

Meat Preservation

Irradiation and Curing



Objectives

- Examine methods for irradiation, curing and smoking meat products
- Examine the variety of meats made available through curing



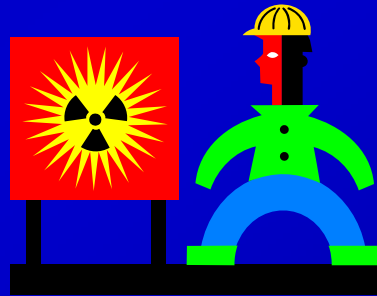
Merchandising Strategies

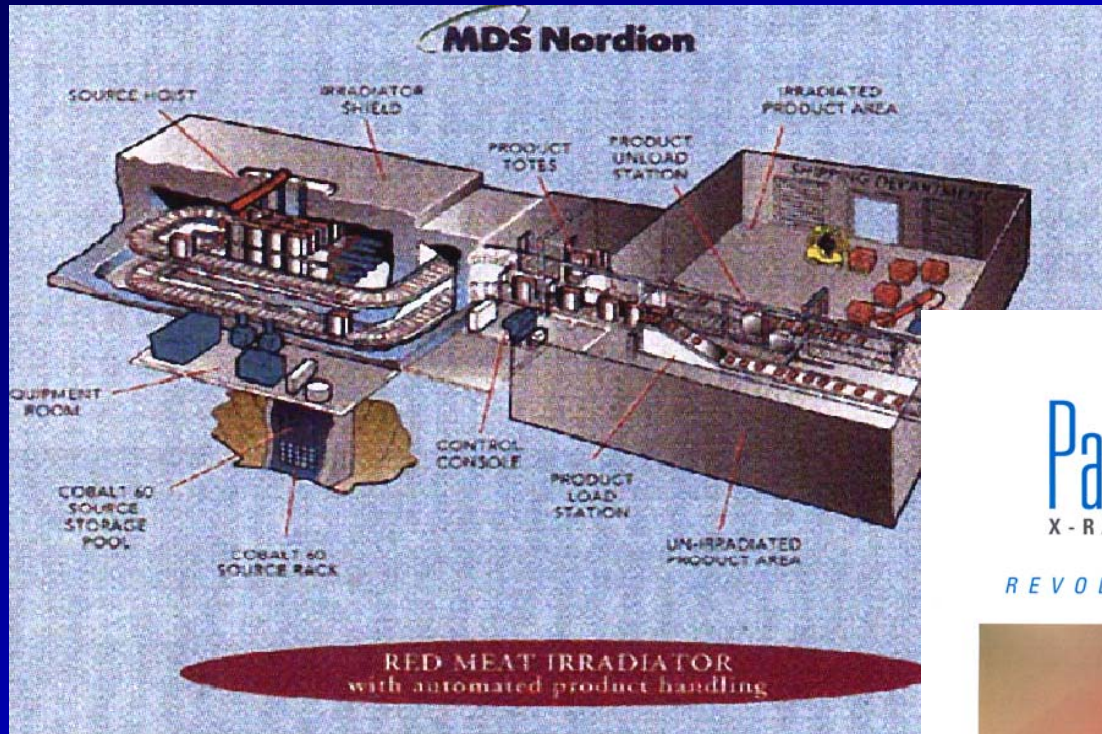
- Today, most meat is sold in containers
- Refrigeration makes this possible
- Traditionally, Curing and sausages were required



Irradiation

- Types of irradiation:
 - Alpha (not used in food industry)
 - Beta
 - Gamma
 - Z-rays





Have you eaten irradiated foods?

Palletron™
X-RAY IRRADIATOR

REVOLUTIONIZING FOOD IRRADIATION

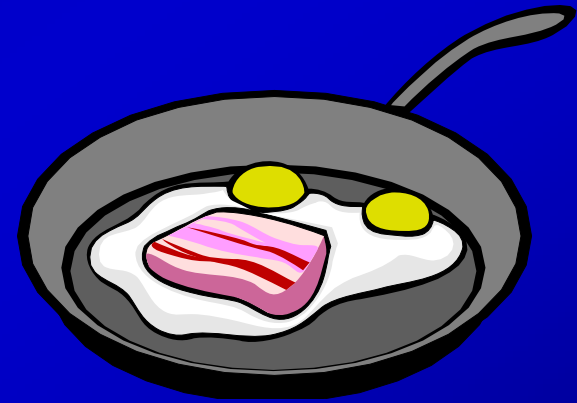
MDS Nordion
Science Advancing Health

QUARON **ECOLAB**



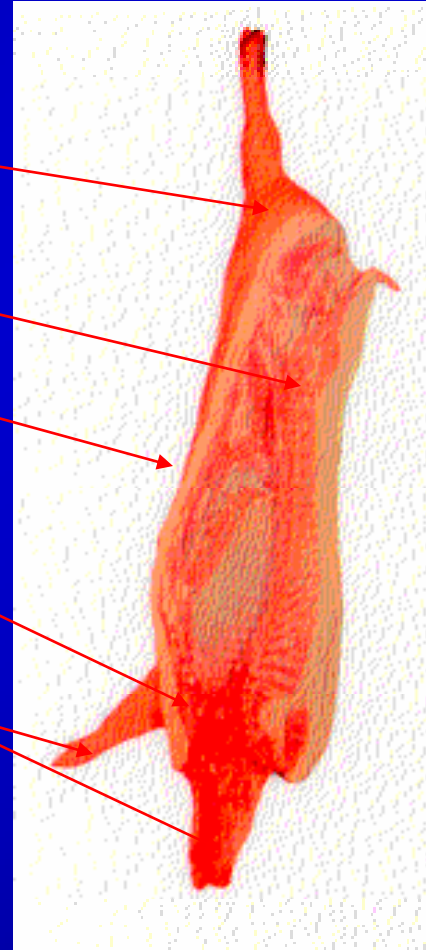
Why Cure Meats?

- Preservation
 - Traditional form of preservation
 - Equatorial countries are still very good at cure processing
- Variety
 - Adds spices and flavors to the same old meat
- Value Added
 - Packer/Retailer can charge more for low quality meats



What parts can be cured?

- Hams
- Loins
- Bacon
- Boston Butts
- Jowls
- Pork hocks



Where does Canadian bacon
come from?



Which Species is Cured?

- Pork, Pork, Pork, Fish, Lamb.....Poultry
- What is the most common cured **beef** product?
 - Corned Beef
 - Corned is from the yellow corn kernel-size salt used as a preservative



Types of Cures

- Dry salt cure
 - Uses only salt
 - Used primarily in pork and beans
- Dry sugar cure
 - Salt and sugar applied in a dry rub
 - Traditional **country cured ham**
- Sweet pickle cure
 - Most common curing process
 - 90% water
 - Honey baked hams
- Cover pickle cure
 - Immerse in water, seldom used because of expense

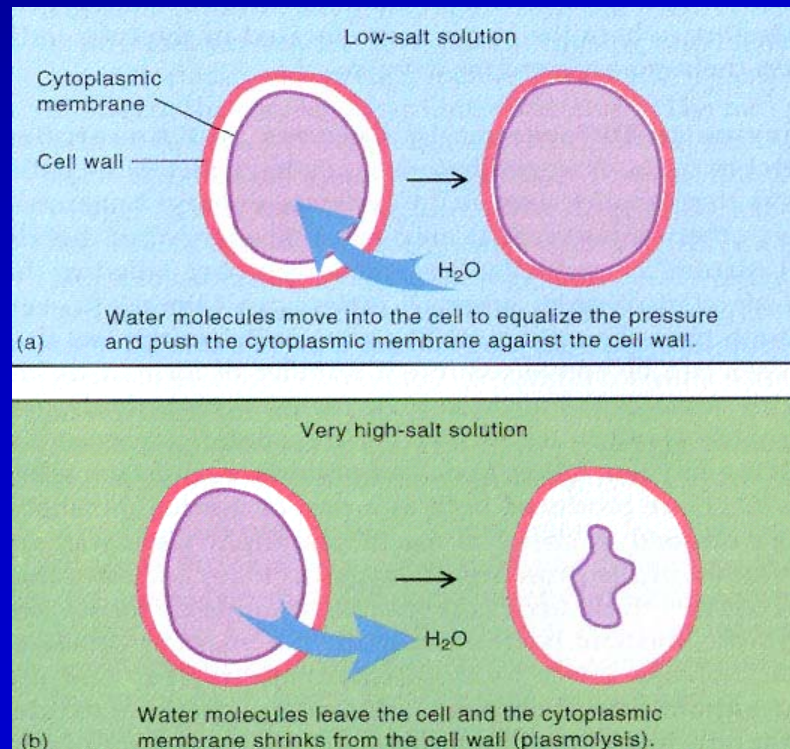


Curing Ingredients

- Salt – NaCl
 - Principal cure ingredient*
 - Only ingredient than can be used by itself
 - Adds flavor (major effect)
 - Enhances the transport of other cure ingredients
- How it works!
 - Pulls moisture from the microbes (osmosis)
 - Also pulls moisture from meat



Cure Ingredients



Why salt concentrations are so high in hams and bacon



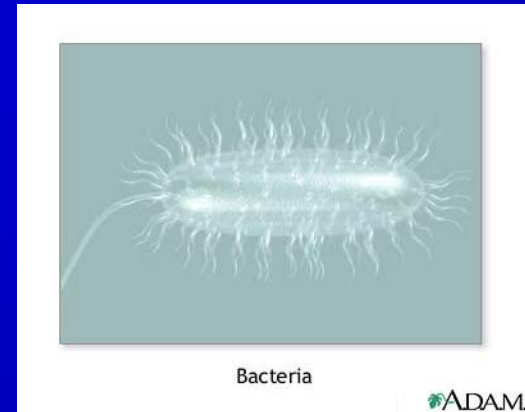
Cure Ingredients

- Sugar
 - Sucrose or dextrose
 - Artificial sweeteners are not allowed
 - Counteracts the taste of salt
 - Has very little sweetening action
 - Colors the product (brown sugar)
 - Energy for bacteria in fermented products



Curing Ingredients

- Nitrates and Nitrites
 - Develop color
 - Prevent outgrowth of *C. botulinum*
 - Prevent warmed over flavor (microwave)
 - Help with flavor intensity
 - Retard rancidity
- Hams = Max of 200 ppm sodium nitrite
- Bacon = Max of 120 ppm sodium nitrite



Sodium Nitrite in Bacon



0 ppm
NaNO₂

40 ppm NaNO₂,
.26% K-SORBATE

80 ppm
NaNO₂

120 ppm
NaNO₂



Curing Ingredients

- Ascorbates
 - Ascorbic acid, Sodium ascorbate, Sodium erythorbate
 - Required for cure pickles (550 ppm)
 - Catalyze conversion of nitrite to nitric oxide
 - Inhibit nitrosamine formation
 - Maintains color
 - Can be sprayed on cut surface to reduce fading during display



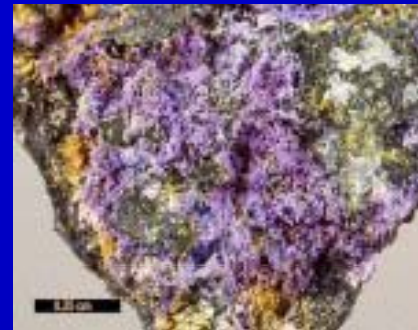
Curing Ingredients

- Phosphates
 - Water retention
- Alkaline phosphate
 - Gives more stable color
 - Reduces oxidation
 - Protects against browning
- Increase water holding capacity***
- Necessary for added water product (think chicken)



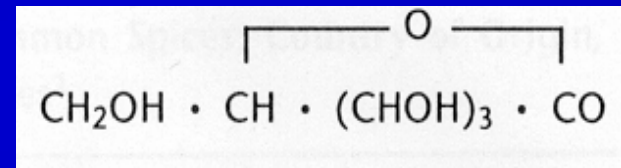
Cure Ingredients

- Phosphates cont.
- Can Use:
 - Sodium hexametaphosphate
 - Sodium pyrophosphate
 - Sodium triphosphate
- Can use up to 5% in pickle
 - Can have up to 0.5% in finished product
- Decreases purge during cooking
- More juicy and tender



Cure Ingredients

- Cure Accelerators
 - Allow reactions in curing to proceed faster
- Glucono delta lactone
 - In hams and sausages
 - Produces a tangy flavor
 - Very common
 - Mostly sugar



Cure Ingredients

- Sweeteners
 - Corn syrup and honey are very common
- Potassium Sorbate
 - Antimicrobial
- Smoke
 - Liquid or wood
- Water
 - Carries all other ingredients and adds juiciness



Cure timeline (Dry Cure)

	<u>CUMULATIVE DAY</u>
KILL HOGS TODAY	0
CUT CARCASSES & "RUB" HAMS	1
"RUB" HAMS SECOND TIME	7
CURE ○ 40 D (1 WEEK/IN. OF THICKNESS)	41
EQUILIBRATE (LET OSMOSIS "WORK")	61
SMOKE AT NO MORE THAN 100°F	62
AGE 42 DAYS (VARIES)	104
SLICE, WRAP AND SHIP	105



Economics of the Dry Cure

- Why are country hams so expensive?
- 105 days to cure * 10,000/day = 1,050,000 hams in stock
- Storage facilities – refrigeration during curing and air conditioning during aging
- Labor
- Almost all country cure business in southeastern U.S.



Cure Timeline (Sweet Pickle)

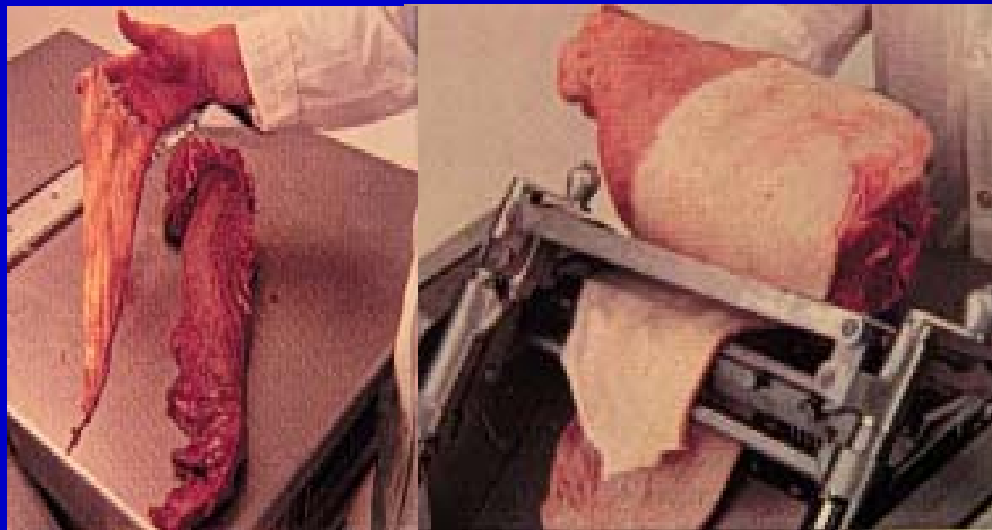
	CUMULATIVE DAY
KILL HOGS TODAY	0
CUT CARCASSES, PUMP HAMS, AND SMOKE THEM	1
COOL TO 38°F	2
SLICE, WRAP AND SHIP	3

How many hams would this packer have on hand if 10,000 hogs were killed/day?



Skinning of a Ham

- Why skin the ham
 - Allows cure to penetrate
 - Silverside shrinks distorting ham



Dry Cure Ham

- Why is he not required to wear gloves or hair net?
- Why is he salting the bone?



Dry Curing

Box Cured

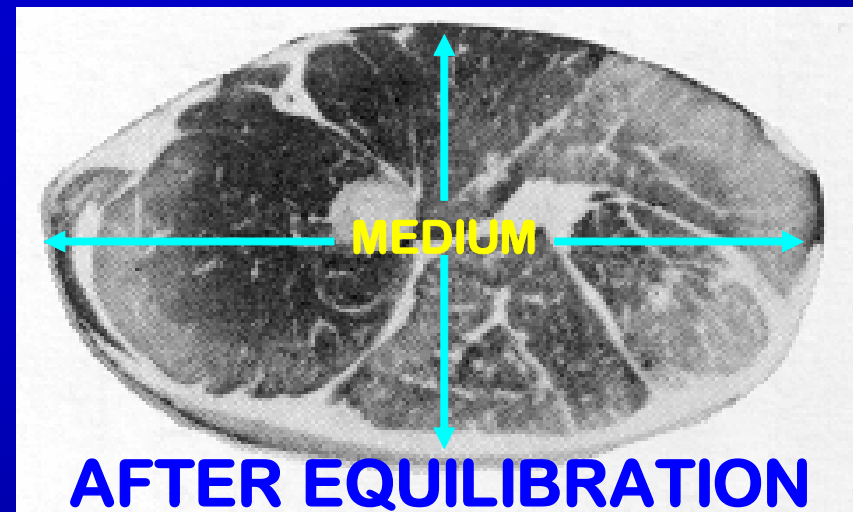
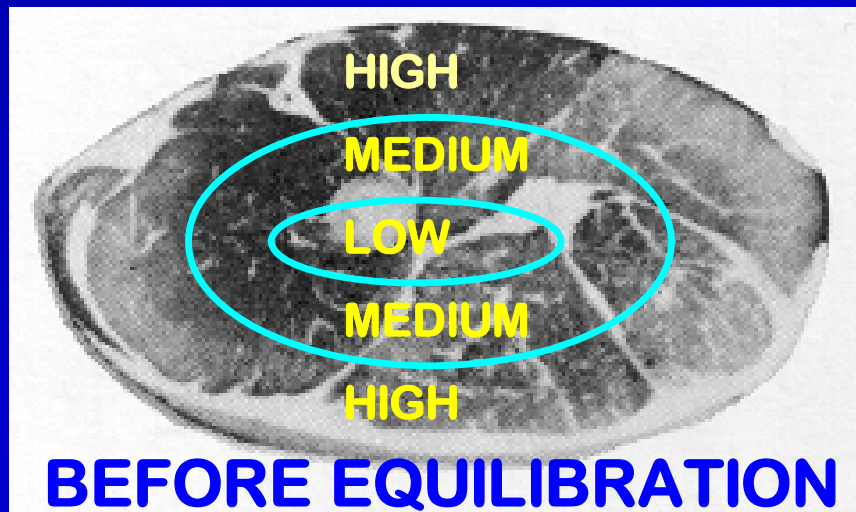


Shelf Cured



Equilibration Period

- Requires 20 days of equilibration at 38°C
- Osmosis makes cure concentration more uniform
- Can make people sick if eaten too soon
 - Salt
 - Bad meat



Dry Cured Bacon in Aging Room



Shrinkage in Country Hams/Bacon

CUMULATIVE SHRINKAGE, %

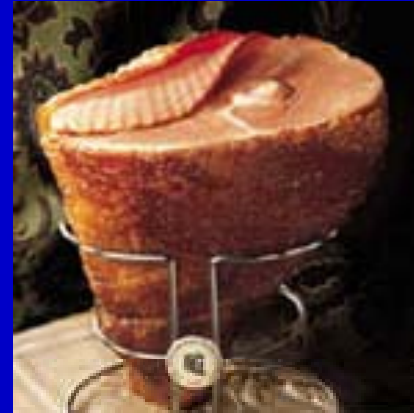
CURING	2
SMOKING	8 - 9
1 MONTH OF AGING	15 - 18
6 MONTHS OF AGING	30±

Why do country cured products costs so much?



Reasons for Pickle Cure

- Cheaper, Cheaper, Cheaper
 - Less overhead cost
 - Water adds weight
 - Less overall shrinkage
- Juicier
- More tender
- Better flavor
- Most people don't like country cure
- 90% of all hams and bacon is produced this way



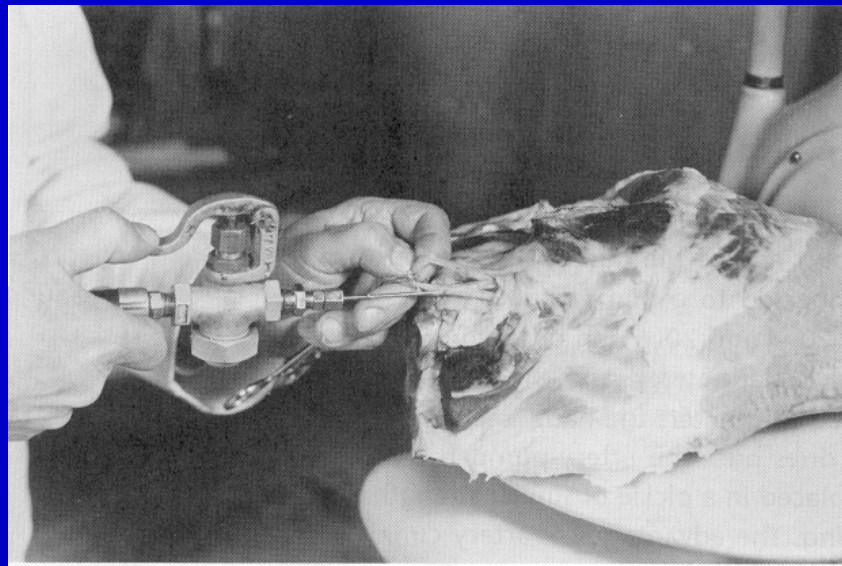
Injection Methods

- **Stitch Pump**
 - Place in several places



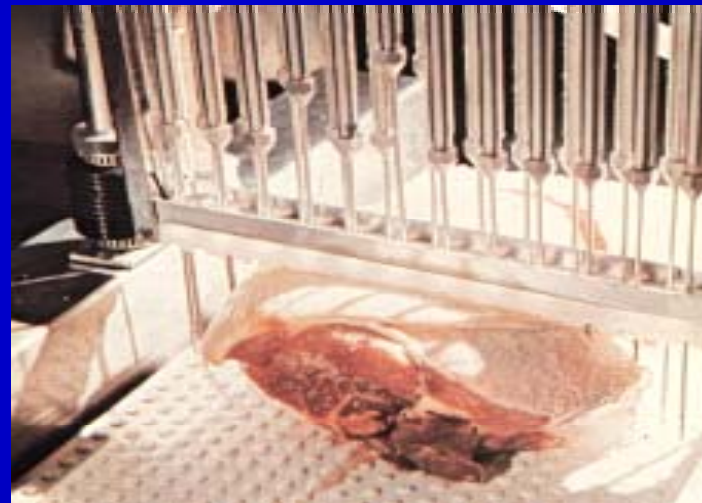
Injection Method

- Artery Pump
 - Similar to stitch but use vein/artery to distribute the brine



Injection Methods

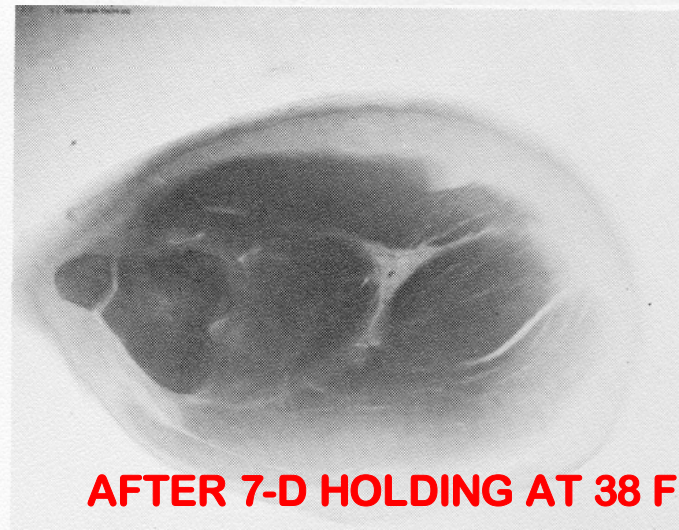
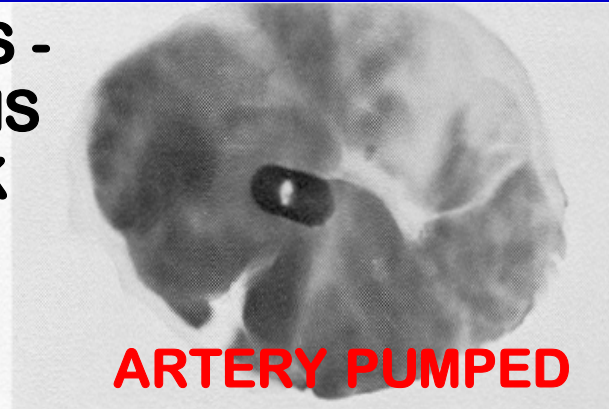
- Multi-needle Injector



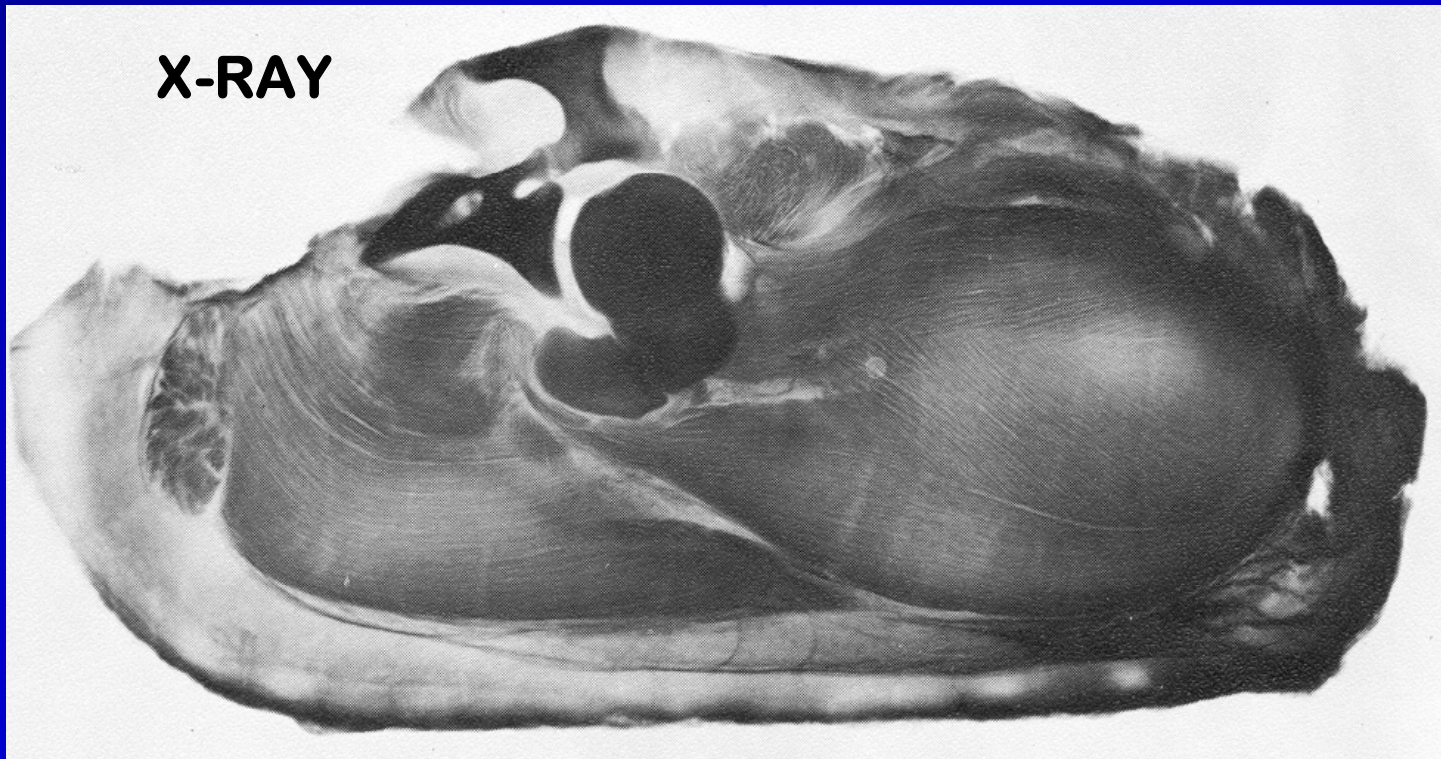
Injection Methods



X-RAYS -
CURE IS
DARK



Injection Methods



Ways to Pump Cure

1. Stitch Pump
2. Artery Pump
3. Multi-needle injector
4. Cover Pickle
5. Combination



Smoking



Smoking

- Hardwoods should be used for smokers



Purpose of Smoking

1. Development of Aroma and Flavor
2. Preservation
3. Creation of new products (value adding)
4. Color development
5. Protection from oxidation
6. Formation of skins



Composition of Smoke

- Phenols
 - Aroma and Flavor, antioxidant
- Alcohols
 - Act as carrier of other components
- Organic acids
 - Skin formation, preservation
- Carbonyls
 - Color and Flavor
- Hydrocarbons
 - Undesirable, carcinogens
- Gases
 - CO₂, CO, O₂, N₂, H₂O etc.



Cooking with Gas



Types of Smoke

- Vaporous
 - Contains two phases
 - Particulate (90%)
 - Gaseous (10%)
 - Contains carcinogens and is slower but is cheap
- Liquid smoke
 - Low to no carcinogens
 - Shorter cook/run time
 - Lower pollution



Liquid Smoke Application

1. Dripping/Drenching
2. Direct Application
3. Atomization



THE END

