

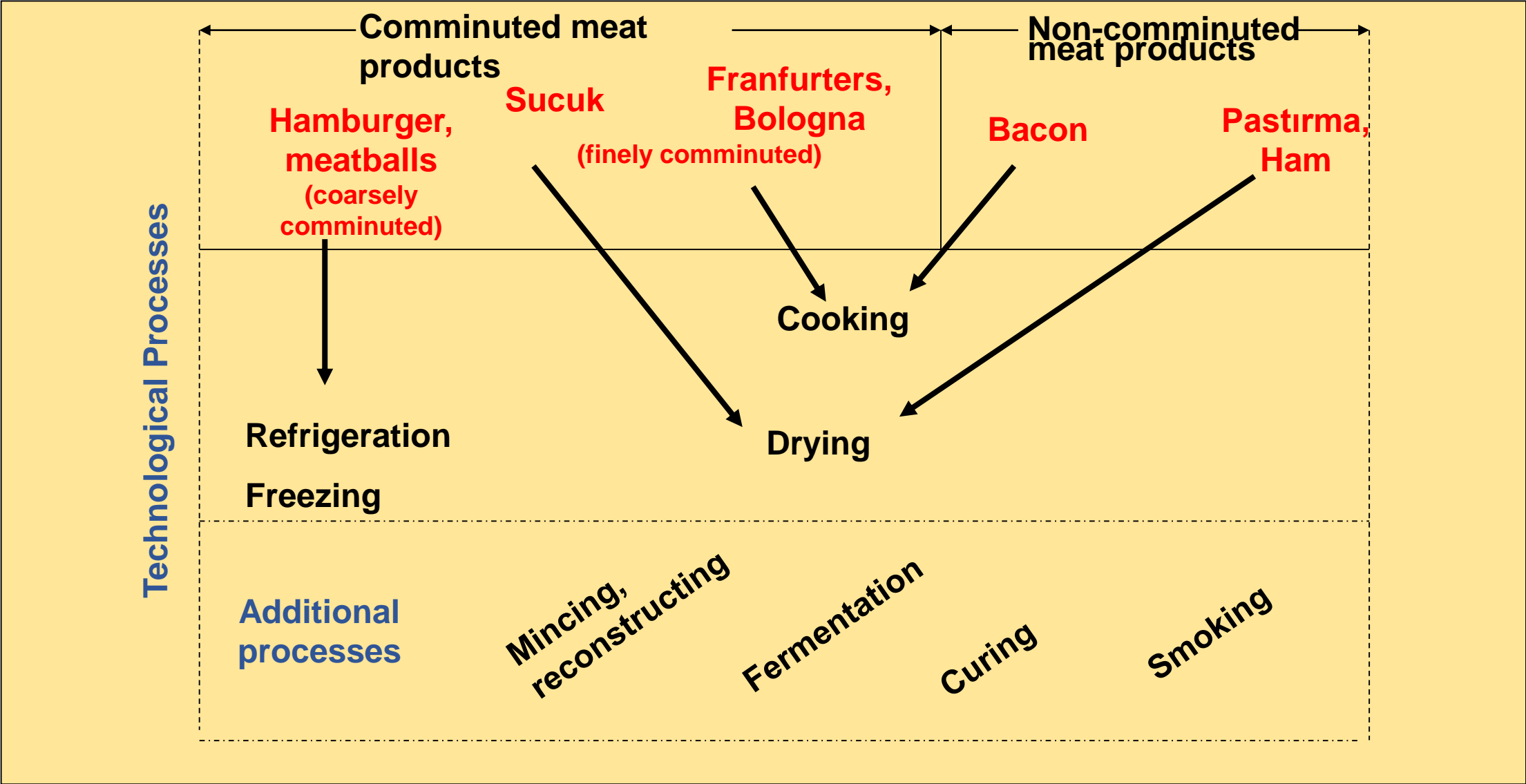
GDM 412 MEAT TECHNOLOGY

LESSON-8

LOW AND HIGH TEMPERATURE APPLICATIONS IN THE MEAT TECHNOLOGY (Storage and Preservation of Meats)

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Techniques in the Production of Meat Products



Conventional methods used meat preservation;

1. Low temperature applications
2. Heat treatments (high temperature)

Low temperature applications

Two techniques are applied;

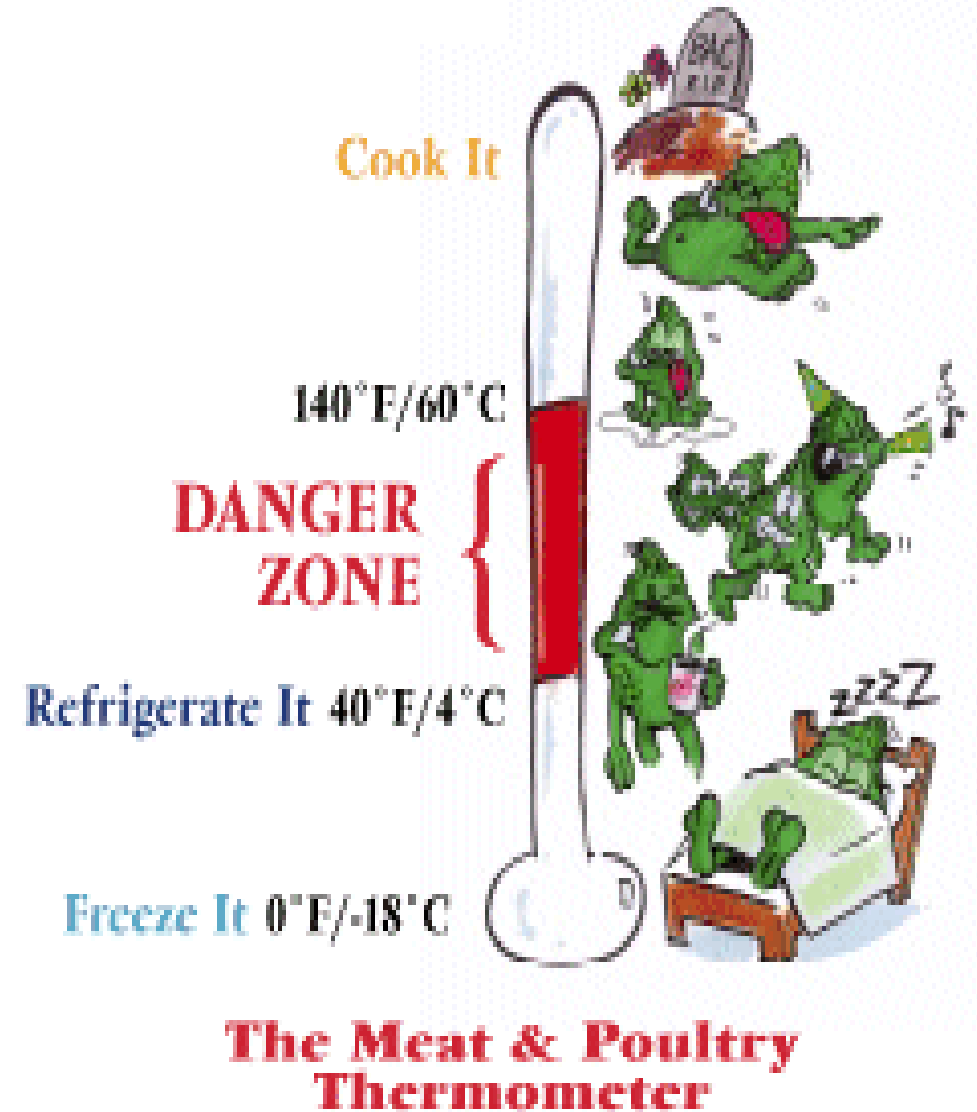
1. Refrigeration or cold storage
 - (at -1°C - 7°C)
2. Freezing or frozen storage
 - (internal temperature of -18°C)

 **"Cold chain"** 

Heat treatments

1. Pasteurization (below 100°C)
2. Sterilization (above 100°C)

→ Commercial sterilization ←



Refrigeration- Purpose

1. Retard microbial growth (refrigeration) or inhibit (freezing)
2. Minimize enzyme activity
3. Limit oxidation reactions
4. Reduce drip loss
5. Facilitate aging



Effect of chilling on microorganisms

Spoilage microorganisms at refrigerated storage of meat products;

✓ Yeasts and molds

- *Thamnidium, Mucor, Rhizopus*- mycelium formation
- *Cladosporium*- formation of black spots
- *Penicilium*- greening
- *Sporotrichum, Chrysosporium*- formation of White spots
- *Candida, Rhotorula, Torulopsis*

✓ Bacteria

- *Pseudomonas, Acinetobacter, Moraxella, Aeromonas, Alkaligenes*
- *Brochothrix thermosphacta*, lactic acid bacteria (vacuum-packaged meat products)

Important pathogens at refrigerated storage of meat products

- *Listeria monocytogenes*
- *Yersinia enterocolitica*
- *Aeromonas hydrophila*
- *Vibrio parahaemolyticus*
- *Clostridium botulinum* Type E

Techniques for chilling of used in meats

- ✓ Slow chilling
- ✓ Rapid chilling
- ✓ Accelerated chilling
- ✓ Shock chilling

Important criteria for refrigerated storage

1. Storage temperature
2. Storage relative humidity
3. Air circulation

Frozen storage

✓ Three stages:

1. Freezing
2. Storage of the frozen product
3. Thawing

✓ These three stages are considered separately.

➤ Problems in process and final products are different.

Effect of freezing on microorganisms

Microorganisms based on their sensitivity to destructive action of freezing

Resistant to freezing: Spores of *Clostridium* and *Bacillus* genera, *Micrococcus*, vegetative forms of *Staphylococcus* and *Streptococcus*

Very sensitive to freezing: Majority of Gr-bacteria, Examples: *Enterobacteriaceae*, *Pseudomonas*

Less resistant to freezing: Chiefly Gr+ bacteria such as *S. aureus* responsible for spoilage

Crystallization phenomenon in muscle tissue

✓ Two steps in crystallization phenomenon;

➤ Nucleation formation

➤ Ice crystal growth

Freezing techniques

- ✓ Very fast freezing (shocked freezing)
 - (Average integral freezing rate is higher than 5 cm/h)
- ✓ Fast freezing
 - (Average integral freezing rate is around 1-5 cm/h)
- ✓ Slow freezing
 - (Average integral freezing rate is around 0.2-1 cm/h)
- ✓ Very slow freezing
 - (Average integral freezing rate is 0.2 cm/h)

Freezer burn



Freezing methods

1. Blast freezing
2. Plate freezing
3. Immersion freezing
4. Cryogenic freezing



Factor affecting storage life of frozen meat products

- ✓ Rancidity due to lipid oxidation
- ✓ Water loss due to sublimation (drying)
- ✓ Flavor loss

Thawing

Important criteria during thawing of meats:

- ✓ Weight loss (Cost)
- ✓ Increase in microbial load (Quality)

Cooking/Heating processes

- ✓ Heat treatment is applied in manufacturing of a variety of meat products.
- ✓ The purpose is to make meats shelf-stable and ready to consume.
- ✓ The characteristic meat flavor is formed due to high temperature applied during the cooking process.
- ✓ Different cooking methods:
 - Boiling, broiling, roasting, barbeque, frying, etc.



Heat treatments

- 1. *Pasteurized products:*** core temperature is lower than 100°C, generally temperature range between 71-82°C is applied.
 - (Storage life: 6 months at 2-4°C)
- 2. *Cooked products:*** Without pressure application, cooking in boiling water – core temperature reaches 100°C.
- 3. *Canned products:*** Commercial sterilization is applied.

The effects of heat on muscle proteins

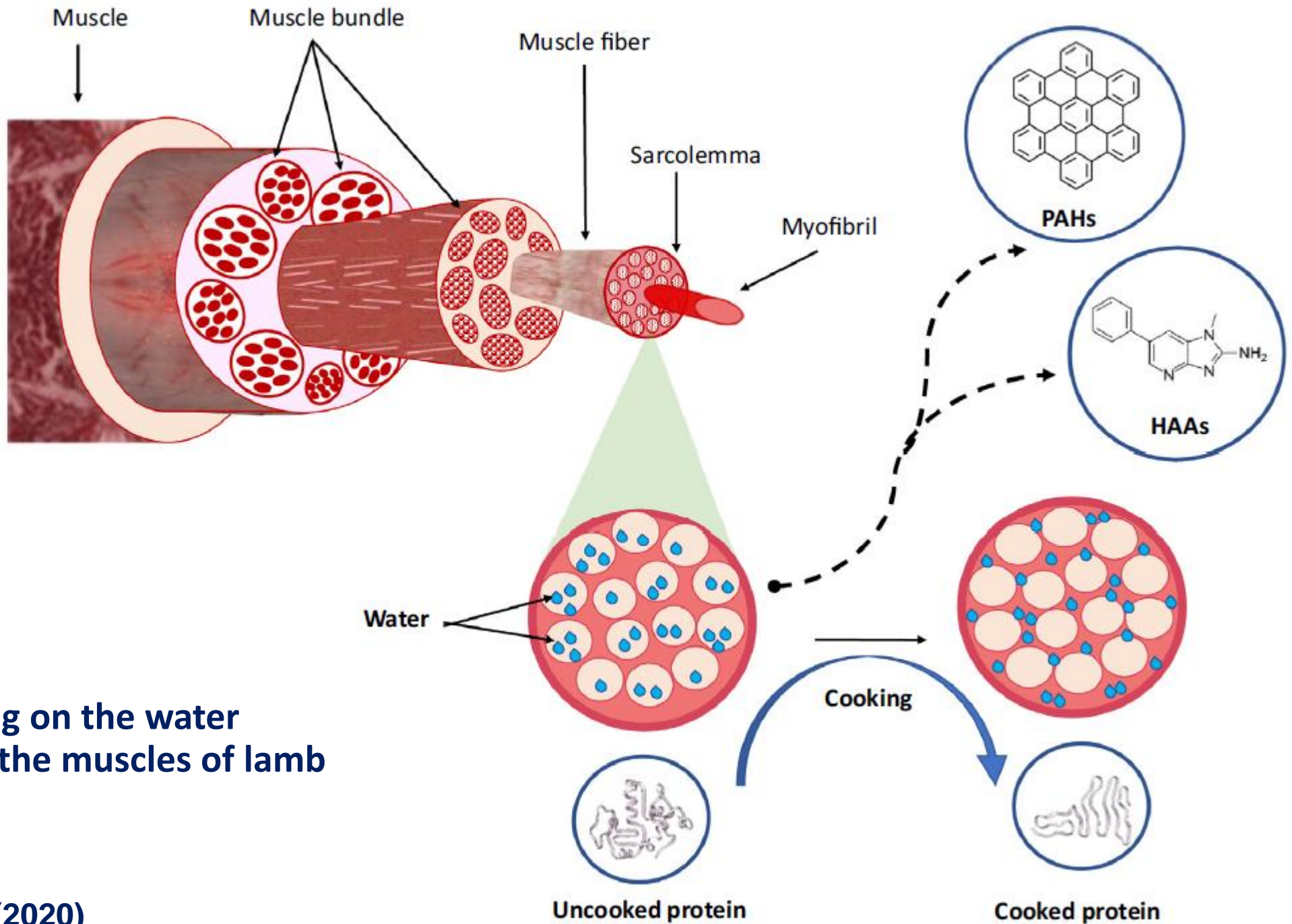
✓ *The final tenderness and juiciness of cooked meat results from a combination of intrinsic and extrinsic factors.*

Intrinsic factors

Amount of collagen, denaturation of the myofibrillar proteins, and water loss

Extrinsic factors

Temperature and length of cooking, and pH



Effect of cooking on the water content within the muscles of lamb meat

Suleman et al. (2020)