USDA Food Safety and Inspection Service
US DEPARTMENT OF AGRICULTURE

Safety Through Inspection

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Food Microbiology

Food Inspector
Accelerated
Promotion Program

Objectives

- Identify the 4 different types of microbes.
- List important pathogens of concern.
- Describe sources of microbes in the establishment.
- Understands the importance of maintaining a sanitary environment.
- Understands the significance of specified risk materials .

What is Microbiology?

- **Microbiology** is a specialized area of biology that studies all living organisms that are too small to be seen by the naked eye.

- These very small living organisms are also known as “microorganisms” or “microbes.”

What is Food Microbiology?

- **Food microbiology** is specifically concerned with the desirable and undesirable effects microbes can have on the quality and safety of food product. For example:
  - **Pathogenic** microbes cause illness or disease.
  - **Spoilage** microbes cause food products to smell, taste or look weird, but may not have an effect on the safety of the product.
  - **Fermentation** microbes help produce a safe food product.

Why is Microbiology Important?

Understanding food microbes and the effects of microbial contamination in the slaughter and processing environment is very important to food safety.

Knowing how microbes can both **negatively and positively affect the product** is essential to producing a safe and wholesome finished product.

What are the Microbes of Concern?

- **Microbiologists study several different types of microbes, but the primary microorganisms of concern in food production are:**
  - Bacteria
  - Parasites
  - Fungi
  - Viruses

Bacteria

- Bacteria are small, single-celled organisms that occur in almost any natural environment.
- In small amounts, bacteria are too small to be seen individually without the aid of a microscope.
- Bacteria can multiply to form groups or colonies on a food source that may become visible with the naked eye.

Common Foodborne Bacterial Pathogens

These bacteria account for most illnesses associated with meat and poultry products

- *Salmonella* spp.
- *Clostridium perfringens*
- *Campylobacter* spp.
- *Bacillus cereus*
- *Listeria monocytogenes*
- *Staphylococcus aureus*
- *Clostridium botulinum*
- *E. coli* O157:H7
- Non-O157 Shiga toxin-producing *E. Coli* (STEC) O26, O45, O103, O111, O121, and O145

Parasites

- Parasites are living organisms that derive nourishment and protection from other living organisms called hosts.
- These organisms live and reproduce within the tissues and organs of infected human and animal hosts.
- Some types of parasites are visible only through the use of a microscope, while others can be seen with the naked eye.
- They may be transmitted from host to host through consumption of contaminated food and water.

Common Foodborne Parasitic Pathogens

- *Giardia duodenalis*, *Cryptosporidium parvum,* and *Cyclospora cayetanensis* - associated with water contaminated with feces
- *Trichinella spiralis* - associated with undercooked pork
- *Taenia saginata* - beef tapeworm
- *Taenia solium* - pork tapeworm
- *Toxoplasma gondii* - associated with undercooked meat (especially pork, lamb, and venison) or shellfish (e.g., oysters, clams, mussels)

Fungi

- **The fungi consist of two major groups of microbes:**
  - **Molds:**
    - Multi-cellular
    - Branching filaments
    - Colonies look “furry” or “downy”
    - Spores
  - **Yeasts:**
    - Egg shaped
    - Colonies are slimy & creamy white
    - Budding

Food Safety and Fungi

- Molds and yeasts do not appear to be responsible for any significant meat- or poultry-related foodborne illnesses.
- In some processes (such as prosciutto), these microbes are used to enhance the texture or flavor of the finished product.

The white mold on prosciutto is *Penicillium*, a naturally present fungus that delays drying and enhances the taste. They are generally non-toxic and help prevent other bacterial attacks on prosciutto.

Viruses

- Viruses are much smaller than bacteria and are too small to be seen with a standard light microscope.
- Viruses are not true living organisms.
  - They are composed of genetic material—either deoxyribonucleic acid (DNA) or ribonucleic acid (RNA)—enclosed in a protein coat.
- Infection may occur through direct contamination of food by a food service worker immediately before food is eaten.
- Once inside the host cell, the virus makes the host cell's produce more virus particles, which interferes with normal host cell function and may result in destruction of the host cell.

Common Foodborne Viral Pathogens

These viruses account for most viral illnesses associated with meat and poultry products

- Norovirus
- Hepatitis A
- Hepatitis E
- Rotavirus

How Do Microbes Get Into the Establishment?

- Live animals (hide, skin, feathers, gastrointestinal tract)
- Dust and microscopic water droplets
- Food ingredients, additives
- Contaminated water/ice
- Contaminated Equipment
- People
- Pests

Where in the Establishment are Microbes?

- Microbes can be found on almost any surface within the establishment
- This is why maintaining a sanitary working environment and practicing good employee hygiene is so important

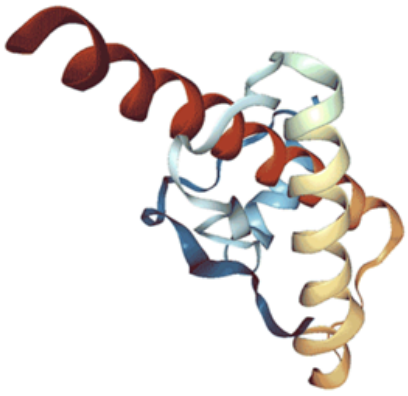
But Wait... There's More!!

- **Infectious agents**, also known as **Prions**, cause a group of diseases called transmissible spongiform encephalopathies (TSE's).

- TSEs are a family of rare, progressive neuro-degenerative disorders that affect both humans and animals.

Infectious Agents - Prions

- Prions are not true living organisms or “microbes” but are a misfolded protein that can transmit their misfolded shape onto normal variants of the same protein.
- The prion protein exists in every mammal in a healthy state.
- When misfolded, they become a proteinaceous infected particle or prion.



Prion Diseases of Food Safety Concern

The primary prion disease of food safety concern is:

- **Bovine Spongiform Encephalopathy (BSE)**, which affects cattle.
- BSE is also believed to infect humans, with the resulting disease called variant Creutzfeldt-Jacob disease (vCJD).

Where Do You Find Prions?

- **Specified risk materials (SRMs)** are tissues in cattle that are considered to be of high risk for prion contamination.
  - SRM's must be removed from all cattle of any age that are presented for slaughter.
  - Establishments must identify, remove, denature and dispose of SRM's.
  - SRM's are inedible and prohibited for use as human food.

- **All of the above safeguard against human exposure to BSE. This will be covered in more detail in a later section of this training.**

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This concludes the Microbiology training module.