

# Identifying Biological Hazards and Controls

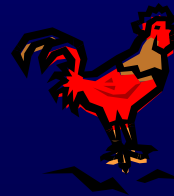
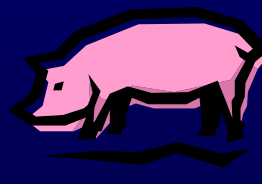
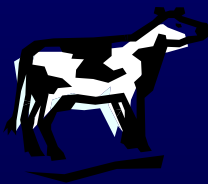
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# Foods Involved in Outbreaks

- **Primarily of Animal Origin**
  - 48% from Beef, Poultry, Eggs, Pork, Fish, Dairy Products
  - **Animal Products**
    - High in Nutrients
    - High Water Activity
    - Provide an Excellent “Food” for Microorganisms
    - Intestinal Tract is a Source of Pathogens



# **Bacterial Foodborne Illness**

- **Food infection**
- **Food intoxication**

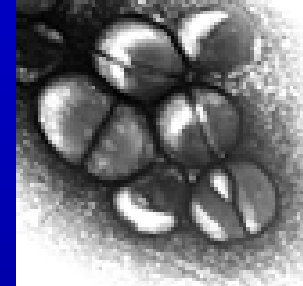
# Food Intoxication

- Food intoxication results from consumption of toxins (or poisons) produced in food by bacterial growth. Toxins, not bacteria, cause illness. Toxins may not alter the appearance, odor or flavor of food.
  - *Staphylococcus aureus*
  - *Clostridium botulinum*
  - *Clostridium perfringens* (toxins released in the gut when large numbers of vegetative cells are eaten)

# Food Infection

- The bacteria is in the food and may become numerous. If the food is eaten, the bacteria may continue to grow in intestines and cause illness.
  - *Salmonella*
  - *Campylobacter*
  - *Hemorrhagic E. coli*
  - *Listeria monocytogenes*

# ***Staphylococcus aureus***



- **Food Intoxication**
- **Pathogen Must Grow in the Food and Produce Toxin**
- **Toxin Causes Illness and is Heat Stable**
- **Live (vegetative) Cells do NOT have to be Consumed**

# ***Staphylococcus aureus - Control***



- **Problem**
  - **Food Must be Temperature Abused for this Illness to Occur**
  - **Humans are Carriers of this Illness**
- **Control**
  - **Good Personal Hygiene**
  - **Keep Foods out of the Temperature Danger Zone**

# ***Clostridium botulinum***

- **Ubiquitous and may occur in almost all foods**
- **Level of contamination is very low**
- **Toxin production**
- **Toxin is among the most toxic of all naturally occurring substances.**
- **Spore Forming Bacteria**
- **Survives Heating/Cooking Process**



# ***Clostridium botulinum.* - Control**

- **Proper chilling of cooked food**
  - **Group II grow below 10 C**
- **Salt and Nitrites**
- **pH**
- **Toxin is NOT Heat Stable**
- **Retort (canned products)**



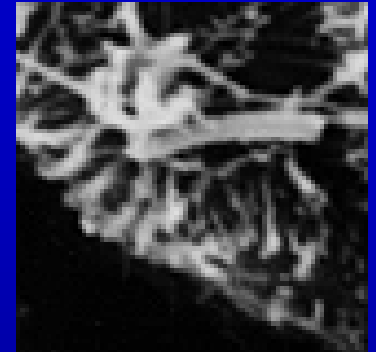
# ***Clostridium perfringens***

- **Widely distributed in nature, normal flora of intestinal tract of man and animals**
- ***C. perfringens* - Poultry**
  - **Must Consume Vegetative Cells**
  - **Toxin produced in the intestine**
- **Spore Forming Bacteria**
- **Resistance to heat varies with strain**
- **Survives Cooking/ Rapid outgrowth**

# ***Clostridium perfringens* - Control**

- **Spores will survive in Cooked Product**
- **Proper chilling of cooked product**

# ***Salmonella***



- **All Meats can be Sources**
  - **30% of Poultry Carry *Salmonella***
- **Some Humans are Carriers**
- **Intestinal Tracts of Animal**
- **Live Cells Must Be Consumed to Cause Illness**
- **Many Types of *Salmonella***

# ***Salmonella* - Control**

- **Proper Cooking**
- **Avoid Cross-Contamination After Cooking**
- **Use only Pasteurized Egg Products or Cook any Product That has Eggs Added**
- **Good Personal Hygiene**

# Campylobacter

- **#1 Cause of Food-Borne Illnesses**
- **Harbored in the Intestinal Tract of Animals**
- **Very Sensitive to Environment**
  - **Cooking**
  - **Oxygen**
  - **Drying**



# ***E. coli* O157:H7**



- **This organism does not have to Grow in Food to Cause Illness**
  - **Low Infectious Dose**
- **Harbored in the Intestinal Tract of Animals**
  - **Cattle, Sheep, Deer, other Farm Animals**

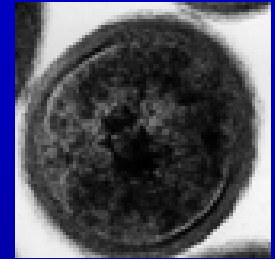
# ***E .coli* O157:H7 - Control**

- **Cooking**
  - **160 F for 15 Seconds**
- **Temperature Control**
  - **Less than 45-40 F**
  - **Fewer Cells = Less Likely to Cause Illness**





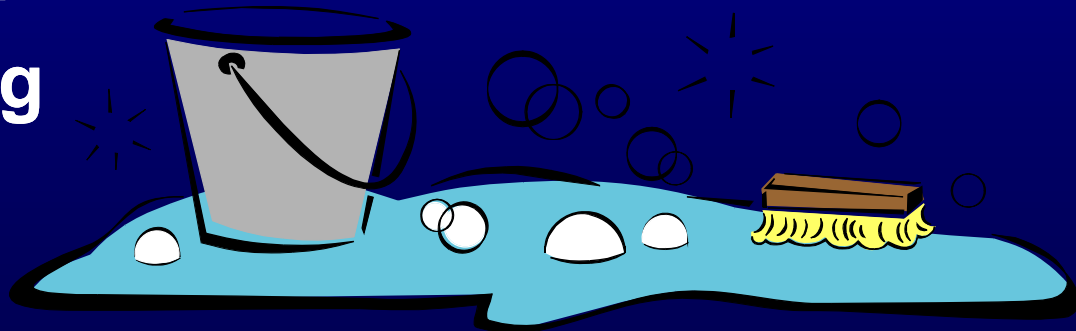
# ***Listeria monocytogenes***



- **Concern in Processed Products**
  - Sliced Deli Meats, Hot Dogs, Soft Cheese
- **Harbored in Intestinal Tract of Animals and the Environment**
- **Cross Contamination from Plant Environment**
- **Grows at Refrigeration Temperature**

# *Listeria monocytogenes* - Control

- Control
  - Proper Cooking
  - Plant Sanitation
  - Low pH
  - Low Aw
  - Freezing



# Control of LM in RTE Foods

- *Listeria monocytogenes* is a SANITATION issue
- Verification of Sanitation SOP's
- Testing for “generic” *Listeria*
- Guidelines to Prevent Post-Processing Contamination from *Listeria monocytogenes* DFES 19: 551-562.
- USDA Compliance Guidelines
  - Antimicrobial ingredients or process

# **Yersinia Enterocolitica**

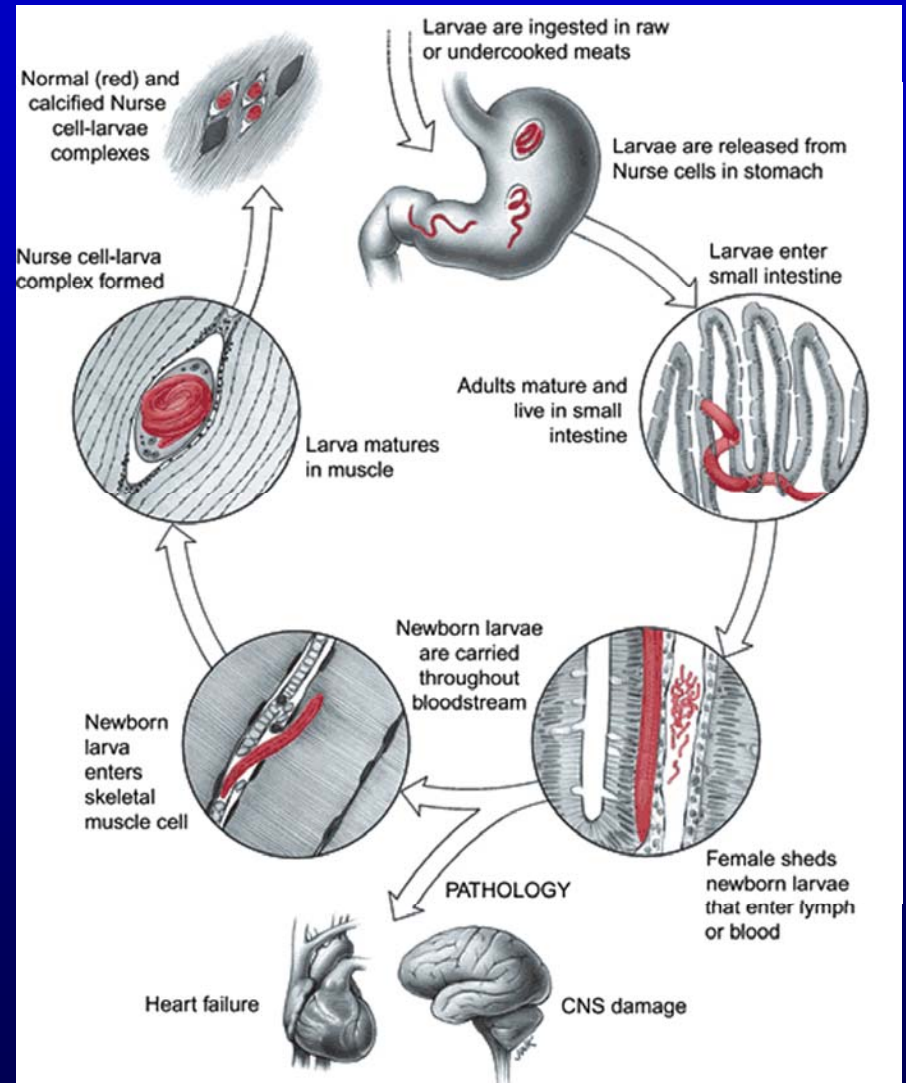
- **Found in a wide variety of animals, food and water.**
- **Only certain bioserotypes are pathogenic**
- **Pigs are principal reservoir of bioserotype pathogenic to humans**

# **Yersinia Enterocolitica - Control**

- **Cooking**
- **Separation of raw from cooked**
- **Reheating of cooked foods**
- **Capable of growth at low temperatures**
  - **Minimum growth temperature 30 F**
  - **Salt will inhibit growth at low temperatures**

# Trichinella spiralis

- Parasite
- Larvae will develop cyst primarily striated muscle
- Infection occurs from ingestion of raw or poorly cooked pork, bear, walrus, or horse meat, or meat from other mammals containing viable, infective larvae.



# Trichinella spiralis - Control

- **Cooking meat**
  - 144 F instant
  - 130 F for 30 minutes
- **Freezing meat**
  - -20 F for 12 days
  - 5 F for 30 days
- **Drying**
  - Dry Sausage, time depends on diameter of sausage
- **Irradiation**



# Norwalk-like virus

- **Common cause of foodborne illness**
  - Rarely diagnosed
- **Acute gastrointestinal illness**
  - More vomiting than diarrhea
  - Resolves within two days.
- **Norwalk-like viruses spread primarily from one infected person to another.**
  - Infected kitchen workers can contaminate a food item during processing or preparation.



# **Vibrio parahaemolyticus**

- **Gastroenteritis**
  - **Diarrhea**
  - **Abdominal cramps**
  - **Vomiting**
  - **Headache**
- **Consumption of raw, underprocessed, or re-contaminated seafood, primarily shrimp, crab or mulluscan shellfish**

# **Vibrio parahaemolyticus - Control**

- **Prevent multiplication of organism after harvest by chilling seafoods**
- **Cook to internal temperatures > 149 F**
- **Avoid cross-contamination of cooked or other RTE foods.**

# Other Foodborne Pathogens

- Some common diseases are occasionally foodborne,
- Usually transmitted by other routes.
  - *Shigella*
  - Hepatitis A
  - *Giardia lamblia*
  - *Cryptosporidia*
  - Even strep throats have been transmitted occasionally through food.

# **Shigella spp.**

- **Less than 10% of reported outbreaks of foodborne illness**
- **Rarely occurs in animals**
- **Disease of humans**
- **Found in water or food polluted with human feces**
- **Foods: salads, raw vegetables, milk and dairy products, and poultry.**
- **Unsanitary handling by food handlers.**

# Shigella spp.

- **Proper employee hygiene**
- **Potable water**
- **Avoiding cross contamination of RTE**

# Hepatitis A

- **Acute liver disease**
  - lasting from a few weeks to several months.
- **Transmission:**
  - Ingestion of fecal matter, even in microscopic amounts
  - Close person-to-person contact or
  - ingestion of contaminated food or drinks.
- **Vaccination:** Hepatitis A vaccination is recommended for all children starting at age 1 year, travelers to certain countries, and others at risk.

# Hepatitis A - Control

- Proper employee hygiene
- Harvest shellfish from approved growing water
- Heat treatment
- Vaccination

## ***Giardia lamblia***

- **One-celled, microscopic parasite**
- **Lives in the intestine and is passed in the stool.**
- **It can survive outside the body and in the environment for long periods of time.**
- **Common causes of waterborne disease**



## ***Giardia lamblia* - Control**

- Practice good hygiene.
- Use potable water.
- Avoid food that might be contaminated.
  - Wash and/or peel all raw vegetables and fruits before eating.
  - Use potable water to wash all food that is to be eaten raw.

# **Cryptosporidium parvum**

- **Severe watery diarrhea, cramps, low grade fever.**
- **Intestinal tract of cattle**
- **Contaminated water, food contaminated by food handlers**

# **Cryptosporidium parvum - control**

- **Heat sensitive**
  - **5 sec at 161 F**
- **Killed by freezing**
  - **-29 F for 24 Hr**
- **Use of potable water**
- **Proper employee hygiene**

# General Control Measures

- **Prevent Contamination**
- **Temperature Control**
  - **Less Than 40-45 F**
  - **Proper Cooking Temperatures**
- **Good Sanitation**
  - **Remove Residual Bacteria from Equipment**
- **Prevent Cross Contamination**
  - **Employee Hygiene**

# Exponential Growth of Bacteria

<b>Bacteria Held at Room Temperature</b>	
<b>Time</b>	<b>Bacteria/Gram</b>
<b>0</b>	<b>1000</b>
<b>30 min</b>	<b>2000</b>
<b>1 Hour</b>	<b>4000</b>
<b>1.5 Hour</b>	<b>8000</b>
<b>2 Hours</b>	<b>16000</b>
<b>5 Hours</b>	<b>1000000</b>

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**Holding at Refrigeration Temps will Slow Growth**

# Intrinsic Factors that Affect Microbial Growth

- Temperature
- Nutrients
- Water Activity
- Oxygen
- pH
- Naturally Occurring Antimicrobial Factors
- Biological Structure



# Identifying Hazards Within Your Plant

- **Know Your Product**
  - **Cooked vs Raw**
  - **Intrinsic Factors**
- **Know What Outbreaks have Been Associated with Your Product**
- **Be Aware of Potential Dangers**