



2

Forms of Contamination



Forms of Contamination

Objectives:

By the end of this chapter, you should be able to identify the following:

- Biological, chemical, and physical contaminants and ways to prevent food from being contaminated by them
- How to prevent the deliberate contamination of food
- The correct response to a foodborne-illness outbreak
- The most common food allergens and how to prevent exposure to food allergens



How Contamination Happens

Contamination:

- Presence of harmful substances in food

Contaminants can:

- Be biological, chemical, or physical
- Cause foodborne illness
- Result in physical injury



How Contamination Happens

Contaminants come from a variety of places:

- Animals we use for food
- Air, contaminated water, and dirt
- Chemicals we use in our operations
- Naturally occurring, such as fish bones
- People
 - Deliberately
 - Accidentally



How Contamination Happens

People can contaminate food when:

- They don't wash their hands after using the restroom.
- They are in contact with a person who is sick.
- They sneeze or vomit onto food or food contact surfaces.
- They touch dirty food-contact surfaces and equipment and then touch food.





How Contamination Happens

Simple mistakes can cause contamination:

- Allowing ready-to-eat food to touch a surface that contacted raw meat, seafood, or poultry
- Storing food or cleaning products incorrectly
- Failing to spot signs of pests





Biological Contamination

Microorganism:

- Small, living organism that can be seen only with a microscope

Pathogen:

- Harmful microorganism
- Make people sick when eaten or produce toxins that cause illness

Toxin:

- Poison

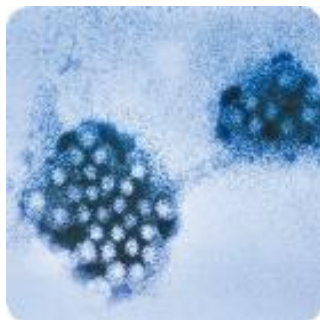


Biological Contamination

Four types of pathogens can contaminate food and cause foodborne illness:



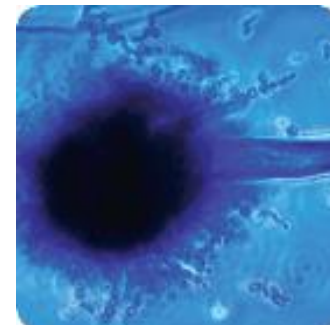
Bacteria



Viruses



Parasites



Fungi



Biological Contamination

The Big Six Pathogens:

- *Shigella* spp.
- *Salmonella* Typhi
- Nontyphoidal *Salmonella* (NTS)
- Shiga toxin-producing *Escherichia coli* (STEC), also known as *E. coli*
- Hepatitis A
- Norovirus



Symptoms of Foodborne Illness

Common symptoms of foodborne illness:

- Diarrhea
- Vomiting
- Fever
- Nausea
- Abdominal cramps
- Jaundice—a yellowing of the skin and eyes



Onset times:

- Depend on the type of foodborne illness
- Can range from 30 minutes to six weeks



Bacteria: Basic Characteristics

Location:

- Found almost everywhere

Detection:

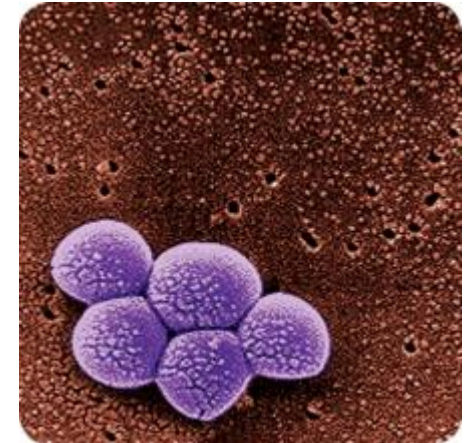
- Cannot be seen, smelled, or tasted

Growth:

- Grow rapidly if FAT TOM conditions are correct

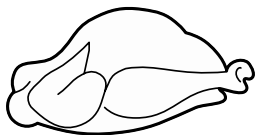
Prevention:

- Control time and temperature



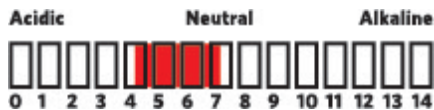


Bacteria: Conditions for Growth



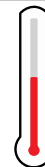
F

Food



A

Acidity



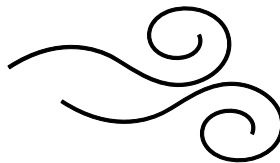
T

Temperature



T

Time



O

Oxygen



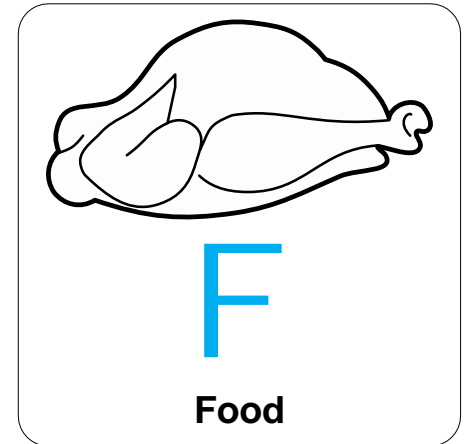
M

Moisture

Bacteria: Conditions for Growth

Food:

- Most bacteria need nutrients to survive.
- TCS food supports the growth of bacteria better than other types of food.

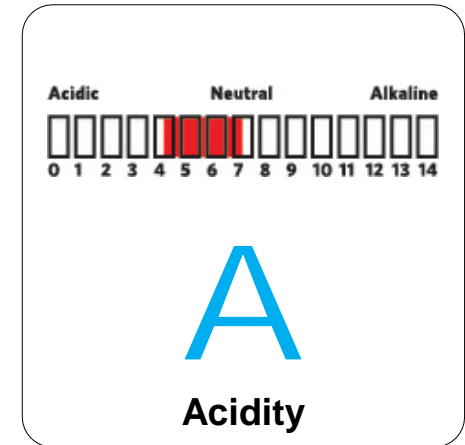




Bacteria: Conditions for Growth

Acidity:

- Bacteria grow best in food that contains little or no acid.

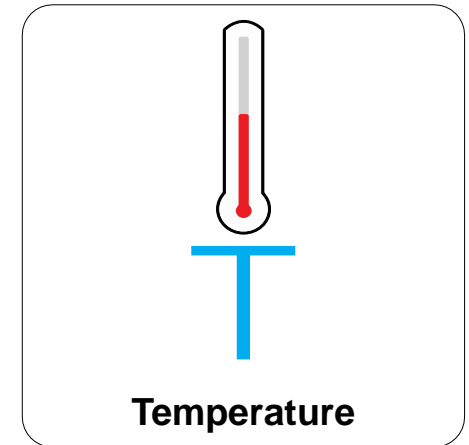




Bacteria: Conditions for Growth

Temperature:

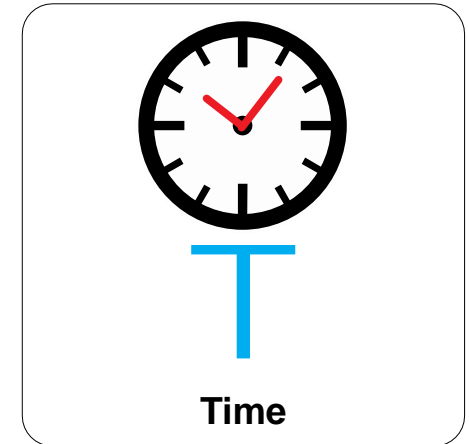
- Bacteria grow rapidly between 41°F and 135°F (5°C and 57°C).
 - This range is known as the temperature danger zone.
- Bacteria growth is limited when food is held above or below the temperature danger zone.



Bacteria: Conditions for Growth

Time:

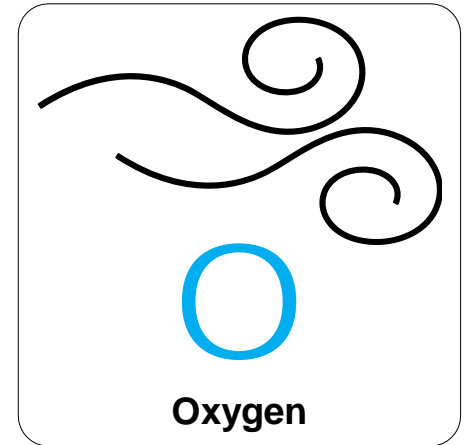
- Bacteria need time to grow.
- The more time bacteria spend in the temperature danger zone, the greater chance they have to grow to unsafe levels.



Bacteria: Conditions for Growth

Oxygen:

- Some bacteria need oxygen to grow.
- Other bacteria grow when oxygen isn't there.

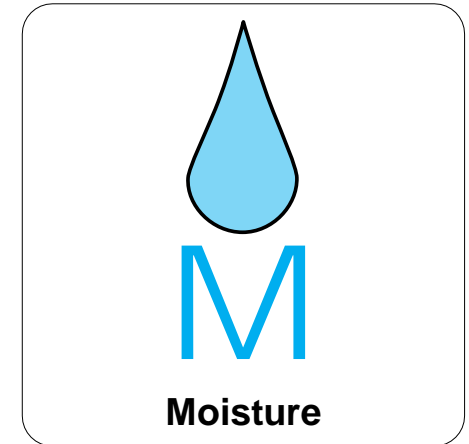




Bacteria: Conditions for Growth

Moisture:

- Bacteria grow well in food with high levels of moisture.
- a_w = water activity; the amount of moisture available in food for bacterial growth.
- a_w scale ranges from 0.0 to 1.0.
- Water has a water activity of 1.0.

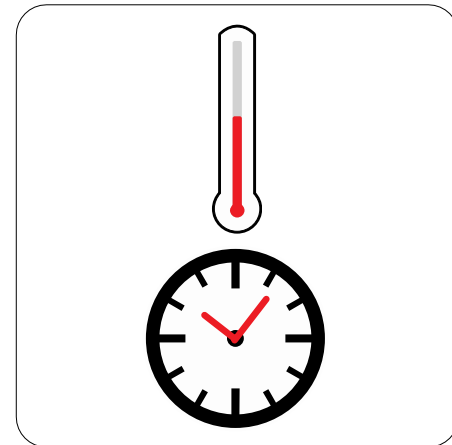




Controlling FAT TOM Conditions

The conditions you can control:

- Temperature
 - Keep TCS food out of the temperature danger zone.
- Time
 - Limit how long TCS food spends in the temperature danger zone.





Major Bacteria That Cause Foodborne Illness

The FDA has identified four types of bacteria that cause severe illness and are highly contagious:

- *Salmonella* Typhi
- Nontyphoidal *Salmonella*
- *Shigella* spp.
- Shiga toxin-producing *E. coli* (STEC)

Food handlers with illnesses from these bacteria must not work in a foodservice operation while they are sick.



Major Bacteria That Cause Foodborne Illness



Bacteria: *Salmonella* Typhi (SAL-me-NEL-uh TI-fee)
Source: People

Food Linked with the Bacteria

- Ready-to-eat food
- Beverages

Prevention Measures

- Exclude from the operation food handlers diagnosed with an illness caused by *Salmonella* Typhi.
- Wash hands.
- Cook food to minimum internal temperatures.



Major Bacteria That Cause Foodborne Illness



Bacteria: Nontyphoidal *Salmonella* (SAL-me-NEL-uh)

Source: Farm animals, people

Food Linked with the Bacteria

- Poultry and eggs
- Meat
- Milk and dairy products
- Produce

Prevention Measures

- Cook poultry and eggs to minimum internal temperatures.
- Prevent cross-contamination between poultry and ready-to-eat food.
- Exclude from the operation food handlers who are vomiting or have diarrhea and have been diagnosed with an illness caused by nontyphoidal *Salmonella*.



Major Bacteria That Cause Foodborne Illness



Bacteria: *Shigella* spp. (shi-GEL-uh)

Source: Human feces

Food Linked with the Bacteria

- Food easily contaminated by hands, such as salads containing TCS food (potato, tuna, shrimp, macaroni, chicken)
- Food that has made contact with contaminated water, such as produce

Prevention Measures

- Exclude from the operation food handlers who have diarrhea and have been diagnosed with an illness caused by *Shigella* spp.
- Wash hands.
- Control flies inside and outside the operation.



Major Bacteria That Cause Foodborne Illness



Bacteria: Shiga toxin-producing *Escherichia coli* (ess-chur-EE-kee-UH KO-LI) (STEC), also known as *E. coli*

Source: Intestines of cattle; infected people

Food Linked with the Bacteria

- Ground beef (raw and undercooked)
- Contaminated produce

Prevention Measures

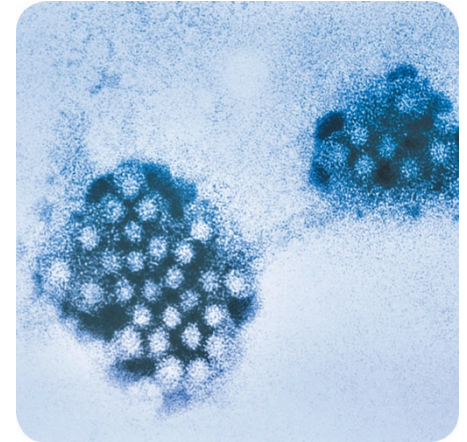
- Exclude from the operation food handlers who have diarrhea and have been diagnosed with a disease from the bacteria.
- Cook food, especially ground beef, to minimum internal temperatures.
- Purchase produce from approved, reputable suppliers.
- Prevent cross-contamination between raw meat and ready-to-eat food.



Viruses: Basic Characteristics

Location:

- Carried by human beings and animals
 - Require a living host to grow
 - Do not grow in food
 - Can be transferred through food and remain infectious in food



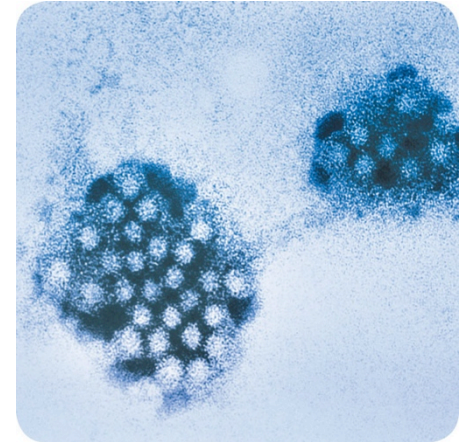
Sources:

- Food, water, or any contaminated surface
- Typically occur through fecal-oral routes

Viruses: Basic Characteristics

Destruction:

- Not destroyed by normal cooking temperatures
- Good personal hygiene must be practiced when handling food and food-contact surfaces
- Quick removal and cleanup of vomit is important





Major Viruses That Cause Foodborne Illnesses

The FDA has identified two viruses that are highly contagious and can cause severe illness:

- Hepatitis A
- Norovirus

Food handlers diagnosed with an illness from Hepatitis A or Norovirus must not work in an operation while they are sick.



Major Viruses That Cause Foodborne Illness



Virus: Hepatitis A (HEP-a-TI-tiss)

Source: Human feces

Food Linked with the Virus

- Ready-to-eat food
- Shellfish from contaminated water

Prevention Measures

- Exclude from the operation staff who have been diagnosed with Hepatitis A.
- Exclude from the operation staff who have had jaundice for seven days or less.
- Wash hands.
- Avoid bare-hand contact with ready-to-eat food.
- Purchase shellfish from approved, reputable suppliers.



Major Viruses That Cause Foodborne Illness



Virus: Norovirus (NOR-o-VI-rus)

Source: Human feces

Food Linked with the Virus

- Ready-to-eat food
- Shellfish from contaminated water

Prevention Measures

- Exclude from the operation staff who are vomiting or have diarrhea and have been diagnosed with Norovirus.
- Wash hands.
- Avoid bare-hand contact with ready-to-eat food.
- Purchase shellfish from approved, reputable suppliers.

Parasites: Basic characteristics

Location:

- Require a host to live and reproduce

Source:

- Seafood, wild game, and food processed with contaminated water, such as produce



Parasites: Basic characteristics

Prevention:

- Purchase food from approved, reputable suppliers.
- Cook food to required minimum internal temperatures.
- Fish that will be served raw or undercooked must be correctly frozen by the manufacturer.





Fungi: Basic Characteristics

Yeasts, molds, and mushrooms:

- Some molds and mushrooms produce toxins.
- Throw out moldy food, unless mold is a natural part of the food.
- Purchase mushrooms from approved, reputable suppliers.





Biological Toxins

Origin:

- Naturally occur in certain plants, mushrooms, and seafood

Seafood toxins:

- Produced by pathogens found on certain fish:
 - Tuna, bonito, mahimahi.
 - Histamine is produced when fish is time-temperature abused.
- Occur in certain fish that eat smaller fish that have consumed a toxin:
 - Barracuda, snapper, grouper, amberjack.
 - Ciguatera toxin is an example.



Biological Toxins

Illness:

- Symptoms and onset times vary with illness.
- People will experience illness within minutes.



Biological Toxins

General symptoms:

- Diarrhea or vomiting
- Neurological symptoms
 - Tingling in extremities
 - Reversal of hot and cold sensations
- Flushing of the face
- Difficulty breathing
- Burning in the mouth
- Heart palpitations
- Hives





Biological Toxins

Prevention:

- Purchase plants, mushrooms, and seafood from approved, reputable suppliers.
- Control time and temperature when handling raw fish.





Chemical Contaminants

Sources:

- Cleaners, sanitizers, polishes, machine lubricants, and pesticides
- Deodorizers, first-aid products, and health and beauty products
 - Hand lotions, hairsprays, etc.
- Certain types of kitchenware and equipment
 - Items made from pewter, copper, zinc, and some types of painted pottery





Chemical Contaminants

Symptoms:

- Vary depending on chemical consumed.
- Most illnesses occur within minutes.
- Vomiting and diarrhea are typical.



Chemical Contaminants

Prevention:

- Use chemicals approved for use in foodservice operations.
- Purchase chemicals from approved, reputable suppliers.
- Store chemicals away from prep areas, food-storage areas, and service areas.
 - Separate chemicals from food and food-contact surfaces by spacing and partitioning.
- **NEVER** store chemicals above food or food-contact surfaces.



Chemical Contaminants

Prevention:

- Use chemicals for their intended use and follow manufacturer's directions.
- Only handle food with equipment and utensils approved for foodservice use.
- Make sure the manufacturer's labels on original chemical containers are readable.
- Follow the manufacturer's directions and local regulatory requirements when throwing out chemicals.





Physical Contaminants

Sources:

- Common objects that get into food
 - Metal shavings from cans
 - Wood
 - Fingernails
 - Staples
 - Bandages
 - Glass
 - Jewelry
 - Dirt
- Naturally occurring objects such as fruit pits and bones



Physical Contaminants

Symptoms:

- Mild to fatal injuries
- Cuts, dental damage, and choking
- Bleeding and pain

Prevention:

- Purchase food from approved, reputable suppliers.
- Closely inspect food received.
- Take steps to prevent physical contamination, including practicing good personal hygiene.



Deliberate Contamination of Food

Groups who may attempt to contaminate food:

- Terrorists or activists
- Disgruntled current or former staff
- Vendors
- Competitors

FDA defense tool:

- A.L.E.R.T.



Deliberate Contamination of Food

- Assure** Make sure products received are from safe sources.
- Look** Monitor the security of products in the facility.
- Employees** Know who is in your facility.
- Reports** Keep information related to food defense accessible.
- Threat** Develop a plan for responding to suspicious activity or a threat to the operation.



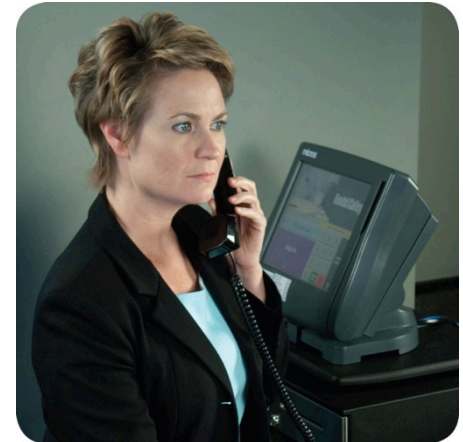
Responding to a Foodborne-Illness Outbreak

- Gather information.
- Notify authorities.
- Segregate product.
- Document information.
- Identify staff.
- Cooperate with authorities.
- Review procedures.



Responding to a Foodborne-Illness Outbreak

- Gather information:
 - Ask the person for general contact information.
 - Ask the person to identify the food eaten.
 - Ask for a description of symptoms.
 - Ask when the person first got sick.
- Notify authorities:
 - Contact the local regulatory authority if an outbreak is suspected.





Responding to a Foodborne-Illness Outbreak

- Segregate product:
 - Set the suspected product aside if any remains.
 - Include a label with “Do Not Use” and “Do Not Discard” on it.
- Document the information:
 - Log information about suspected product.
 - Include a product description, product date, lot number, sell-by date, and pack size.





Responding to a Foodborne-Illness Outbreak

- Identify staff:
 - Keep a list of food handlers scheduled at the time of the incident.
 - Interview staff immediately.
- Cooperate with authorities:
 - Provide appropriate documentation.
- Review procedures:
 - Determine if standards are being met.
 - Identify if standards are not working.



Food Allergens

Food allergen:

- A protein in a food or ingredient some people are sensitive to.
- These proteins occur naturally.
- When an enough of an allergen is eaten, an allergic reaction can occur.



Food Allergens

Allergy symptoms:

- Nausea
- Wheezing or shortness of breath
- Hives or itchy rashes
- Swelling in various parts of the body, including the face, eyes, hands, or feet
- Vomiting and/or diarrhea
- Abdominal pain
- Itchy throat





Food Allergens

Allergic reactions:

- Symptoms can become serious quickly.
- A severe reaction, called anaphylaxis, can lead to death.





Food Allergens

Common Food Allergens—The Big Eight



Milk



Soy



Eggs



Wheat



Fish, such as bass, flounder, and cod



Crustacean shellfish, such as crab, lobster, and shrimp



Peanuts



Tree nuts, such as walnuts and pecans



Preventing Allergic Reactions

Food labels:

- Check food labels for allergens.

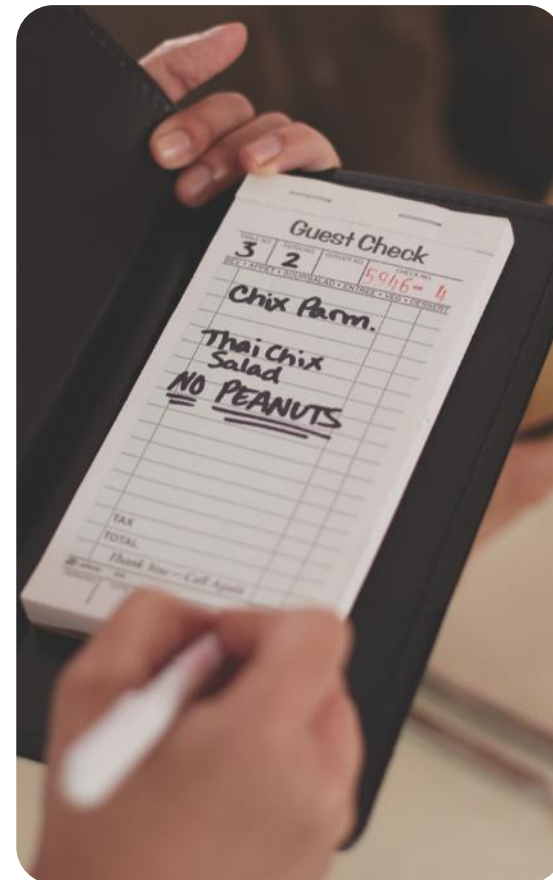




Preventing Allergic Reactions

Service staff:

- Describe menu items and preparation to guests.
- Identify any allergens in the item.
- Suggest menu items without the allergen.
- Clearly identify the guest's order for kitchen and service staff.
- Deliver food separately to prevent cross-contact.





Preventing Allergic Reactions

Kitchen staff:

- Avoid cross-contact
 - Do **NOT** cook different types of food in the same fryer oil.
 - Do **NOT** put food on surfaces that have touched allergens.





Preventing Allergic Reactions

How to avoid cross-contact:

- Check recipes and ingredient labels.
- Wash, rinse, and sanitize cookware, utensils, and equipment.
- Make sure the allergen doesn't touch anything for customers with food allergies.
- Wash your hands and change gloves before prepping food.
- Use separate fryers and cooking oils for guests with food allergies.
- Label food packaged on-site for retail use.

