

Conversion of Muscle to Meat

**“A death with purpose gives
meaning to life”**

**Trent Loos;
Rural Route Radio**

Maintaining Homeostasis

- **The need to maintain the physiological state of the body**
- **Homeostasis**
- **What is death?**
- **Metabolism continues**
- **What happens before, during, and after death will greatly affect meat quality**

Conversion of Muscle to Meat

- **Two major changes occur:**
 - **Physical**
 - **Structural changes to the meat**
 - **Biochemical**
 - **Cessation of blood flow**
 - **Metabolism**



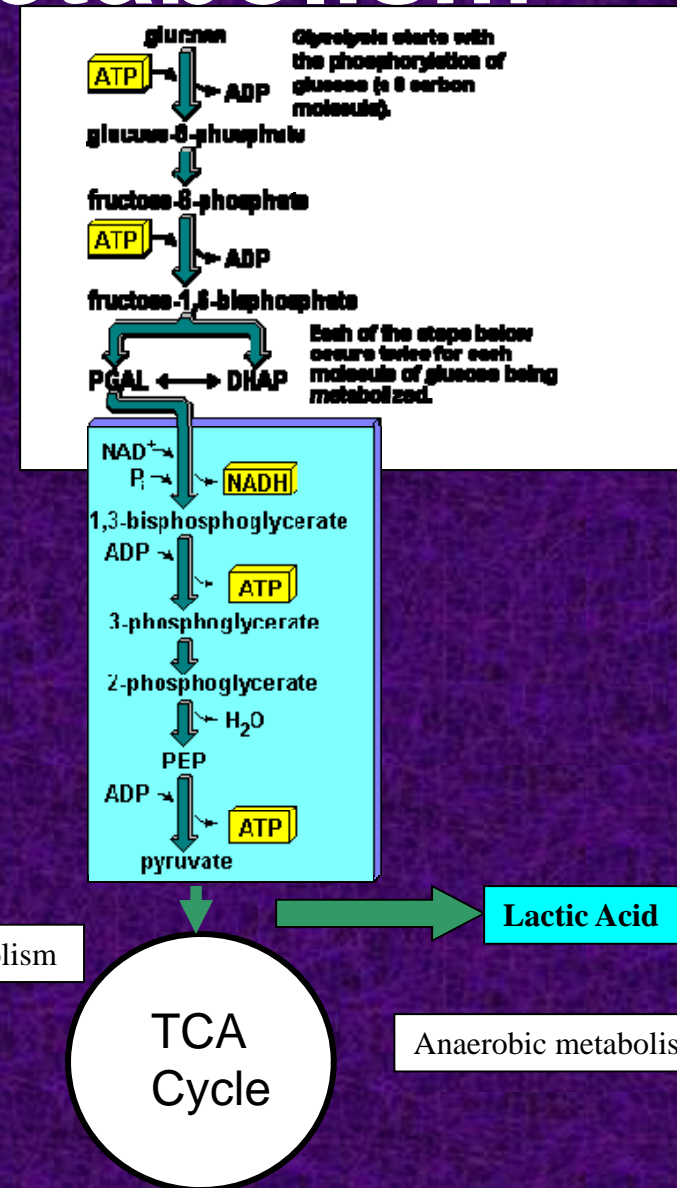
What Happens!?

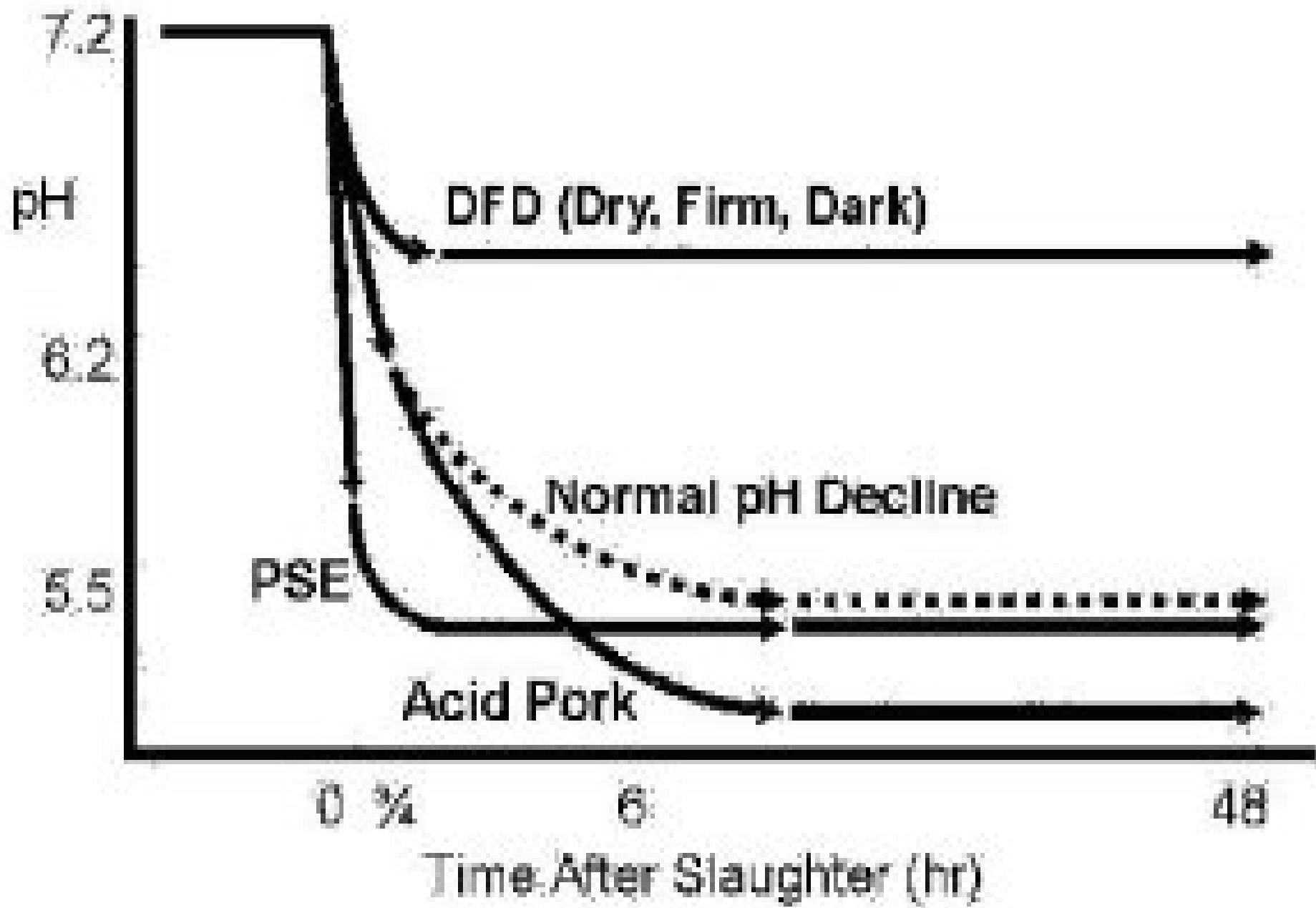
- **Stunned and Bled**
- **Removal of blood**
- **Drop in blood pressure**
- **Increased heart rate**
- **Vasoconstriction**
- **Anaerobic Metabolism**



Anaerobic Metabolism

- Creatine Phosphate
- ATP decreases
- Glycolysis will run wide open
- Lactic Acid production
- pH drops
- 7.1 to 5.6 normal
- Will continue to drop until runs out of energy or pH too low for enzymatic activity

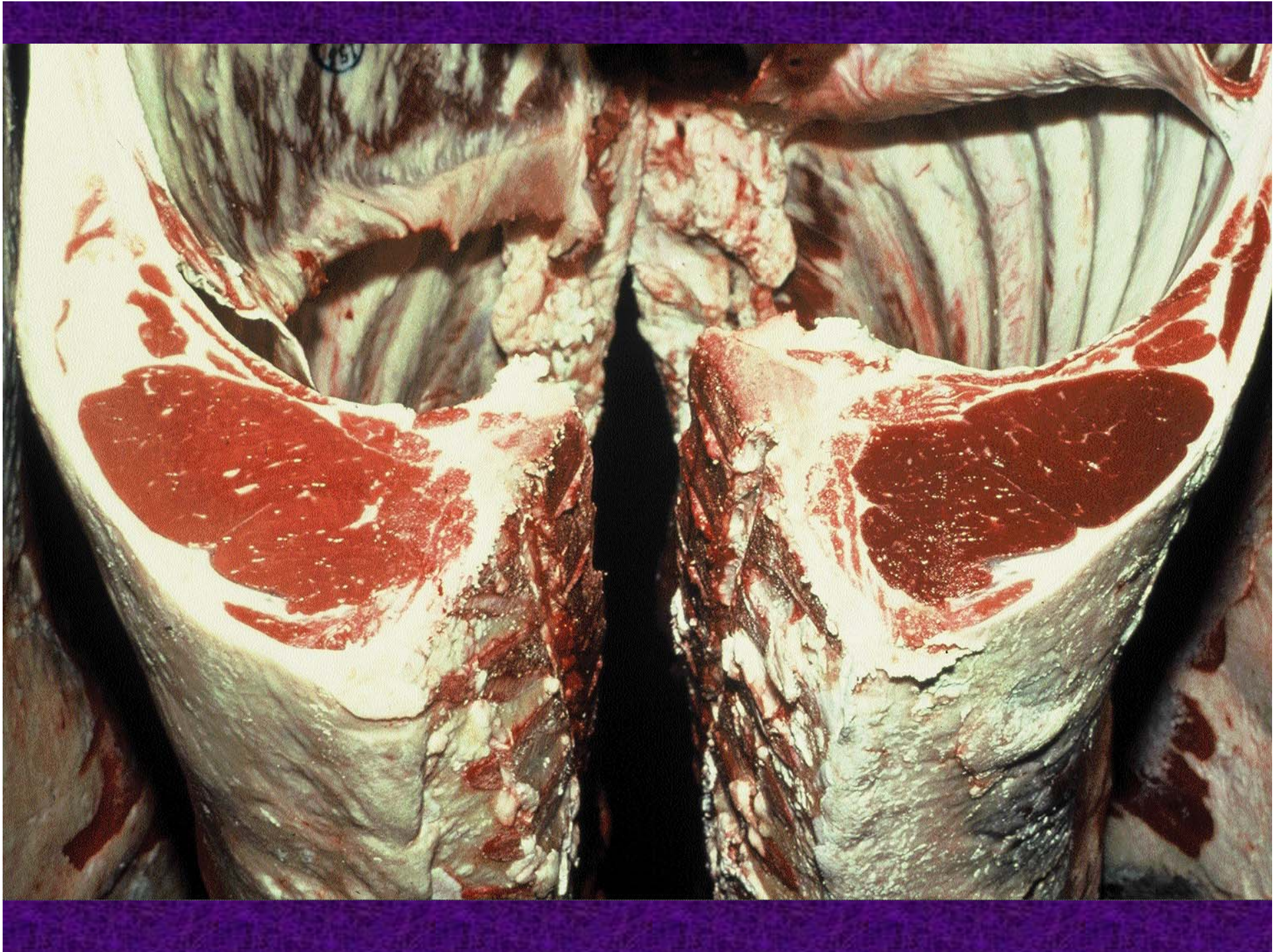




Dark, Firm, and Dry (DFD)

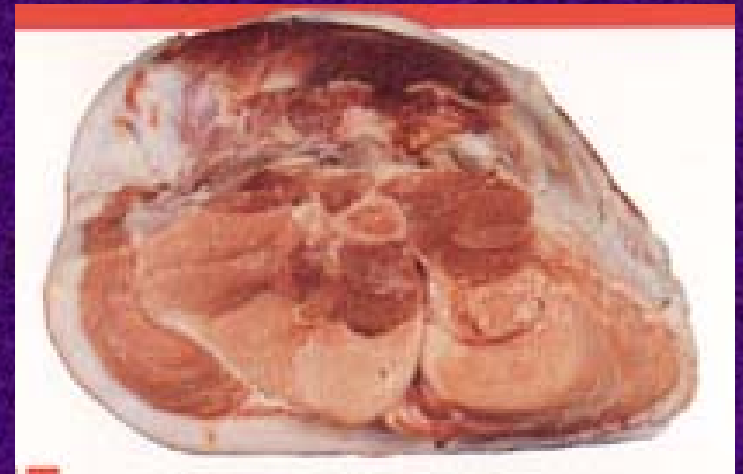
- Severe prolonged stress (>12h)
- Fight or flight
- No glucose or glycogen
- pH 7.1 to 6.8
- Dark cutters (Beef)
- Bacterial growth
- Looks old
- Works well for further processing

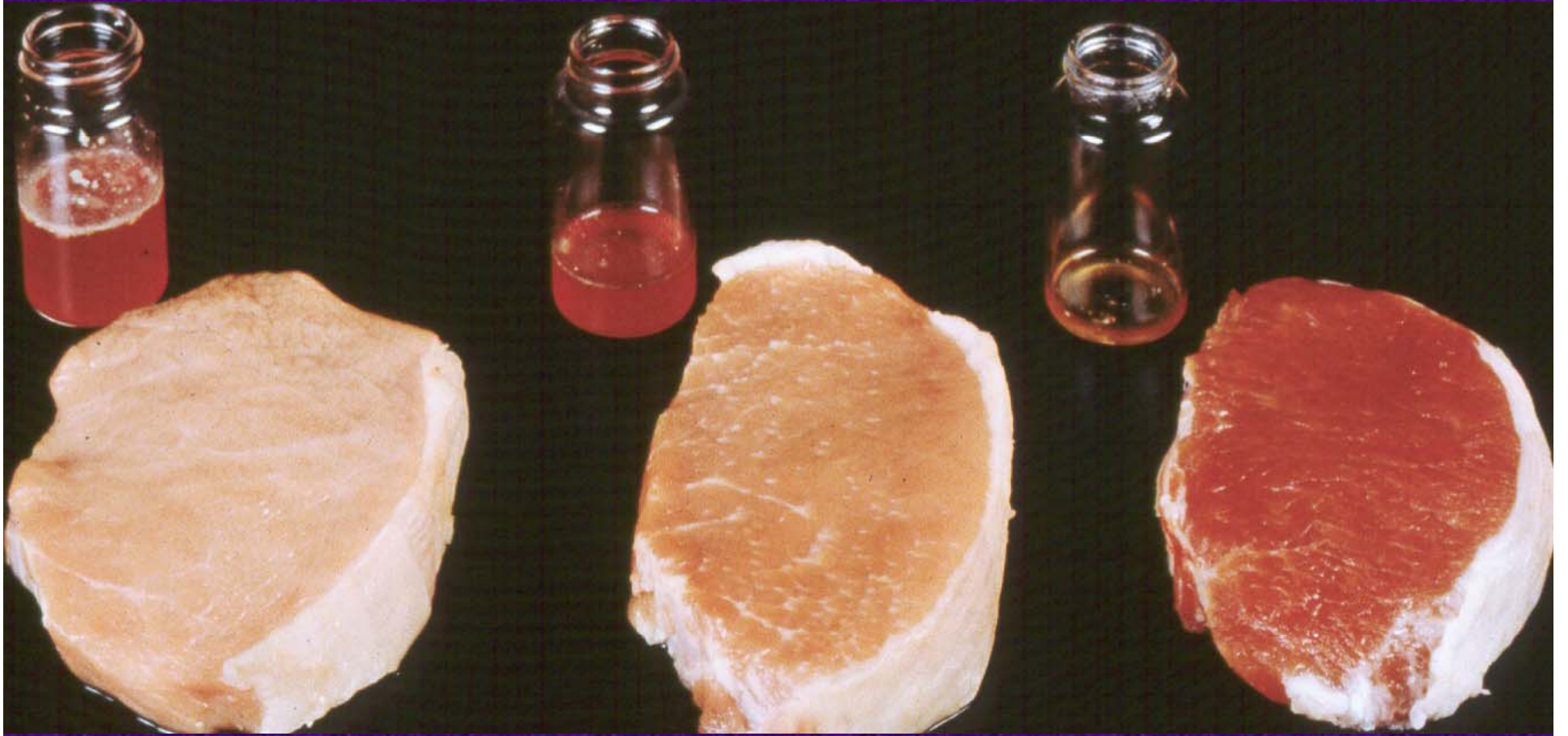




Pale, Soft, Exudative (PSE)

- Severe short term stress
- Pork
- Fight or Flight
- Glycolysis geared up
- Combination of high muscle temp + glycolysis
- 7.1 to 5.4 or lower
- Denatures proteins
- Cannot hold onto water
- Cannot be used in processed meats



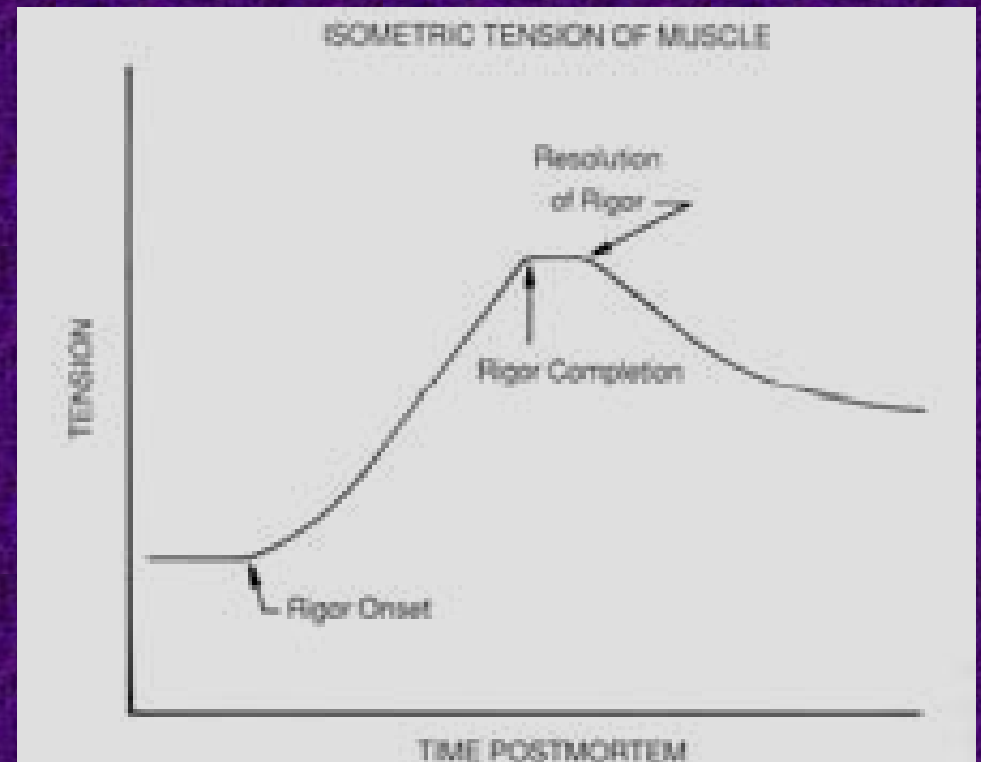


Development of Rigor

- **During the conversion of muscle to meat**
- **Ca²⁺ is released into the muscle cell**
- **Muscles contract**
- **ATP Depleted, cannot relax**
- **Myosin stays attached to actin**
- **Rigor Mortis – stiffness of death**
- **Nerves stay active for 6 to 10 min., but can maintain minor activity for over 15 minutes**

Development of Rigor

- Three phases of rigor
- 1.) Onset
 - Gradual loss of plasticity
- 2.) Completion
 - Complete loss of plasticity
- 3.) Resolution
 - Gradual loss of tension
 - Protease activity at the Z-lines
 - Not a loss of actomyosin bonds



Delay time before onset of Rigor

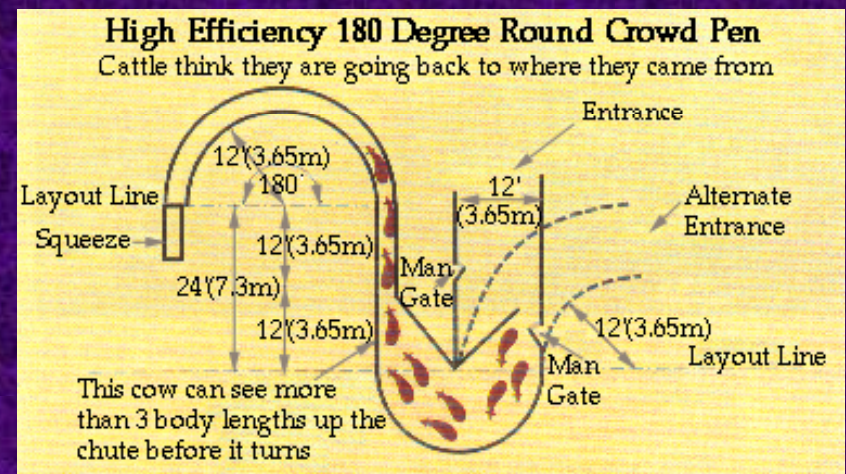
<u>Species</u>	<u>Hours</u>
Beef	6-12
Lamb	6-12
Pork	$\frac{1}{4}$ -3
Turkey	<1
Chicken	< $\frac{1}{2}$
Fish	<1

Influencing Factors

- **Factors influencing the Physical and Biochemical changes**
 - Handling
 - Environment
 - Transportation
 - Nutrition/ Growth Promotants
 - Genetics
 - Immobilization (Stunning)
 - Chilling

Handling

- Stress
- Cattle – head to tail
- Pigs – eye to eye
- Sheep – Judas Goat
- Redesign facilities
- Re-train employees
- Hot Shots
- Bruises



Environment

- **More quality problems during drastic weather changes**
- **Hot vs Cold**
- **Co-mingling with unfamiliar animals**
- **Stress**



Transportation

- **Very Stressful**
- **Trucker Quality Assurance (TQA)**
- **Keep warm or cool (sprinklers)**
- **Co-mingling with unfamiliar animals**
- **Over crowding**
- **30 minutes to load 180 pigs**



Transportation

- **Slip resistant floor**
- **Gentle acceleration and stopping**
- **Clean**
- **Eliminate the use of hot shots!**
- **Eliminate downers; non-injured and injured**
- **Rest (2 to 4 h) for pigs; cattle not normally rested for set period of time**

Nutrition/ Growth Promotants

- Time off Feed
- Creatine Phosphate
- Growth Promotants:
 - Type IIb fibers
 - Leaner, heavier muscled carcasses
 - Tougher Meat
 - Lower quality grades in beef



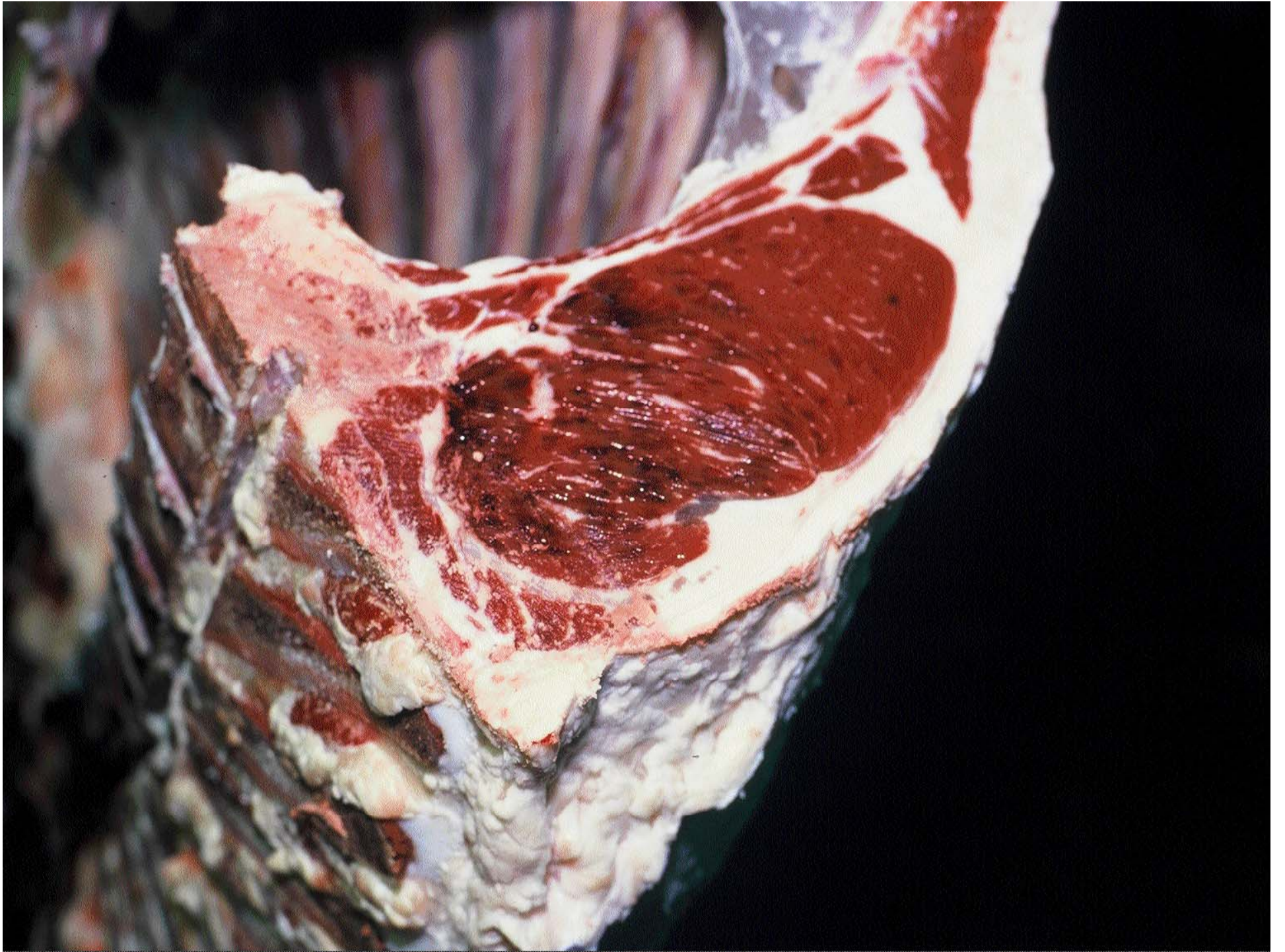
Genetics (Pigs)

- **Napole gene**
 - **AKA:**
 - **Acid Meat Gene**
 - **Hampshire Gene**
 - **More Glycogen (higher Glycolytic Potential)**
- **Halothane Gene**
 - **Rapid onset of rigor**
 - **Open mouthed breathing**
 - **Blotchiness of skin**
- **PSS (Porcine Stress Syndrome)**
 - **Nervous twitch**
 - **Leaky Ryanodine Receptor**
- **Heavy muscled; High lean to fat**
- **PSE**

Immobilization

- **Pigs**
 - CO₂, Electricity
- **Cattle**
 - Captive bolt
- **Sheep**
 - Captive bolt, electricity
- **Stun to stick**
 - Blood splashing
 - Fiery Fat
- **Blown out joints, backbones, etc**





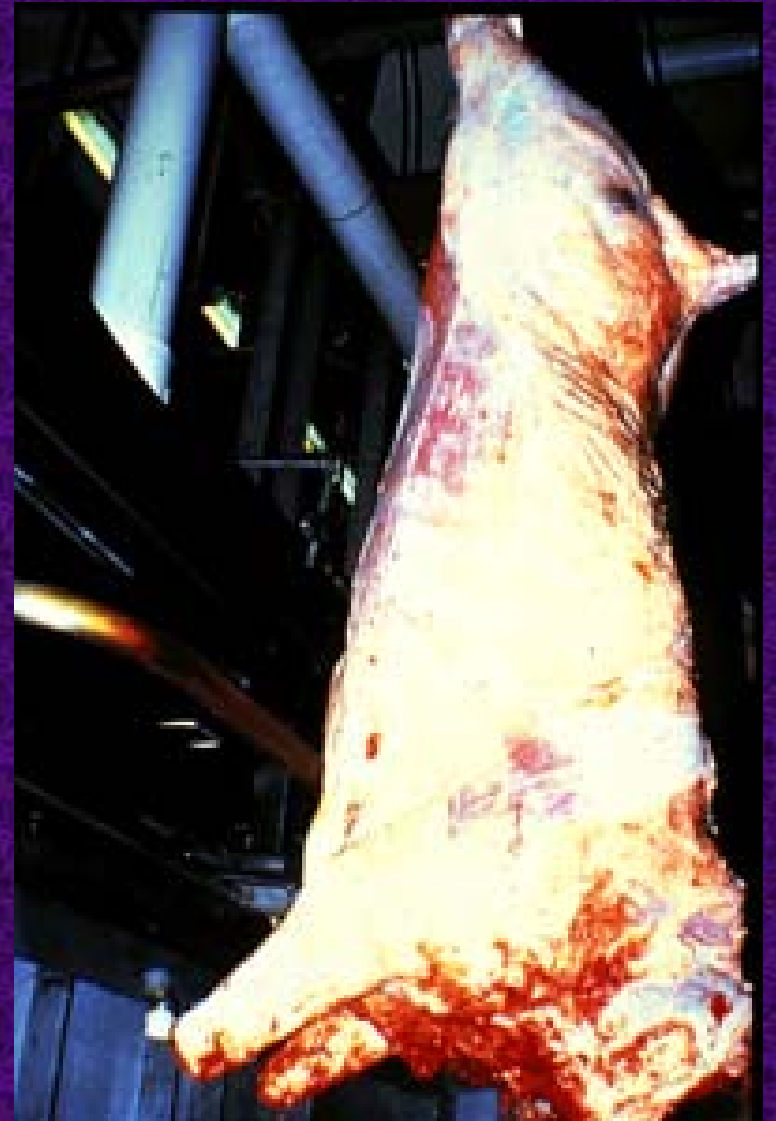
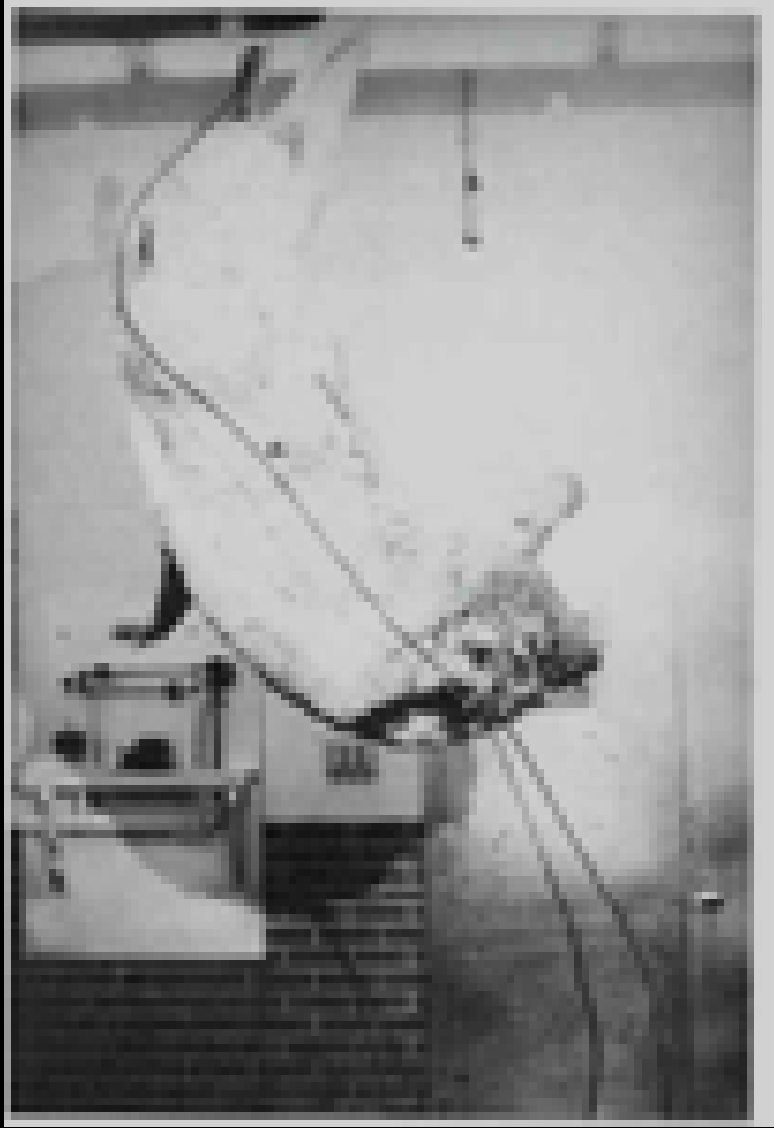
Chilling

- Remove heat as quickly as possible
- Pork
- Blast chill
- Thickness of Muscle
- Air flow
- Good cooler will forgive a lot of sins
- We need to be careful!!



Chilling

- **Cold Shortening – too cold before it goes into rigor (<15° C or 59° F)**
 - Muscle Fiber Type
 - Problem in Beef and Lamb
 - Electrical stimulation or 48 hour chill
- **Thaw Rigor – muscle frozen before it goes into rigor**
 - At thawing muscle tries to complete the process
 - Decrease in size
- **Tough, moisture loss**



Feel the wind in your face

