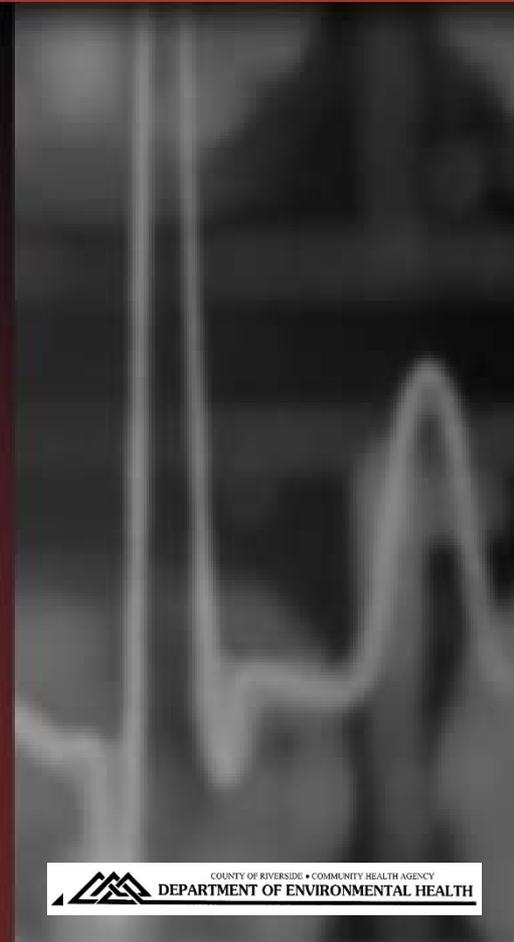


# FOODBORNE ILLNESS

*A microbiology review*



# FOODBORNE ILLNESS

## *Challenges to control*

- Poor consumer handling of food
- Emerging pathogens have increased resistance
- Food supply is *global*
- More food is eaten outside of home
- New modes of transmission

# FOODBORNE ILLNESS

## *Types of Contamination*

### – *Physical*

- Metal shavings, broken glass, wood splinters, bandages

### – *Chemical*

- Cleansers, metal leaching (copper, lead, cadmium), pesticides

### – *Biological*

- Bacteria, fungi, viruses, parasites

# FOODBORNE ILLNESS

- **Food infection**
  - Bacteria are consumed
  - Body reacts by raising temperature- *fever*
  - Longer incubation
- **Food intoxication**
  - Toxin contaminated food is eaten
  - Shorter incubation

# FOODBORNE ILLNESS

## *Limiting factors of microbial growth*

- Time
- Temperature
- Moisture ( $A_w > 0.85$ )
- pH
- Nutrients
- Competition

# FOODBORNE ILLNESS

## *PATHWAYS OF CONTAMINATION*

**FOOD HANDLERS**

**WATER**

**PACKAGING**

**INGREDIENTS**



**FOOD CONTACT  
SURFACES**

**VERMIN**

**SOIL**

**AIR**

# FOODBORNE ILLNESS

- Centers for Disease Control
- Top 4 emerging pathogens
  - *E.coli* 0157:H7
  - *Salmonella enteritidis*
  - *Listeria monocytogenes*
  - *Campylobacter jejuni*

# FOODBORNE ILLNESS

- **CDC estimates:**
  - 6.5-33 million FBI cases each year
    - Highly under-reported
  - E.coli causes about 21,000 cases each year
  - Salmonella causes 2-4 million illnesses/yr.
  - Campylobacter cause 1-6 million cases/yr.

# ***BACTERIA***

## **Escherichia coli**



- **Infection**
- **Incubation:** 3-4 days
- **Symptoms:** diarrhea, vomiting, mild fever
- **Foods:** undercooked ground beef, unpasteurized cider
- **Source:** Human and bovine intestinal tract

# *BACTERIA*



## Campylobacter jejuni

- **Infection**
- **Incubation:** 2-5 days
- **Symptoms:** diarrhea, vomiting, headache, fever, muscle pain
- **Foods:** poultry, dairy products, water
- **Sources:** intestinal tracts of wild/ domestic animals

# *BACTERIA*

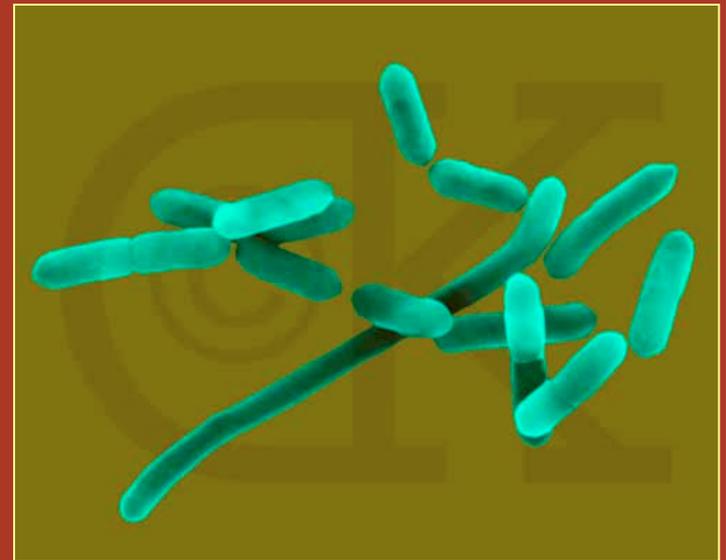
## Salmonella enteritidis

- **Infection**
- **Incubation:** 12- 36 hours
- **Symptoms:** abdominal cramps, headache, fever, nausea, diarrhea
- **Foods:** poultry, meat, eggs and egg products, sliced melons
- **Sources:** water, soil, insects, animals, and humans



# *BACTERIA*

## Listeria monocytogenes



- **Infection**
- **Incubation:** 3 to 70 days
- **Symptoms:** flu-like, meningitis, encephalitis, spontaneous abortion
  - Fetuses, infants, and pregnant women
- **Foods:** unpasteurized milk, ice cream, ready-to-eat, lunchmeats
- **Sources:** soil, water, damp environments, domestic/ wild animals (esp. fowl)

# *BACTERIA*

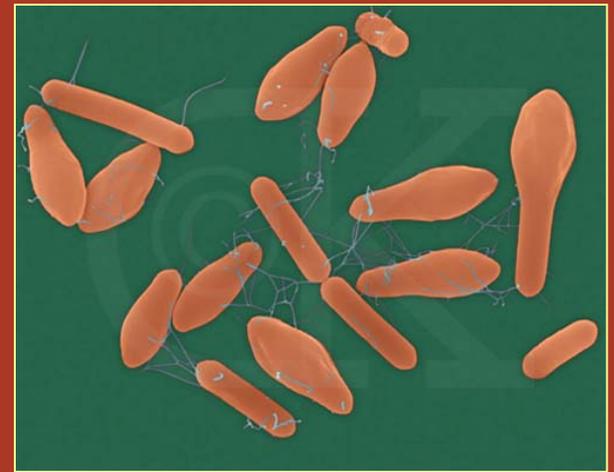
## Clostridium perfringens



- **Infection**
  - Forms spores in adverse conditions
- **Incubation:** 10- 12 hours
- **Symptoms:** abdominal pain, nausea, diarrhea
  - Fever, headache, vomiting usually absent
- **Foods:** Stews, gravies, beans
- **Sources:** soil, animal and human intestinal tracts

# *BACTERIA*

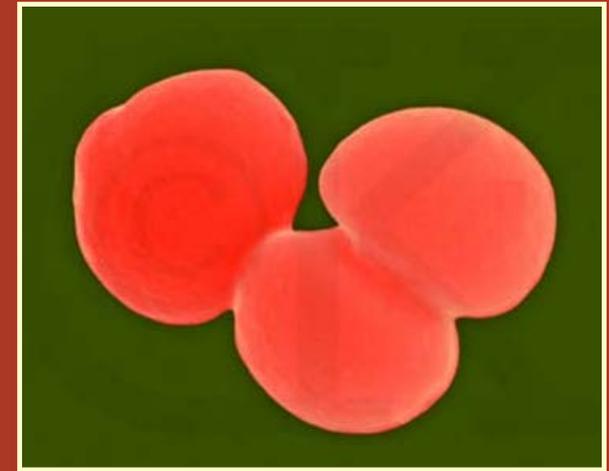
## Clostridium botulinum



- **Intoxication**
- **Incubation:** 4 hours to 8 days
- **Symptoms:** vomiting; constipation; difficulty with vision, swallowing, speaking; paralysis, death
- **Foods:** baked potatoes, sous vide, garlic/ oil mixtures, low-acid canned foods
- **Sources:** present on almost all foods, soil, water

# *BACTERIA*

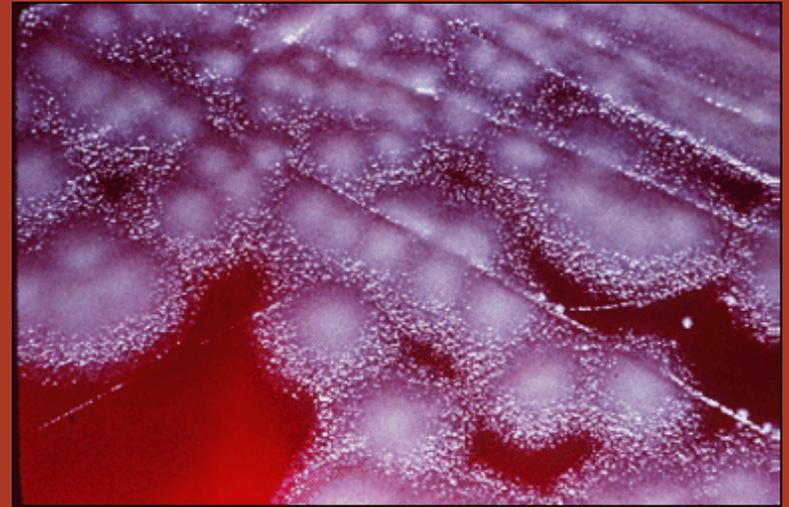
## Staphylococcus aureus



- **Intoxication**
- **Incubation:** 1 to 7 hours
- **Symptoms:** nausea, retching, abdominal cramps, diarrhea
- **Foods:** ready-to-eat, reheated foods, dairy products, protein foods
- **Source:** skin, hair, nose, throat, infected sores, animals

# *BACTERIA*

## Bacillus cereus



- **Intoxication**
- **Incubation:** 30 min. to 6 hours (emetic) and 6 to 15 hours (diarrheal)
- **Symptoms:** nausea, vomiting, watery diarrhea
- **Foods:** rice products, starchy foods, casseroles, puddings, soups
- **Source:** soil and dust, cereal crops

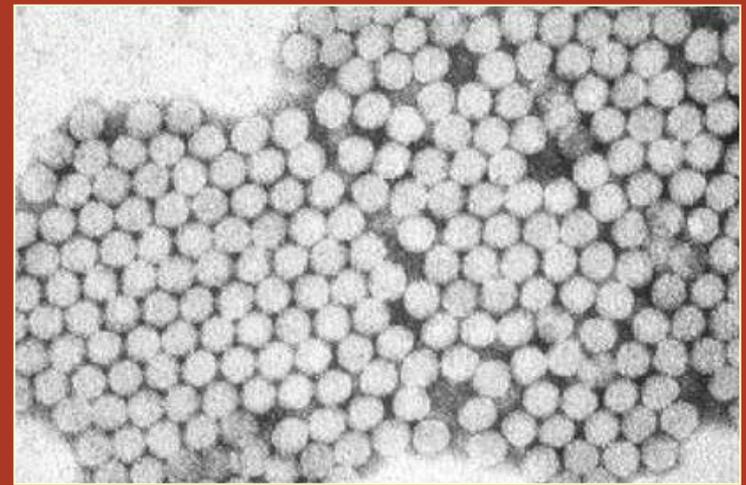
# *VIRUSES*

## **Basic characteristics**

- Need living cell to propagate
- Do not reproduce in food
- Do not need PHF
- Smallest microbial contaminant
- Spread usually result of poor hygiene

# *VIRUSES*

## Hepatitis A

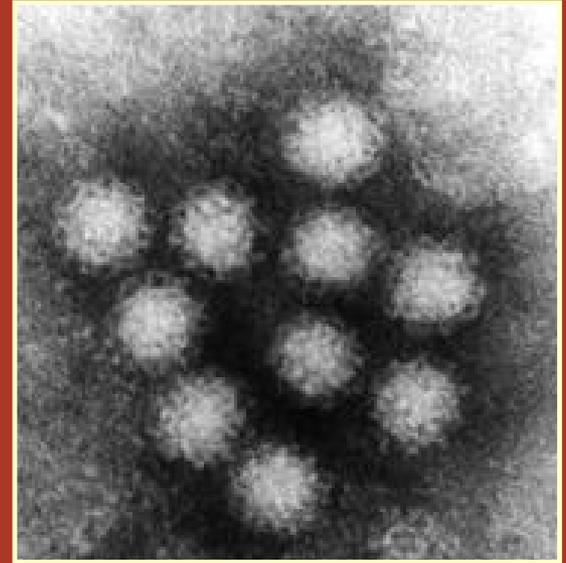


- **Infection**
- **Incubation:** 10-50 days
- **Symptoms:** sudden fever, vomiting, jaundice
- **Foods:** water (ice), shellfish, ready-to-eat, fruit juices, vegetables
- **Source:** human intestinal/ urinary tracts

# *VIRUSES*

## **Norwalk virus**

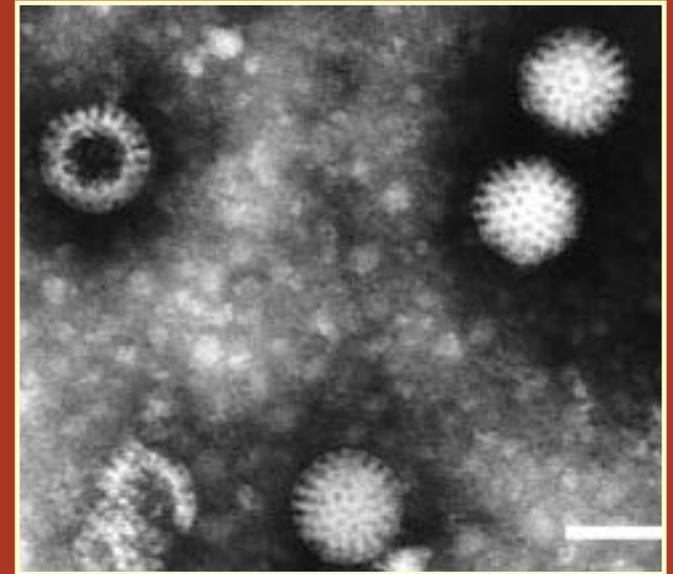
- **Infection**
- **Incubation:** 10-50 hours
- **Symptoms:** nausea, diarrhea, headache, mild fever
- **Foods:** water, shellfish, raw vegetables and fruits
- **Source:** human intestinal tract, water



# *VIRUSES*

## Rotavirus

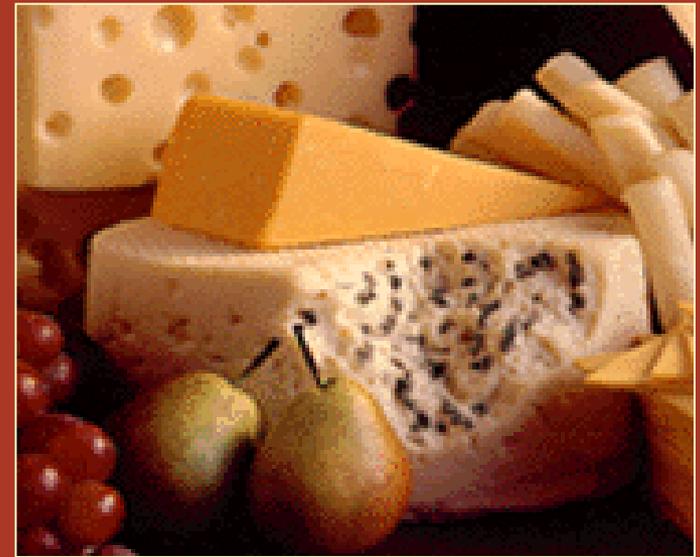
- **Infection**
- **Incubation:** 1-3 days
- **Symptoms:** vomiting, diarrhea, mild fever
- **Foods:** ready-to-eat, water and ice
- **Sources:** human intestinal tract, water



# FUNGI

## Molds

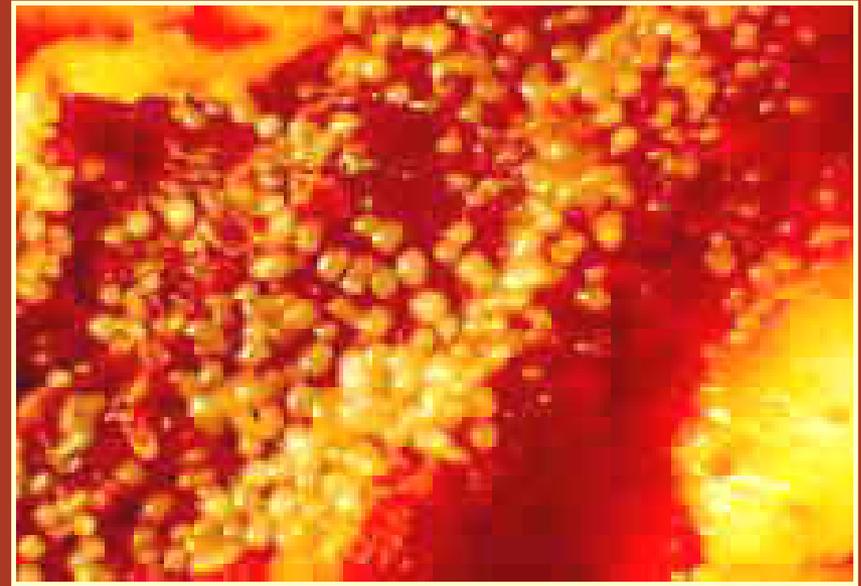
- Usually *spoil* foods, sometimes illness
- Sweet, acidic, low  $A_w$  foods
- Some produce aflatoxins (peanuts)
- Gorgonzola, bleu, Brie, Camembert cheeses, mushrooms



# *FUNGI*

## Yeasts

- Spoil food
- Produce CO<sub>2</sub> and alcohol
- Prefer sweet, acidic, A<sub>w</sub> foods
  - Jams, jellies, syrup, honey, fruit juice



Yeast colony growing on pizza

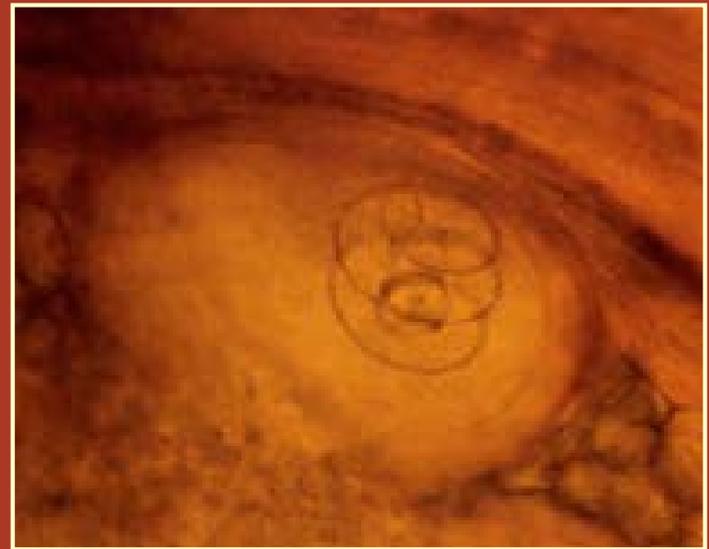
# *PARASITES*

## ***Basic characteristics***

- Living organisms
- Require a host
- Usually killed by freezing (and cooking)
- Normal fauna in many animals
  - Hogs, cats, rodents, fish, etc.

# PARASITES

## Trichinella spiralis



- **Roundworm**
- **Incubation:** 2-28 days
- **Symptoms:** flu-like, swelling around eyes, extreme sweating, hemorrhaging
- **Foods:** undercooked pork, game
- **Source:** domestic pigs, bear, walrus

# PARASITES

## Anisakis simplex

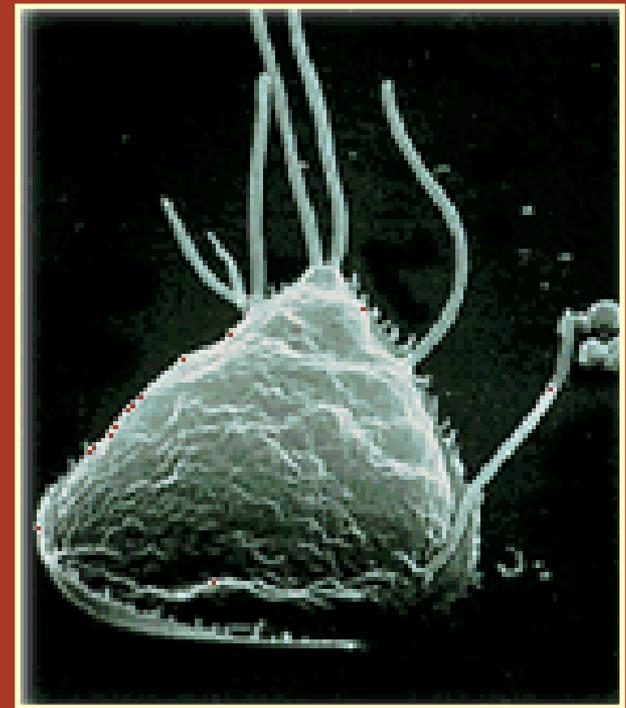


- **Roundworm**
- **Incubation:** hours to 2 weeks
- **Symptoms:** tickle in throat, coughing up worms
- **Foods:** undercooked, improperly frozen seafood
- **Source:** marine fish- bottom feeders

# PARASITES

## Giardia lamblia

- **Protozoan**
- **Incubation:** 3-25 days
- **Symptoms:** fatigue, nausea, gas, weight loss, abdominal cramps
- **Foods:** water, ice, raw vegetables
- **Source:** beavers, bears, dogs, cats, humans



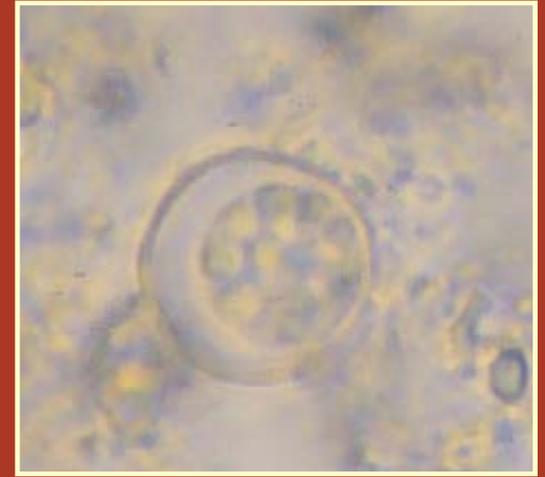
# *PARASITES*

## **Cryptosporidium parvum**



- **Protozoan**
- **Incubation: 1-12 days**
- **Symptoms:** severe diarrhea, may have no symptoms
- **Foods:** water, raw foods, unpasteurized cider, ready-to-eat
- **Source:** humans, cattle, barn-wash

# PARASITES



## Cyclospora cayetanensis

- **Protozoan**
- **Incubation:** days to weeks
- **Symptoms:** watery diarrhea, weight loss, bloating, cramps, vomiting, muscle aches
- **Foods:** water, marine fish, raw milk, raw produce
- **Source:** humans, water