Meat Quality: Tenderness

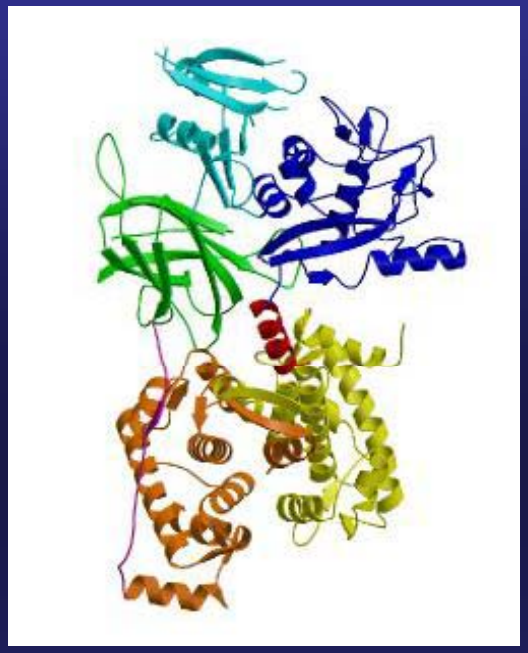
Meat Tenderness

- #1 Quality Concern
- #1 Palatability Concern for Consumers
- Costs the Beef Industry over $253 million annually
- Guaranteed Tender Product

Measuring Tenderness

- Objectively
  - Warner-Bratzler Shear Force Machine
  - ½” meat core; parallel to fiber orientation
- Subjectively
  - Sensory Panel
  - Human perspective

What is tenderness



- Proteases enzymes
- Calcium activated
- Calpains, calpastatin
- Degrade Z-disk
- Myofibril fragmentation
- Occurs pre- and postmortem
- 5 – 6% protein degradation/ d in humans

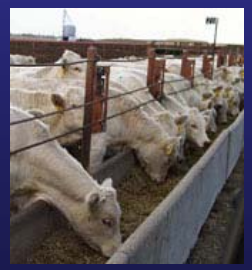
Make things more tender

- People will spend their lives and careers searching for ways to improve tenderness and understand the factors involved
- Ways to improve tenderness
  - Make the Sarcomeres longer
  - Disrupt the integrity of the myofibrils
  - Disrupt the integrity of the connective tissue matrix

What affects Tenderness

Implants/ Growth Promotants

Diet



Cooler Affects

Contractile State

Age of Animal

Muscle Function

Aging

Cooking Methods

Diet

- Vitamin D_3
- Hypothesis; Vitamin D_3 will raise the level of circulating calcium, thus activating more calcium dependent proteases
- Calpains = activated by calcium
- Fed the last 6 to 10 d before slaughter

Vitamin D3

- Increased plasma Ca concentrations (Swanek et al., 1999; Karges et al., 1999)
- Increased tenderness (WBSF) by 0.58 kg and sensory panel tenderness by 0.6 units (Swanek et al., 1999; Karges et al., 1999; Montgomory et al., 2000)
- No improvements in tenderness (Scanga et al., 1999; Rentfrow et al., 2000; Wertz et al., 2001)
- Under 4.5-kg WBSF confidence level

Growth Promotants/ Implants

- Beef Implants
- Increase Testosterone
- Increase Calpastatin
- Implanted steers had higher WBSF values that non-implanted counterparts (Roeber et al., 2000; Platter et al., 2003)

ELANCO Paylean™

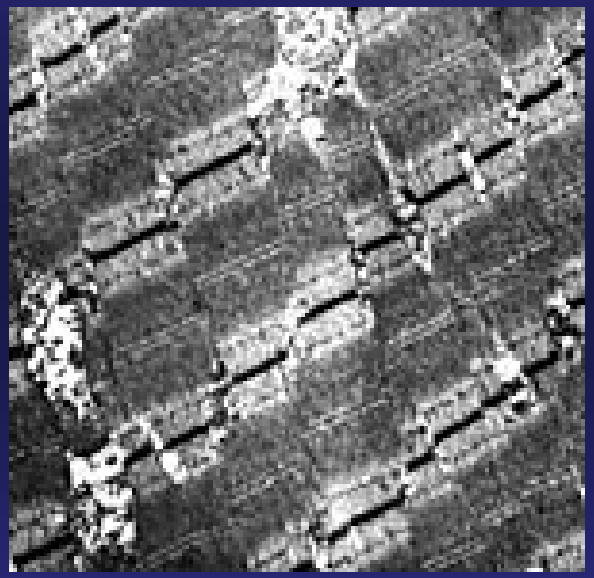
ELANCO Optaflexx

Growth Promotants/ Implants

- Increased WBSF values in implanted Bos indicus cattle (Barham et al., 2003)
- However, under 4.5-kg
- Ractopamine (Paylean or Optaflexx) does not affect tenderness; sensory or WBSF (McKeith et al., 1988; Stoller et al.,2003; Schroeder, 2005)

Cooler Affects

- Talked about this in the conversion of muscle to meat
- Cold Shortening
- Thaw Rigor
- Problem in beef and lamb
- Electrical Stimulation



Contractile State

- Myosin – Actin cross-bridging
- Rigor mortis
- Achilles Tendon
- Pelvic hung
  - Tenderstretch
  - Lessens the affects of rigor
  - Not done in US

Muscle Function

- Support vs. Locomotion
- Amount of connective tissue
- Extent of rigor
- Can get tenderness differences within a given muscle or steak
- Double muscled cattle
- Callipyge Lamb

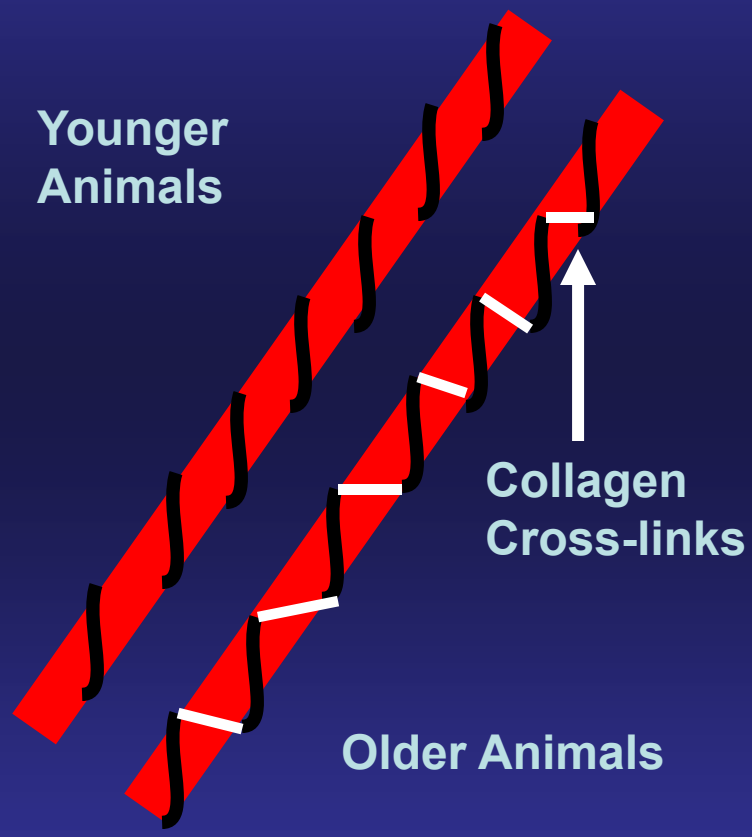
Moo-shoe pork

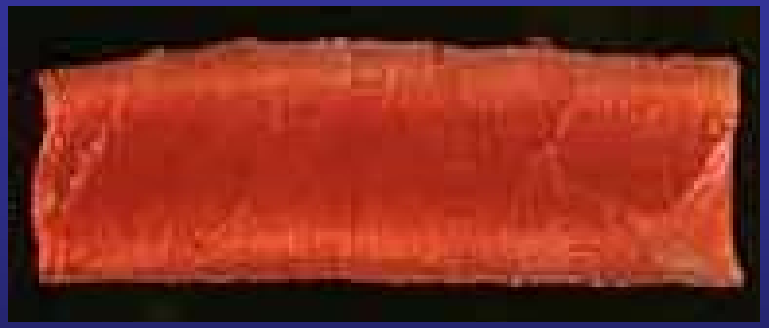
Post-mortem Aging

- Dry vs. Wet Aging
- Dry = meat lab & small meat processors
- Wet = majority of meat in the US
- Dry = considerable shrink
- Wet ≈ 20d from packing plant to grocery store

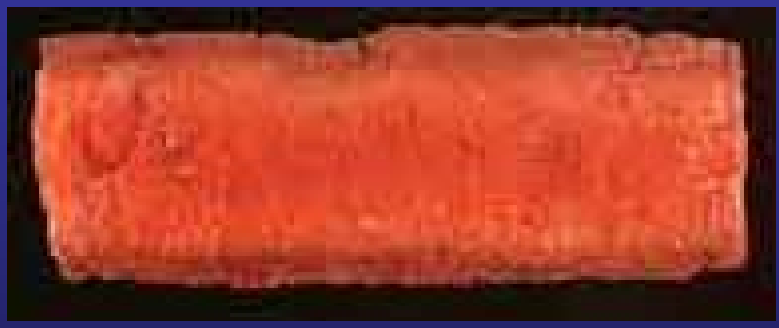
Age of Animal

- As age increases; meat becomes less tender (Miller and Montgomery, no date)
- Insoluble collagen
- Cross-links are heat stable
- Larger fiber diameters



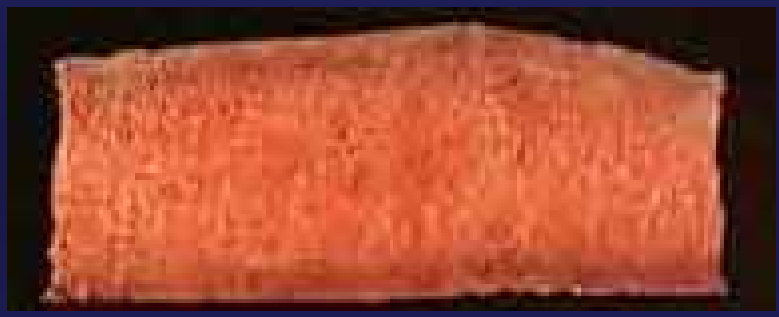


Very Rare/Approx. 130°F

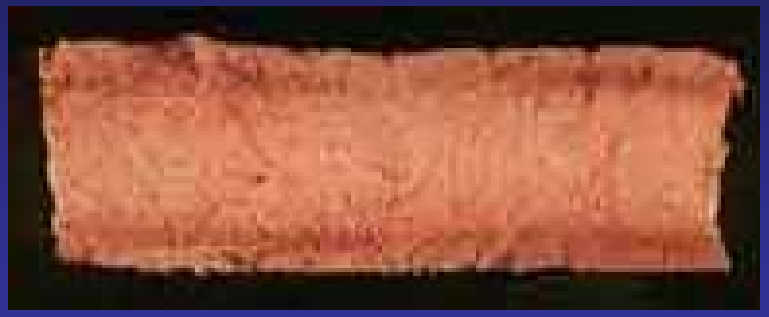


Rare/Approx. 140°F

Medium Rare/Approx. 145°F



Medium/Approx. 160°F



Well Done/Approx. 170°F

Very Well Done/Approx. 180°F

Degree of Doneness

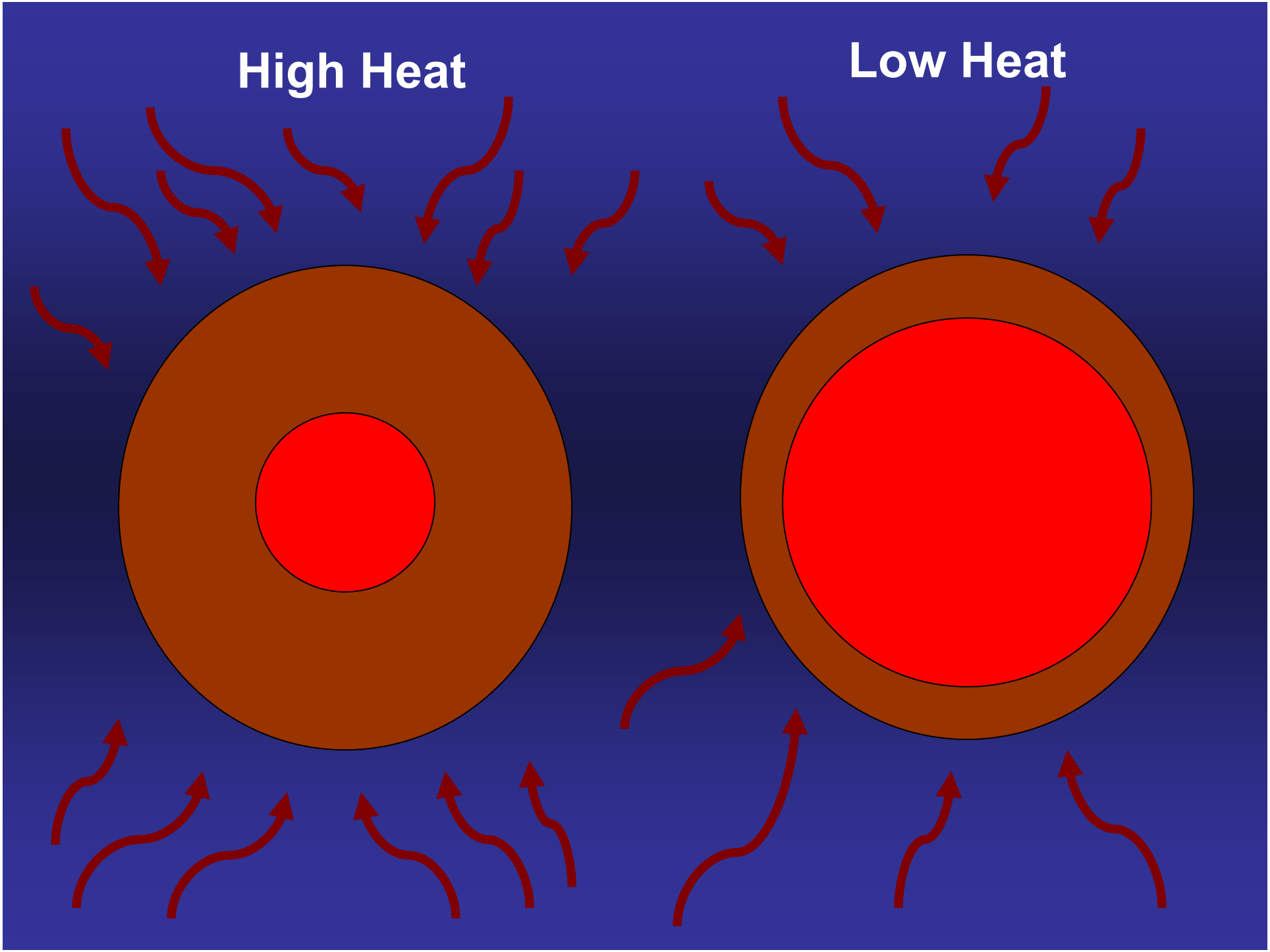
- Composition of meat: 70% water, 20% protein, 8% fat, 2% ash
- Higher degree of doneness = less water and fat
- Toughening of contractile proteins
- Problem with consumers
- Beef, Pork, and Chicken

Physical Changes during Cooking

- Upon cooking myofibrillar protein structure changes
- Disintegration of filaments as temperature increases
  - Protein hardening
  - Appears over 147° F
- Connective tissue
  - 1/3 original length
  - Collagen shrinkage
  - More soluble

Cooking the Tender cuts

- Dry Heat Cookery
- Broil
- Grill
- Pan – Fry
- Stir – Fry
- Roast
  - Be careful of degree of heat


High Heat
Low Heat

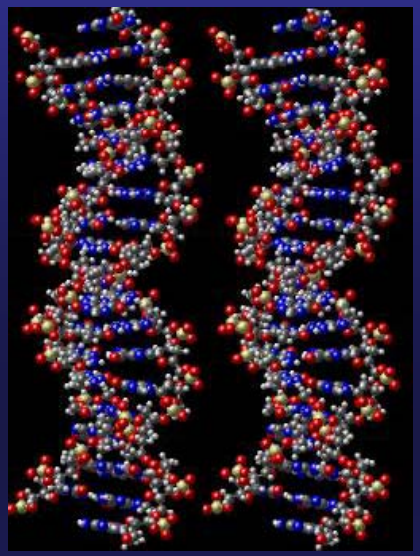
Cooking the Tough Cuts

- Moist Heat Cookery
- Low heat, long time
  - Prevent protein hardening
- Braise
  - Steam type heat
- Stewing
  - Cover with liquid

Rentfrow's Recommendations

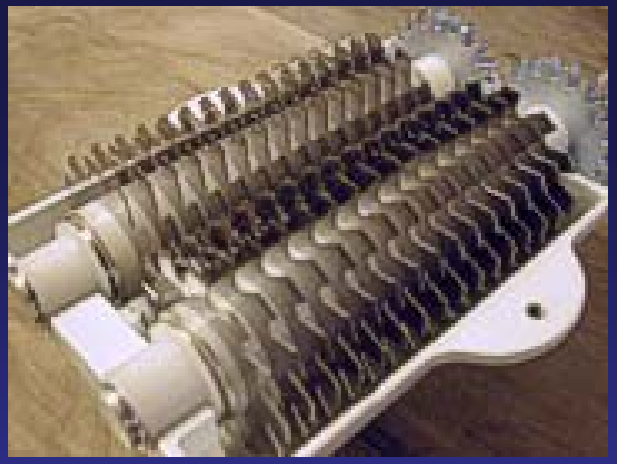
- Just to the point where a good vet can't save it!!
- Beef = Medium Rare
- Pork = Medium
- Chicken = Fried or BBQ

Other things to think about!



- Genetics = 45% heritable
  - GeneSTAR, Igenity, EPD's?
- Mechanical Tenderizers
  - Cubers or Jaccard
- Chemical Tenderizers
  - Papain (papya), Bromelin (pineapple), Ficin (fig)
- Marinating for Tenderness
  - Softens connective tissue, & increases H2O intake


JACCARD



See ya at lab