FOODBORNE ILLNESS

A microbiology review

COUNTY OF RIVERSIDE • COMMUNITY HEALTH AGENCY
DEPARTMENT OF ENVIRONMENTAL HEALTH

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

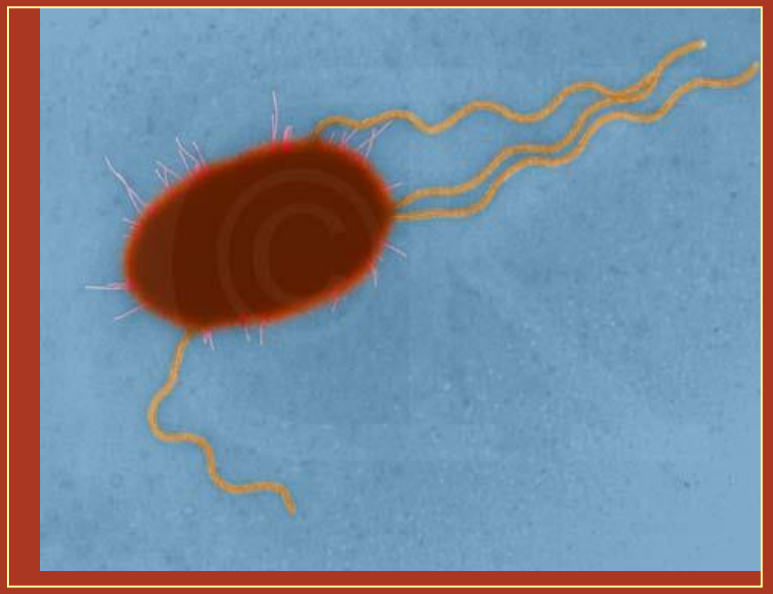
FOODBORNE ILLNESS

- **Centers for Disease Control**
- **Top 4 emerging pathogens**
  - *E.coli 0157:H7*
  - *Salmonella enteriditis*
  - *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

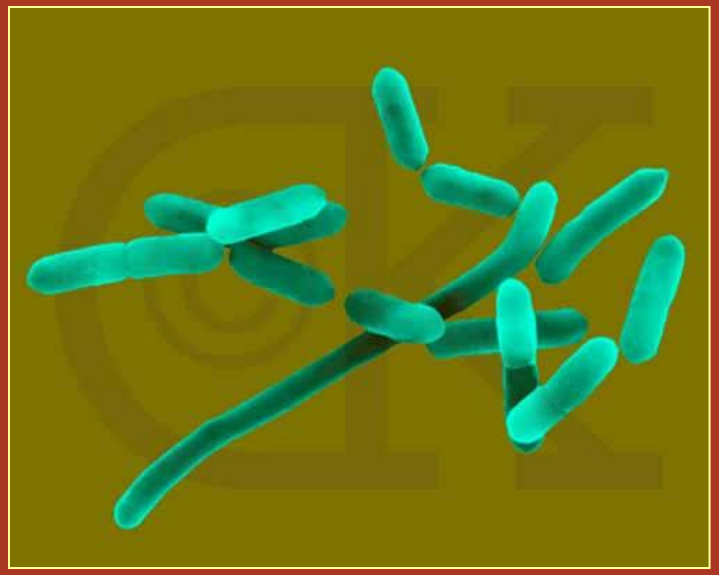
- **Infection**
- **Incubation:** 2-5 days
- **Symptoms:** diarrhea, vomiting, headache, fever, muscle pain
- **Foods:** poultry, dairy products, water
- **Sources:** intestinal tracts of wild/ domestic animals

BACTERIA

Salmonella enteriditis

- **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

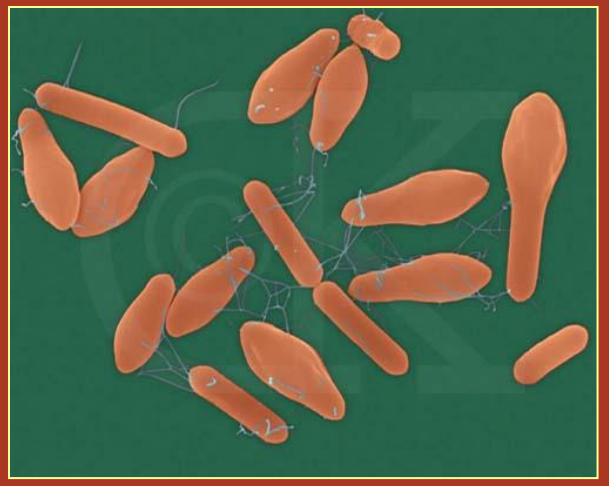
- **Infection**
- **Incubation**: 3 to 70 days
- **Symptoms**: flu-like, meningitis, encephalitis, spontaneous abortion
  - Fetuses, infants, and pregnant women
- **Foods**: unpasteurized milk, ice cream, ready-to-eat, lunchmeats
- **Sources**: soil, water, damp environments, domestic/ wild animals (esp.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

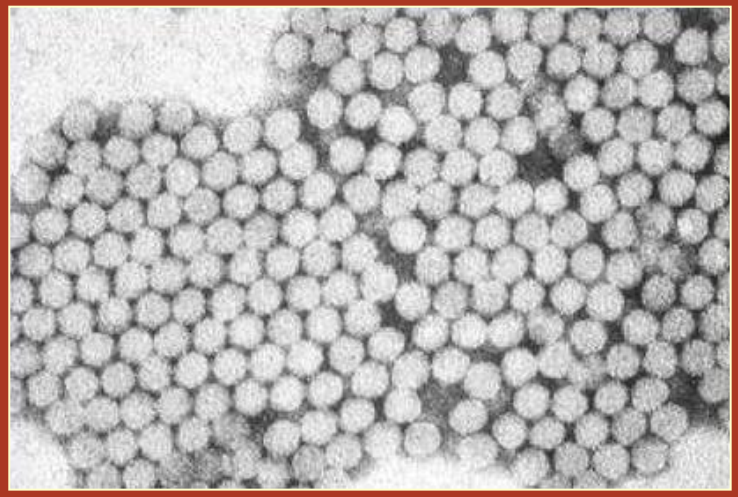
Bacillus cereus

- **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

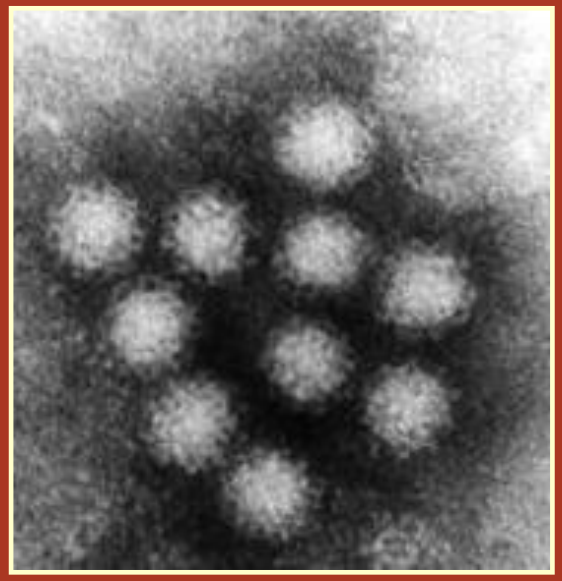
- Need living cell to propagate
- Do not reproduce in food
- Do not need PHF
- Smallest microbial contaminant
- Spread usually result of poor hygiene



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

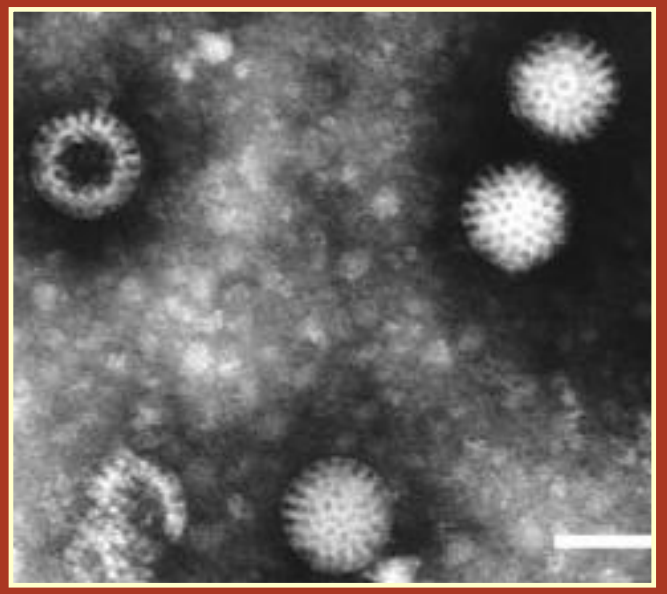
VIRUSES



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



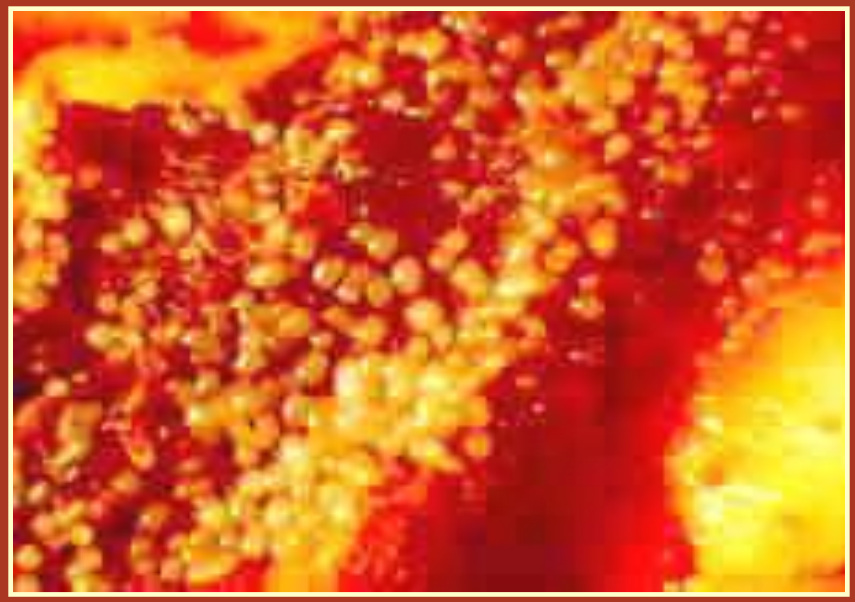
Rotavirus

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

Molds

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

Yeasts



Yeast colony growing on pizza

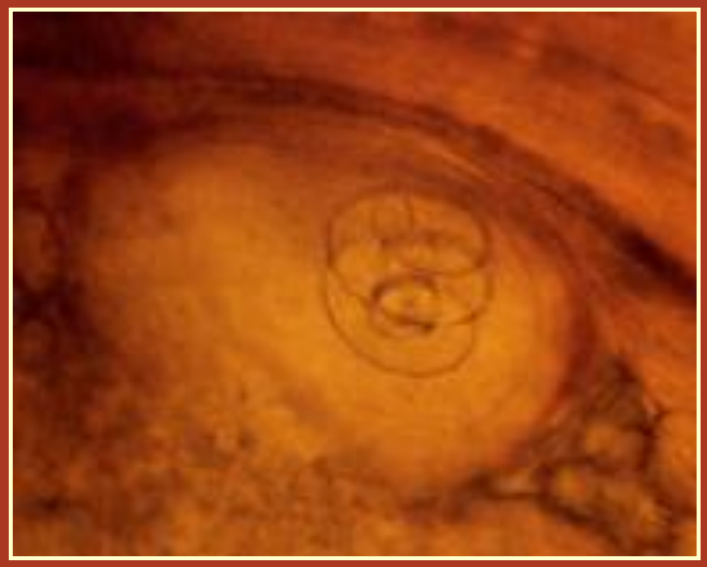
- Spoil food
- Produce CO_2 and alcohol
- Prefer sweet, acidic, A_w foods
  - Jams, jellies, syrup, honey, fruit juice

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

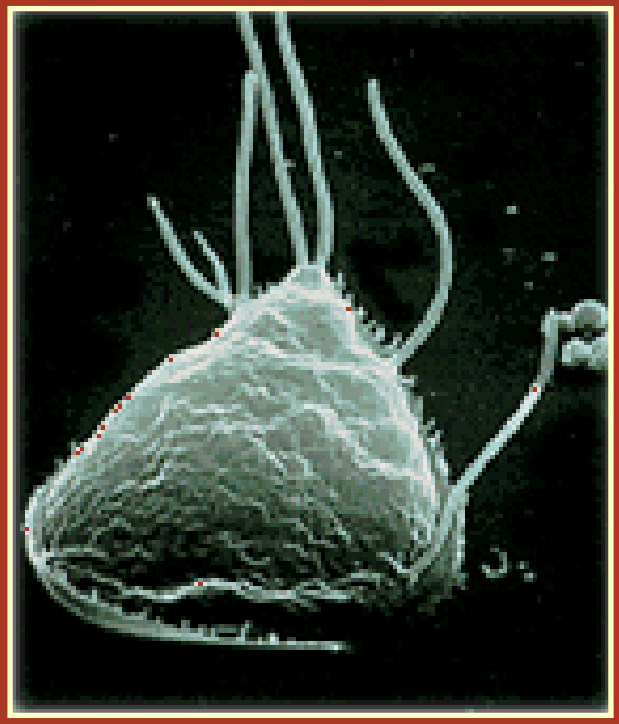
- **Roundworm**
- **Incubation**: 2-28 days
- **Symptoms**: flu-like, swelling around eyes, extreme sweating, hemorrhaging
- **Foods**: undercooked pork, game
- **Source**: domestic pigs, bear, walrus

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

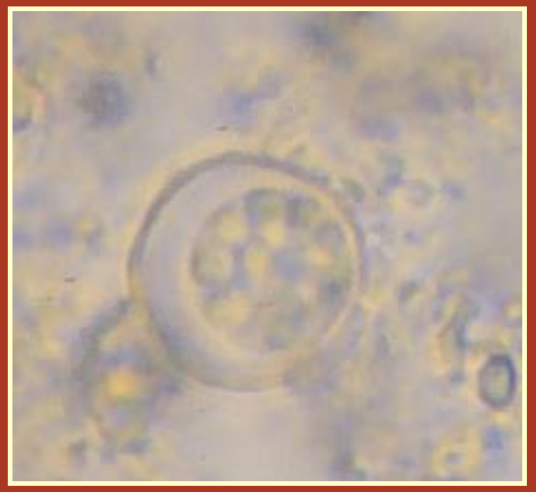
- **Protozoan**
- **Incubation:** 3-25 days
- **Symptoms**: fatigue, nausea, gas, weight loss, abdominal cramps
- **Foods**: water, ice, raw vegetables
- **Source**: beavers, bears, dogs, cats, humans

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