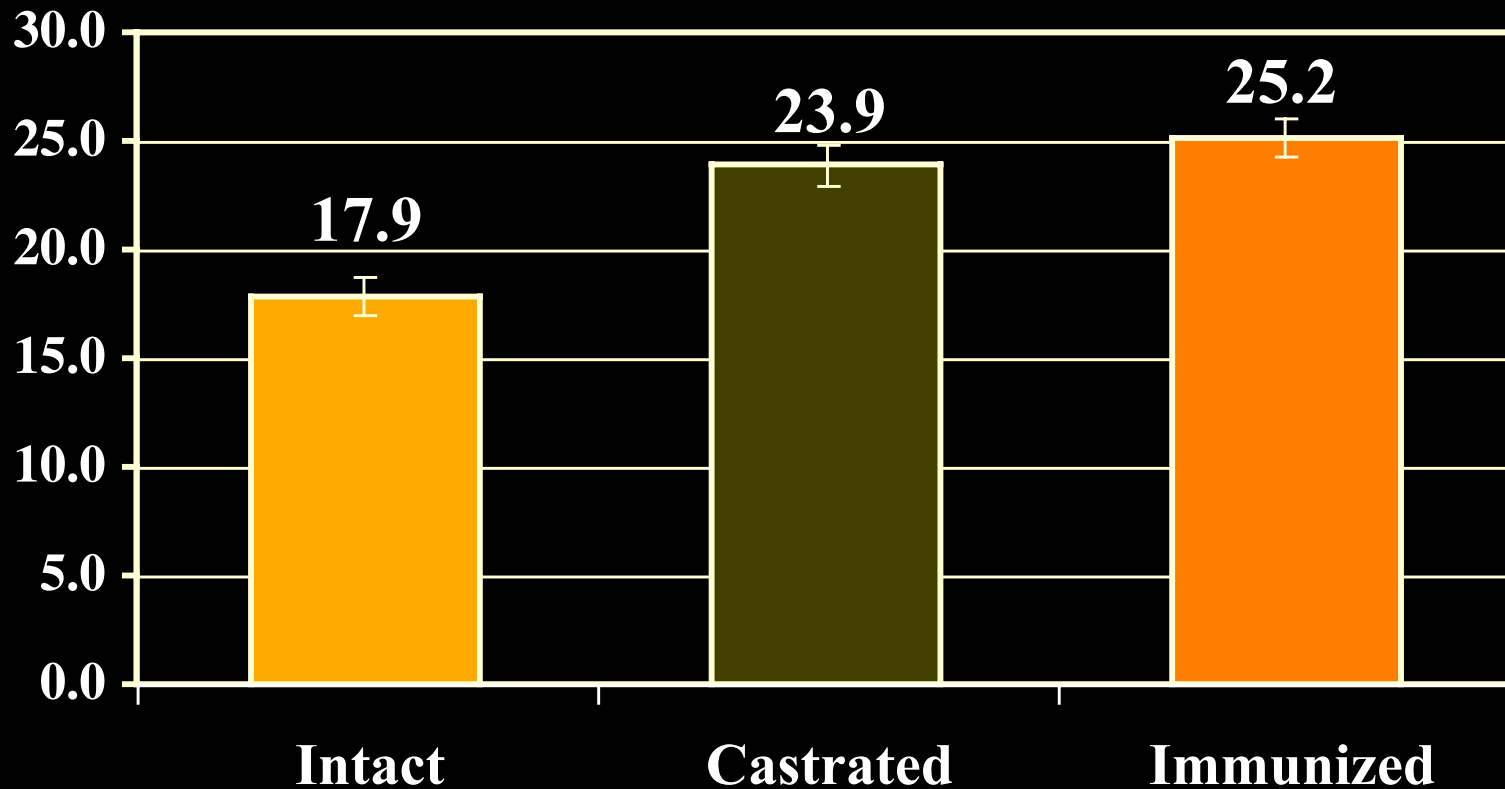
## \*Marbling



\*A larger number equates to increased marbling and higher meat quality.

# Meat Quality Data of Intact, Castrated, and LHRH immunocastrated Esperanca Animals Only (n=30)

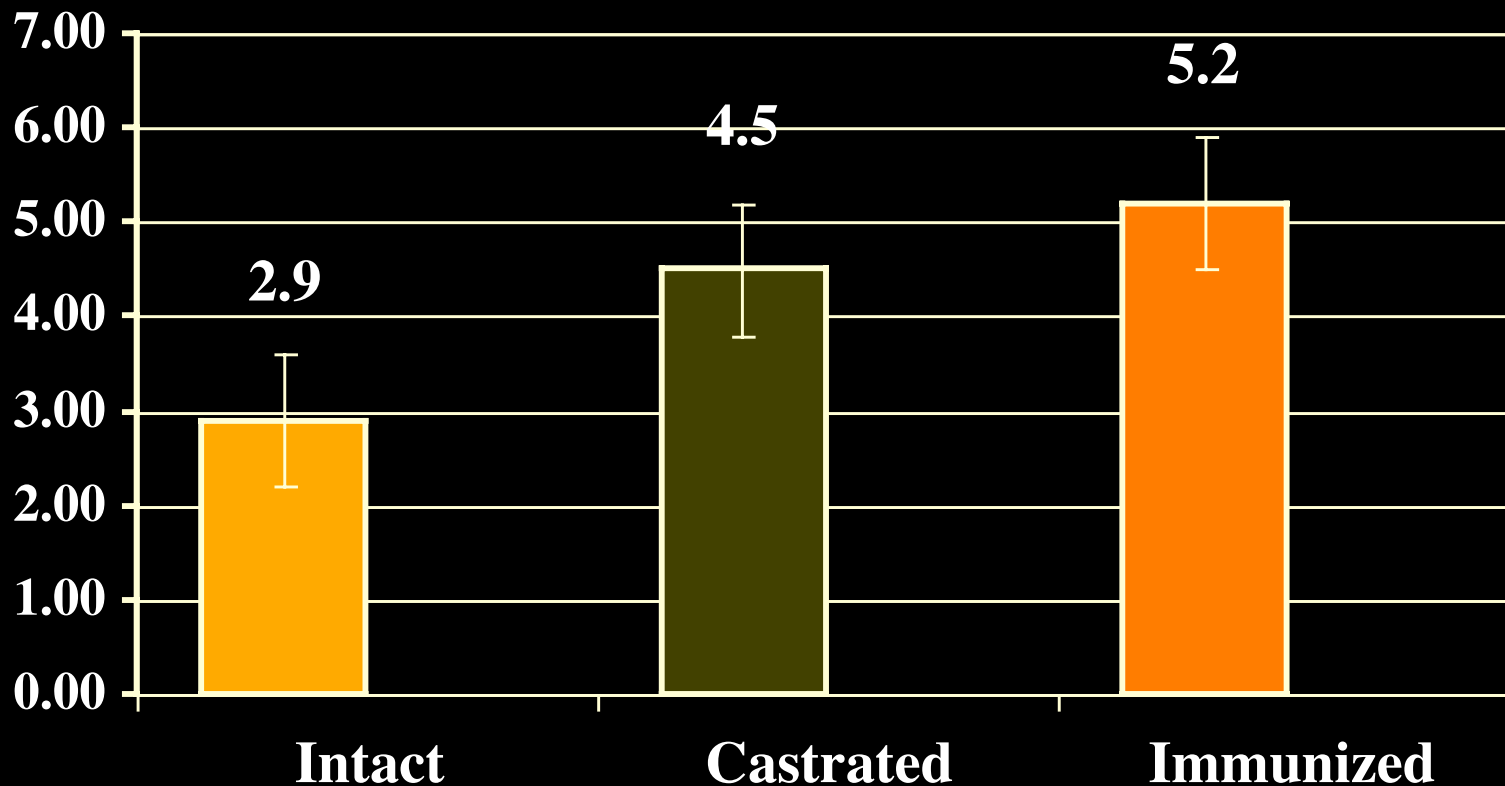
## \*Percentage of Carcass Fat



\*A larger number equates to increased fat and higher meat quality.

# Meat Quality Data of Intact, Castrated, and LHRH immunocastrated Esperanca Animals Only (n=30)

**\*Fat Thickness, mm**



\*Thicker fat in the region measured indicates higher quality meat.

# Meat Quality Data of Intact, Castrated, and LHRH immunocastrated Esperanca Animals Only (n=30)

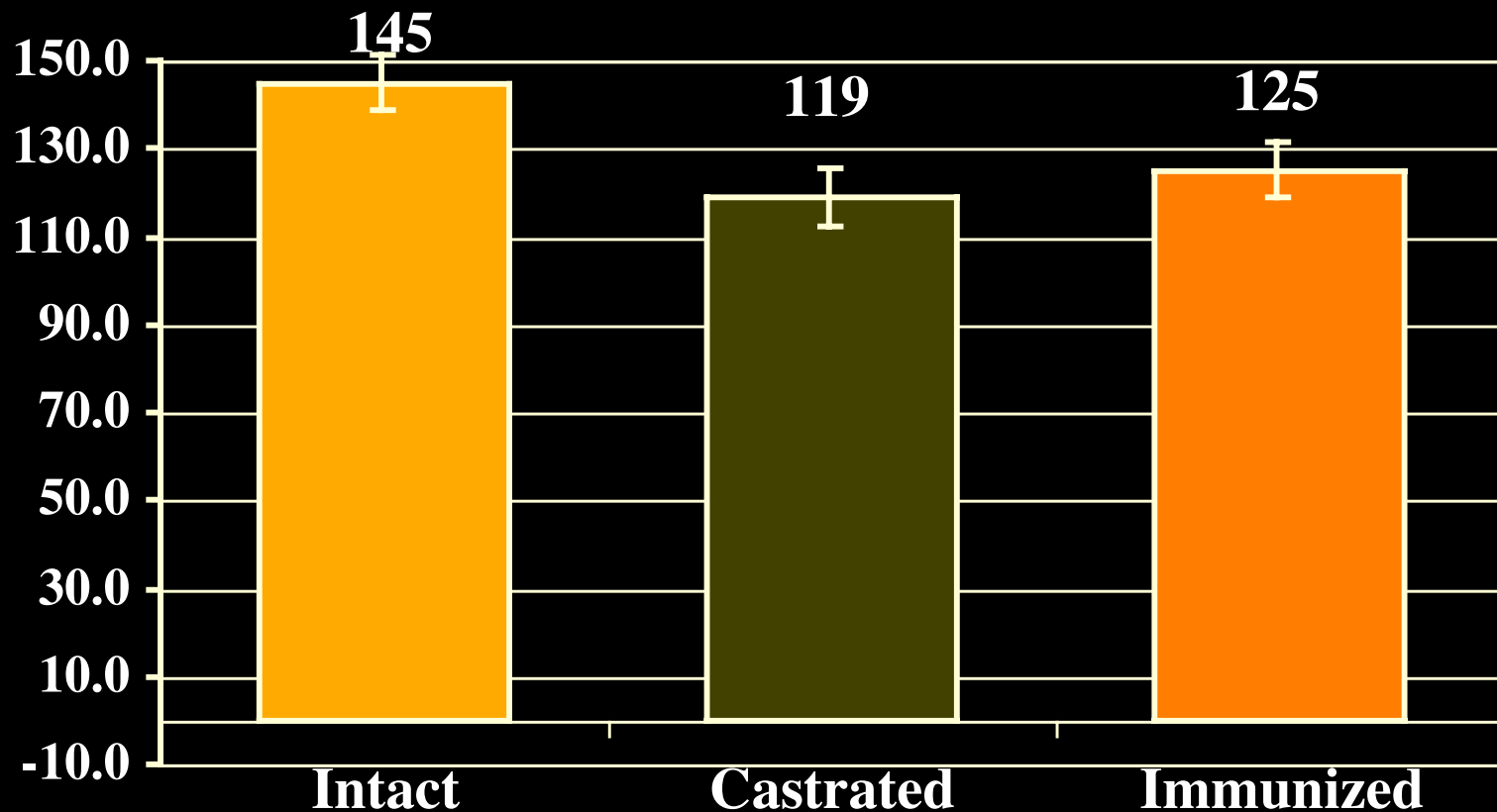
## \*Tenderness (Taste Panel)



\* A blind, subjective evaluation by a panel of meat tasting experts, larger number is higher meat quality.

# Meat Quality Data of Intact, Castrated, and LHRH immunocastrated Esperanca Animals Only (n=30)

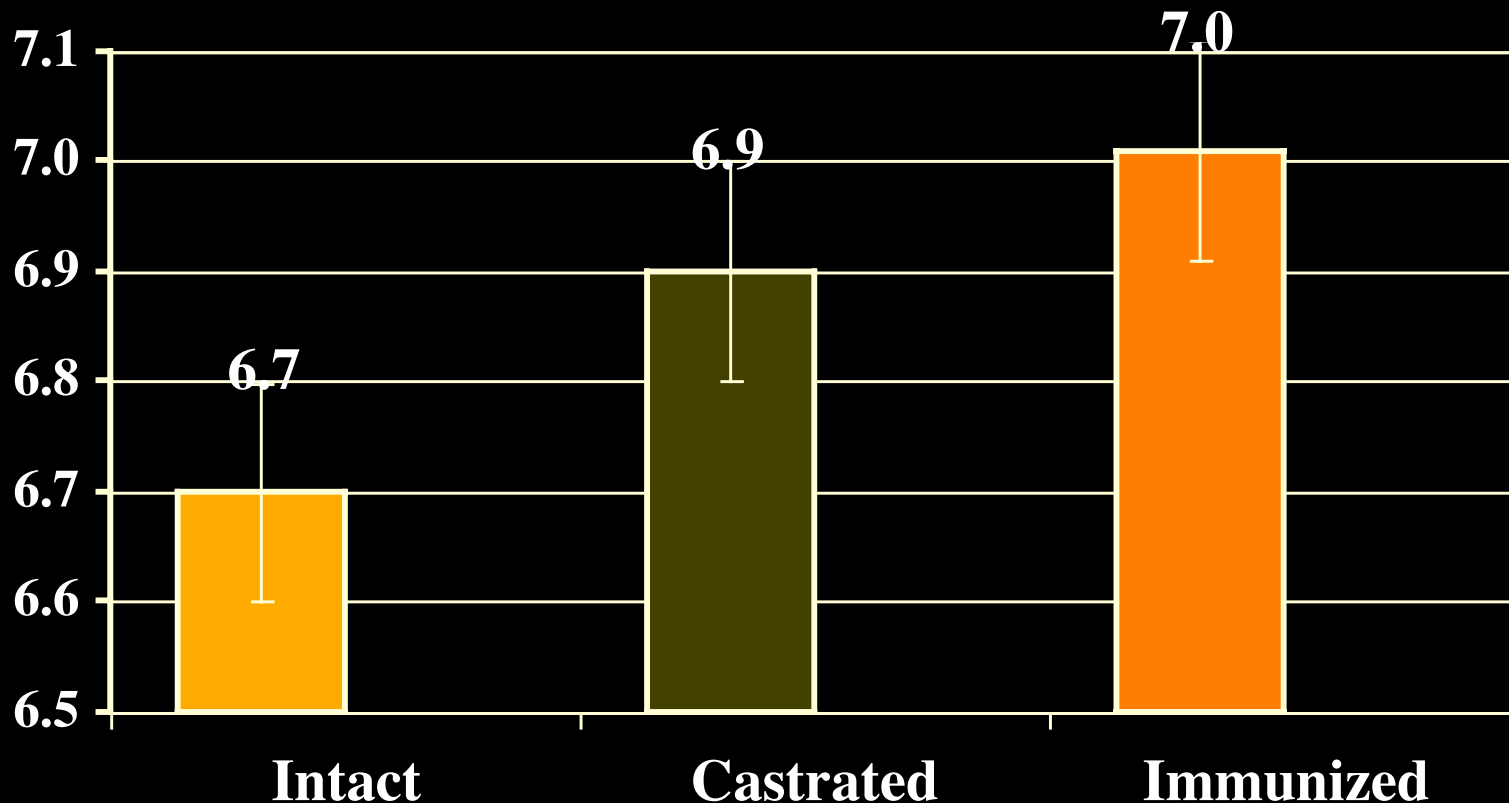
**\*Tenderness** (Texturometer in Newtons)



\*A smaller number equates to increased tenderness and higher meat quality.

# Meat Quality Data of Intact, Castrated, and LHRH immunocastrated Esperanca Animals Only (n=30)

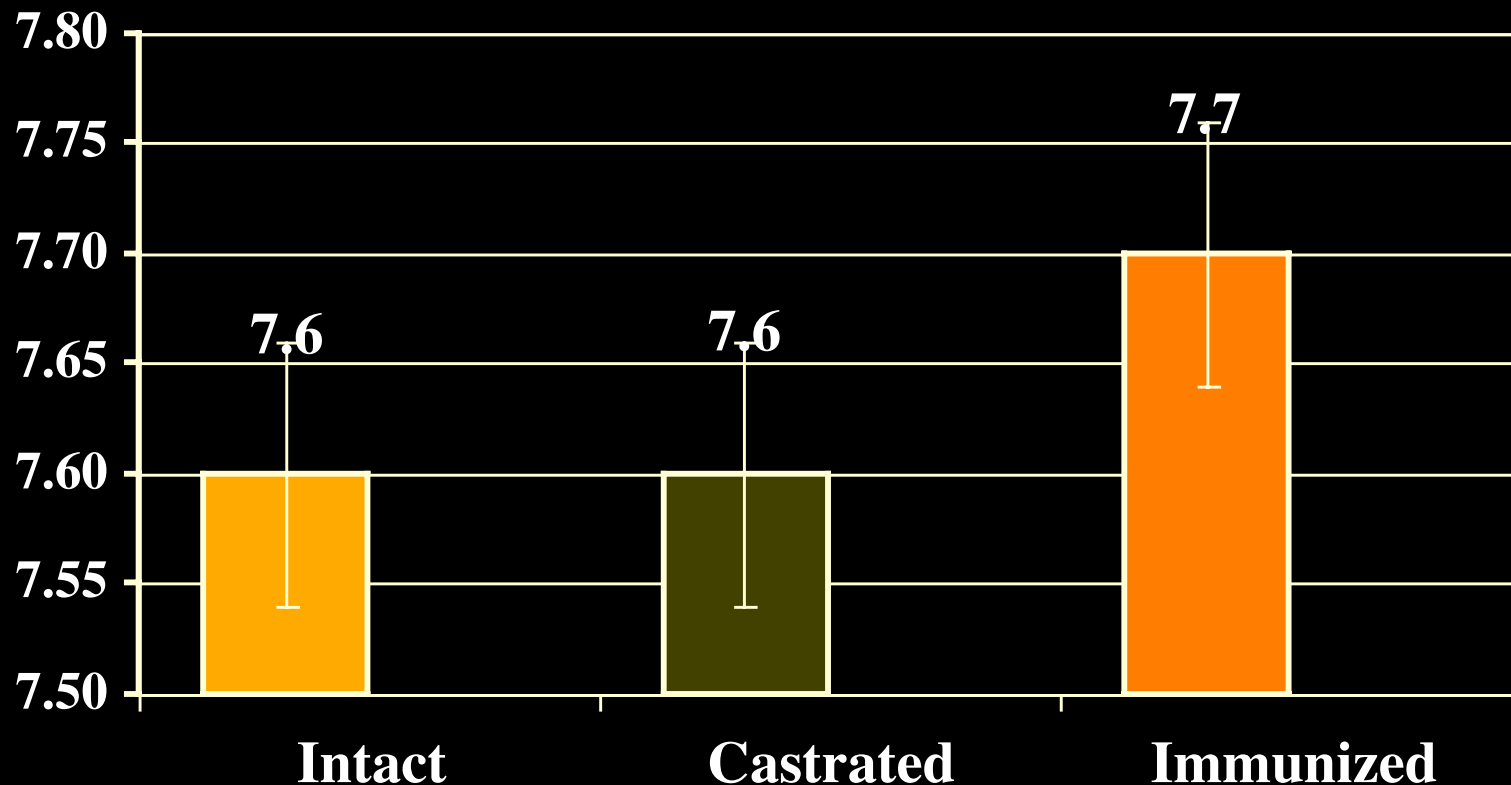
## \*Meat Juiciness



\*Variation from 1 to 9, where 1 = meat extremely dry, undesirable flavor, tough; 5 = average; 9 = meat extremely juicy, flavorful and tender.

# Meat Quality Data of Intact, Castrated, and LHRH immunocastrated Esperanca Animals Only (n=30)

## \*Meat Flavor



\*Variation from 1 to 9, where 1 = meat extremely dry, undesirable flavor, tough; 5 = average; 9 = meat extremely juicy, flavorful and tender.

# Meat Quality Data Conclusions



- Beef from immunized animals has preferable better fat content and marbling structure (when compared with intact animals).
- Beef from immunized animals is comparable in tenderness, juiciness and flavor to that of castrated animals (and far superior to intact animals).
- Weaknesses: only 30 animals were evaluated in this study.

## Overall Study Conclusions

- The price of BULL meat in Brazil is 37 \*REAL/15kg.
- The price of STEER (immunized) meat in Brazil is 41 REAL/15kg.
- Based on the results of these studies, a rancher injecting his animals with the LHRH vaccine would make 20.30 REAL more per animal opposed to leaving the animals as intact bulls\*\*.
- For ranchers using traditional castration procedures: if ONLY one animal dies from castration complications, then the rancher makes an additional 704.05 REAL by using the vaccine (assuming a 257.6 Kg carcass).
- We think Brazilian Cattle Ranchers would prefer the LHRH vaccine to traditional castration practices or raising intact bulls.
- Note- obtaining Brazilian government approval for the use of this vaccine in Bulls, will probably require less time and money than obtaining approval in the US Heifer market.

\*One Brazilian REAL is equal to 0.35 US DOLLARS (on 10/13/2003)

\*\*In Brazil the usable carcass is 53% of the animal weight- assuming intact bulls 523 Kg & LHRH immunized 486 Kg.

# Acknowledgments



- Jerry J. Reeves: Washington State University
- Jennifer Hernandez: Washington State University
- David DeAvila: Washington State University
- Kevin Bertrand: Washington State University
- Eraldo Zanella: Universidade de Passo Fundo
- Edson L. de A. Ribeiro: Universidade Estadual de Londrina
- Heather Marney: Amplicon Express

For additional information contact:

Robert Bogden  
President  
Amplicon Express  
1610 NE Eastgate Blvd  
Pullman, Washington 99163 USA  
1-509-332-8080 ext. 24  
<bogden@genomex.com>