Three Characteristics of Presentations

- Quality, Length and Cost
- High Quality and Short talk ≠ Low cost
- High Quality and Low Cost talk ≠ Short
- Short and Low Cost talk ≠ High Quality
- This presentation: Low cost and not Short
Long Term vs. Short Term vs. Very Short Term Management & Handling

- **Long term** - management and handling factors months or weeks before slaughter that can affect meat quality.

- **Short term** - management and handling practices days before slaughter that can affect meat quality.

- **Very short term** - management practices hours or minutes before slaughter that can affect meat quality.
Carcass & Meat Quality

- Safety and wholesomeness
- Presence or absence of bruises
- Nutritional composition
- Marbling and visual quality factors
- Purge loss and processing yields
- Appearance and shelf-life
- Tenderness, flavor and juiciness
- Whether demanded by consumers, grocers, or restaurants, how animals are produced and handled is becoming a component of 'quality.'
Meat Safety & Wholesomeness

- Cleanliness of the finishing, transportation, and holding pen environments can affect cleanliness of carcasses.

- Practicality and economic issues are limiting factors, but cleanliness is very important.

- Stress in cattle can increase shedding of E. Coli O15:H7 organisms.

- This becomes a safety issue!
Cattle - Bruises and Meat Color

- Bruises can result from traumas within a few days, hours or minutes before slaughter.
- Facilities free of protruding objects, proper flooring, good loading and unloading ramps, and ‘slow handling’ minimize bruising.
- Excitement, transportation during extreme & variable weather, and long holding at processing plants can cause glycogen depletion and ‘dark cutting beef’.
- Economic losses are major ($20-40/100lb. carcass).
Beef Marbling, Meat Color

- Marbling is an important economic factor for beef and it relates to palatability.
- Meat Color is extremely important for shelf-life and consumer acceptance.
Cattle - Marbling, Tenderness

- Aggressive implanting within 70 days of slaughter, and/or 4 or more implants can negatively affect tenderness and marbling

- Improper use of ractopamine hydrochloride or zilpaterol can negatively affect tenderness and marbling

- Improper use of implants or β-agonists can make cattle more susceptible to be dark-cutting carcasses

- Very hot temperatures during loading and transporting increase this susceptibility
Meat Tenderness

- Approximately 40% heritable in cattle

- Can be affected by improper implant strategies (cattle) and beta agonists (all species)

- Post-mortem environment can have major effects on tenderness
  - Electrical stimulation of beef, chilling temperature, time post-mortem, cooking method, mechanical and chemical enhancement, & endpoint temperature can have major effects
Definitions of and Causes of Stress

- Stress can be categorized as: 1) physical, 2) emotional, or 3) physical x emotional combination.
- Stress defined as: physiological changes in heart rate, respiration rate, body temperature, and/or blood pressure when animals are exposed to 'stressors.'
- Stressors occur when the environment becomes uncomfortable or hazardous.
- In general, pigs are more susceptible to physical stressors, sheep are more susceptible to emotional stressors, and cattle to a combination of physical and emotional stressors.
Glycogen Depletion and Repletion

- When muscle glycogen is depleted and animals are not slaughtered at that time, glycogen can be replenished.
- Several days are required to accomplish this in cattle.
- If animals are slaughtered when muscle is mostly depleted of glycogen, meat will have a high pH and dark color because the normal acidification process cannot occur postmortem.
- In pork, the term ‘dark, firm, and dry’ (DFD) is used; in cattle and sheep the term is ‘Dark Cutter.’
Cattle – Stress and Meat Quality

- ‘Physical stress’ seems to be most critical in causing ‘dark cutting’ beef

- Long transportation, standing more than 12 hours at the slaughter facility, & mixing cattle before slaughter can cause ‘dark cutting’ beef

- Stress several days before slaughter also can reduce marbling
Nutritional Management of Cattle

- Oral electrolyte therapy (Nutri-Charge™) can reduce physical stress
  - Reduce weight loss
  - Reduce dark cutters by 50%
  - Increase % Choice carcasses
Summary

- Producers, transporters, and meat processors all have responsibility for proper production and handling of cattle in order to optimize animal welfare and meat quality.

- This requires knowledge of genetics, stress, management, muscle physiology, handling, stunning, chilling, and meat quality.
Summary

- Gentle handling should always be the goal.
- Proper loading facilities are critical for optimum handling.
- Slaughter facilities must have properly designed unloading facilities to unload cattle quickly.
- Holding facilities must be designed for quiet and easy movement of cattle.
Summary

- Processing plants should have proper equipment and procedures for handling “downer” animals.
- Proper stunning equipment and procedures are critical for good meat quality.
Summary

- Implants and beta agonists should be used properly to prevent possible negative effects on marbling and tenderness.
- Cattle should be handled quietly without hotshots, and transported in acceptable weather to minimize 'dark cutting' beef.
- Utilize 'point of balance' principle in handling.
- Holding time at processing plants should be minimal to prevent 'dark cutting' beef.
Thank you for your attention

- Questions?
U.S. National Pork Board Animal Welfare Committee

- Swine Welfare Indexing System
- Advocates the use of science as the basis for establishing appropriate rearing practices
- “Husbandry” skills and practices are cited as the most important factor for animal well-being
Handling Injured or Non-Ambulatory Hogs

- If a USDA inspector veterinarian is not available to examine a downer, USDA regulation 311.27 allows plants to perform “Emergency Slaughter” for humane reasons.

- However, the carcass and parts must be held with the head for later inspection.
Fast-Food Restaurants' Welfare Requirements

- McDonald's, then Burger King, then Wendy's implemented animal welfare requirements for their suppliers.
- Minimum of 72 in² of hen cage space, increased voltage for chicken stunning, surprise inspections.
Animal Welfare and Meat Quality

- Whether demanded by consumers, grocers, or restaurants, how animals are produced and handled is becoming a component of 'quality.'
Food Marketing Institute & National Council of Chain Restaurants

- Developed auditing system to allow grocers and restaurants to evaluate suppliers.
- Establish minimum cage size for hens, standards for beak trimming, preventing dairy cow tail removal, eliminating gestation stalls for pregnant sows, etc.
Beginning in 2009, the routine castration of male pigs will be banned in Norway.

Starting in 2002, only veterinarians will be permitted to perform this procedure.

The pigs must receive analgesia.

A similar Danish ban was used as the model.
Normal pH decline is from ~ 7.4 in living muscle to about 5.4-5.6.

In some hogs, pH drops very rapidly, giving an ultimate pH of 5.2 or 5.3.

Low pH before natural body heat has been removed by chilling causes denaturation of muscle proteins.

In severe cases, meat will be pale, soft and exudative (watery), commonly called PSE
Pork Meat Quality Problems

- When muscle glycogen is depleted before slaughter, glycolysis does not occur and pH remains high.
- pH of 6.5 to 6.9 results in dark, firm, and dry (DFD) meat.
- DFD meat is tender and juicy and results in high cooking and processing yields.
- However, consumers are very reluctant to purchase DFD meat, and microbial growth is more rapid!
Stress Effects on Hogs

- Hogs moved to unfamiliar, uncomfortable or hazardous surroundings may become stressed.
- Excitement, fatigue, overheating, or chilling may result.
- Increased heart rate, respiration rate, blood pressure or body temperature result.
- “Stress Hormones” then accelerate glycolysis for energy.
- Fasting more than 10-12 hr or extensive exercise can cause glycogen depletion, even though the “stress hormones” are not released in acute levels.
Stress Effects on Hogs

- When hogs are stressed, anaerobic glycolysis is favored, and lactic acid is produced as a by-product.
- Muscle cannot get rid of lactic acid quickly and the liver cannot neutralize large quantities quickly.
- Acidosis can result and cause death.
- Hogs slaughtered in an acidotic state will have PSE muscle.
Stress Effects on Hogs

- If hogs are slaughtered in a state of muscle glycogen depletion without lactic acid accumulation, the pH will remain higher than normal and DFD pork results.
- Fasting more than 18 hr. or exercise can cause glycogen depletion, even though the “stress hormones” are not released in acute levels.
The genetic susceptibility to stress in hogs was first described as the Porcine Stress Syndrome (PSS).

- PSS hogs were more susceptible to death and typically produced PSE meat when they were stressed, but did not die.
- PSS hogs have a defect in the sacroplasmic reticulum that causes Ca++ to leak.
- The mutation of the gene is named ryanodine (RYR1).
Handling Injured or Non-Ambulatory Hogs

- Non-ambulatory ("downer") animals require special attention!
- Ambulatory animals should be unloaded quickly and then the "downers".
- A slid board or cripple cart should be used.
- The Humane Slaughter Act prohibits dragging of "downers".
- They should be slaughtered promptly to minimize suffering.