

---

## Gastrointestinal diseases

**Gastrointestinal diseases** refer to diseases involving the gastrointestinal tract, namely the esophagus, stomach, small intestine, large intestine and rectum, and the accessory organs of digestion, the liver, gallbladder, and pancreas.

**Gastropathy** is a general term used for **stomach diseases**. Examples including the name include portal hypertensive gastropathy. However, there are many other stomach diseases that don't include the word "gastropathy" such as gastric or peptic ulcer disease, gastroparesis, and dyspepsia.

Many **stomach diseases** are associated with infection. Historically, it was widely believed that the highly acidic environment of the stomach would keep the stomach immune from infection. However, a large number of studies have indicated that most cases of stomach ulcers, gastritis, and stomach cancer are caused by *Helicobacter pylori* infection. One of the ways it is able to survive in the stomach involves its urease enzymes which metabolize urea (which is normally secreted into the stomach) to ammonia and carbon dioxide which neutralises gastric acid and thus prevents its digestion. In recent years, it has been discovered that other *Helicobacter* bacteria are also capable of colonising the stomach and have been associated with gastritis.

Gastritis and stomach cancer can be caused by *Helicobacter pylori* infection.

There are many types of chronic disorders which affect the stomach. However, since the symptoms are localized to this organ, the typical symptoms of stomach problems include nausea, vomiting, bloating, cramps, diarrhea and pain.

### Gastritis

In the stomach there is a slight balance between acid and the wall lining which is protected by mucus. When this mucus lining is disrupted for whatever reason, signs and symptoms of acidity result. This may result in upper abdominal pain, indigestion, loss of appetite, nausea, vomiting and heartburn. When the condition is allowed to progress, the pain may become continuous; blood may start to leak and be seen in the stools. If the bleeding is rapid and of adequate volume it may even result in vomiting of bright red blood (hematemesis). When the acidity is uncontrolled, it can even cause severe blood loss (anemia) or lead to perforation (hole) in the stomach which is a surgical emergency. In many individuals, the progressive bleeding from an ulcer mixes with the feces and presents as black

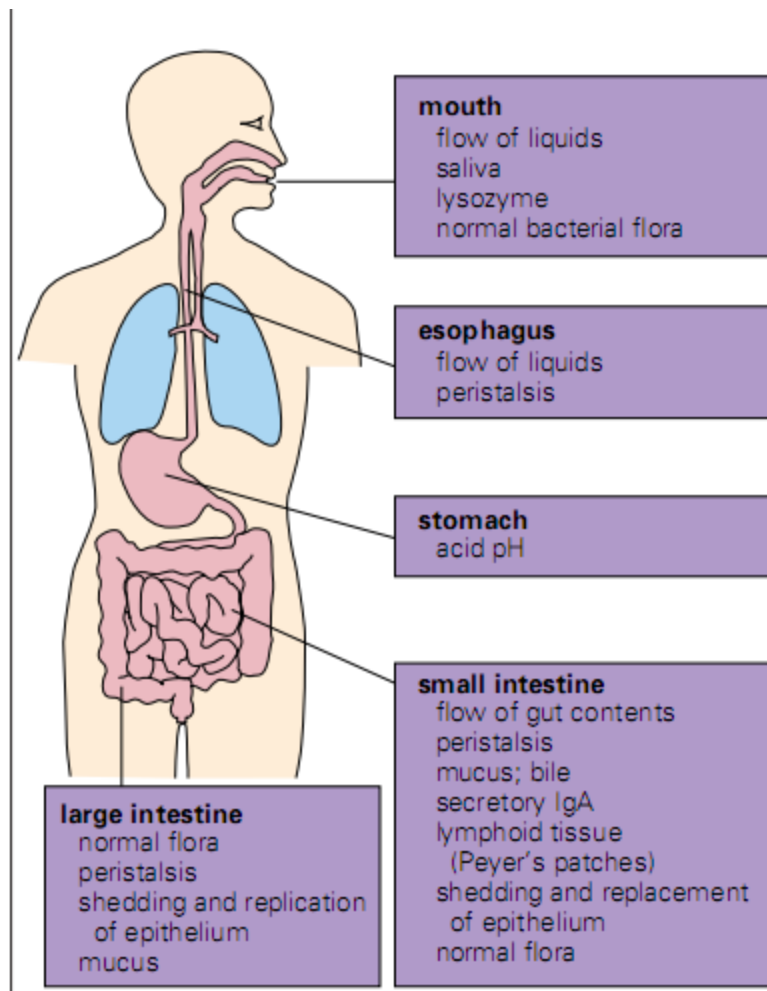
stools. Presence of blood in stools is often the first sign that there is a problem in the stomach.

### **Diarrhea**

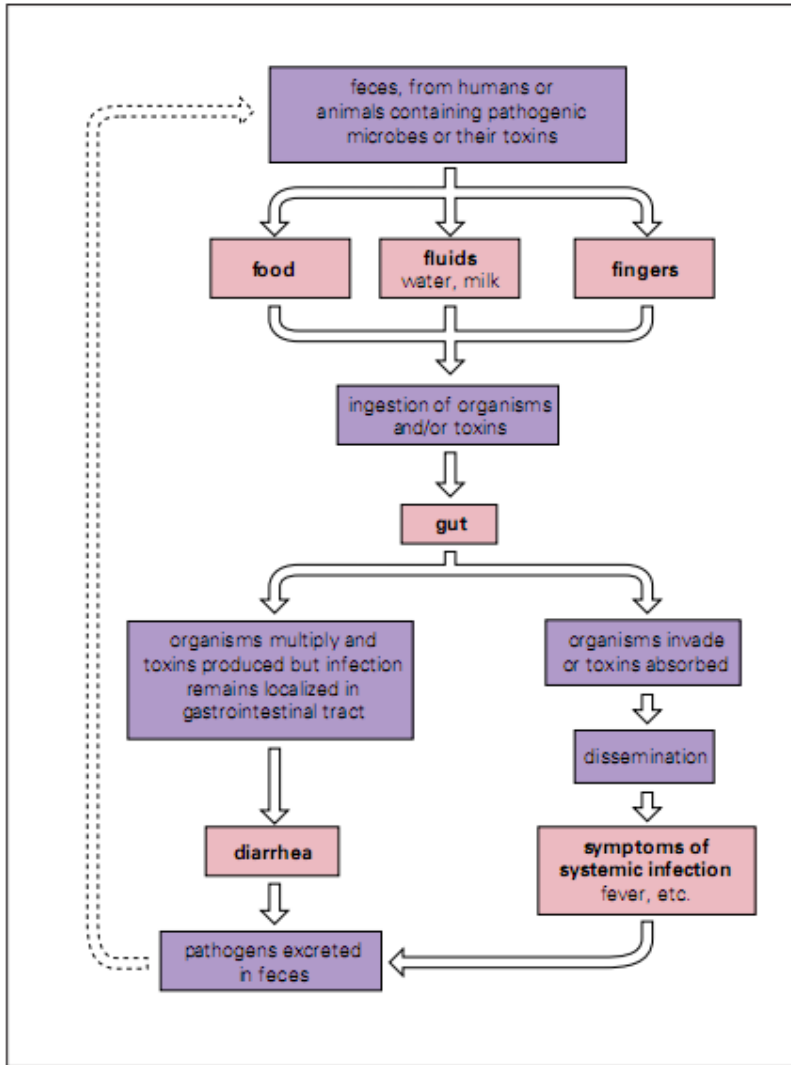
During digestion, food is stored in the liquid present in the stomach. The food that is not digested travels to the large intestine and colon in liquid form. These organs begin to absorb the water turning the food into a more solid form. Different viruses or bacteria can increase the amount of liquid that is secreted and moves too quickly through the digestive tract for the water to be absorbed. Diarrhea comes in two types: acute diarrhea and chronic diarrhea. The acute diagnosis can last for a few days up to a week of time. Chronic diarrhea lasts for several days or longer periods of time lasting a few weeks. The difference in diagnosis will help determine the cause of the illness.

### **Crohn's disease**

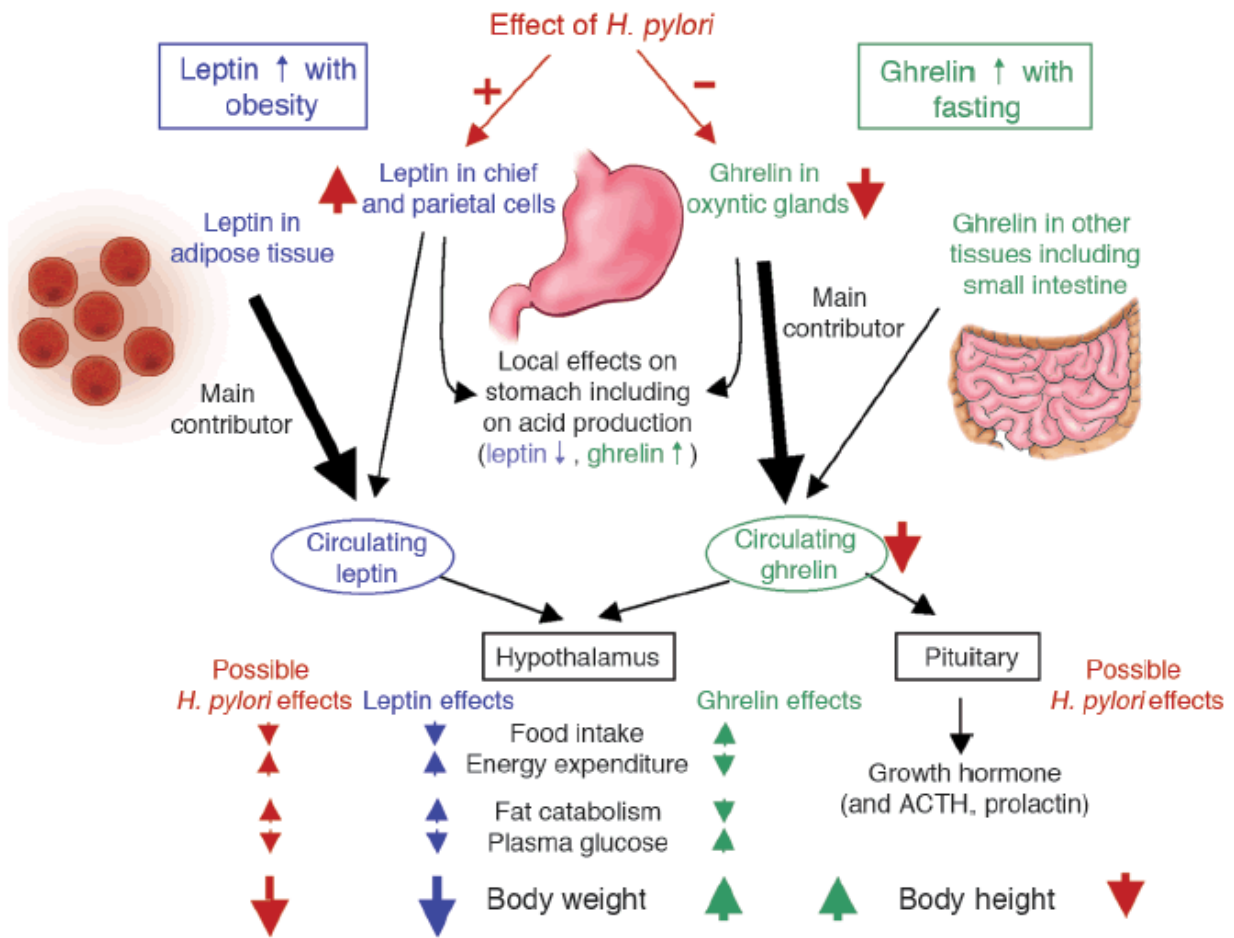
Crohn's disease is an inflammatory bowel disease that can affect any part of the digestive tract, even the stomach, although it's a rare presentation. Its main feature is inflammatory ulcers that can affect the total thickness of the stomach wall and can bleed but rarely perforate. Symptoms include abdominal pain, loss of appetite, and weight loss. Diarrhea is also a symptom that can develop, so checking stools for the appearance of blood is important. It is possible for symptoms of Crohn's Disease to remain with a person for weeks or go away on their own. Reporting the symptoms to a doctor is recommended to prevent further complications.



**Fig. 20.3** Every day we swallow large numbers of microorganisms. Because of the body's defense mechanisms, however, they rarely succeed in surviving the passage to the intestine in sufficient numbers to cause infection.



**Fig. 20.4** Infections of the gastrointestinal tract can be grouped into those that remain localized in the gut and those that invade beyond the gut to cause infection in other sites in the body. In order to spread to a new host, pathogens are excreted in large numbers in the feces and must survive in the environment for long enough to infect another person directly or indirectly through contaminated food or fluids.

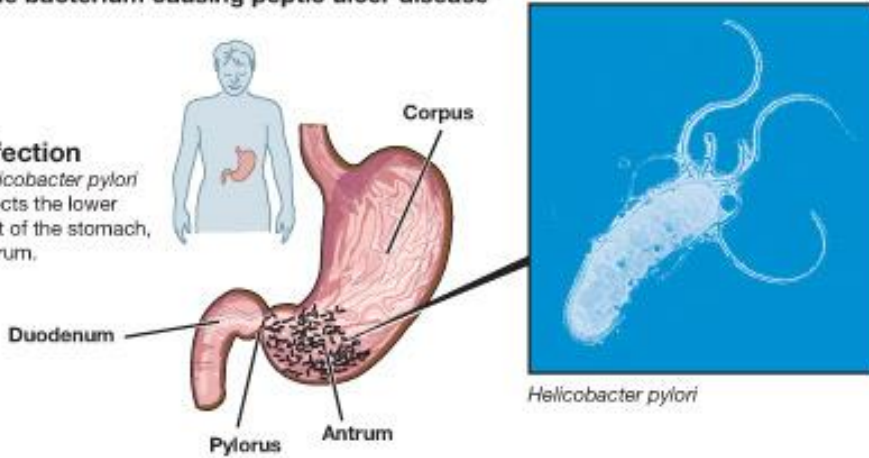


# Helicobacter pylori

– the bacterium causing peptic ulcer disease

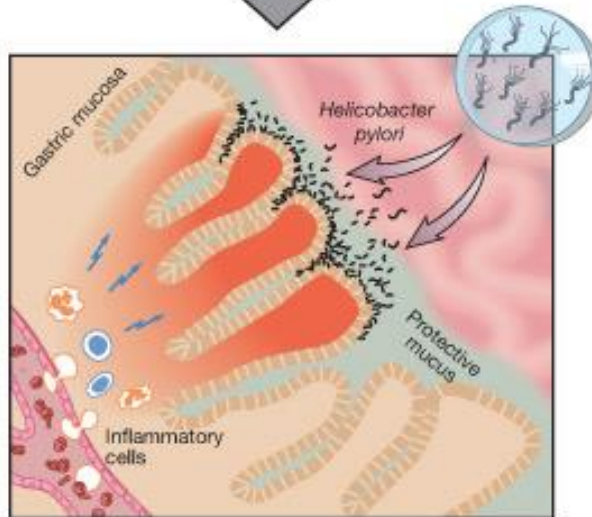
## Infection

*Helicobacter pylori* infects the lower part of the stomach, antrum.



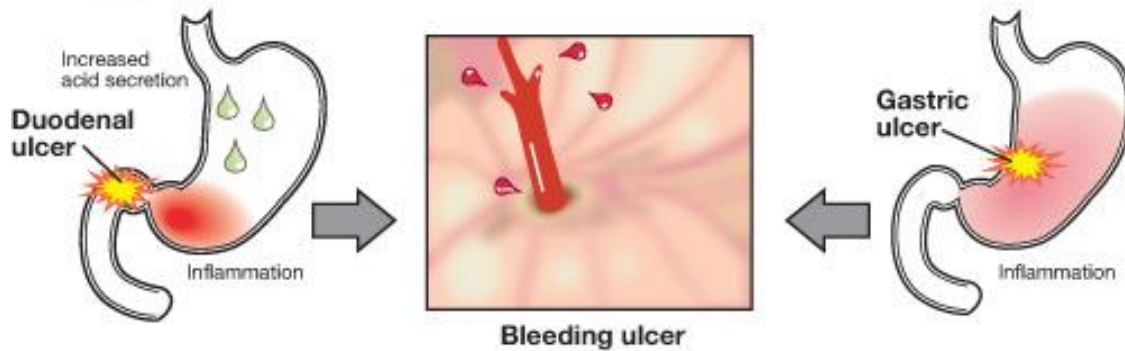
## Inflammation

*Helicobacter pylori* causes inflammation of the gastric mucosa (gastritis). This is often asymptomatic.



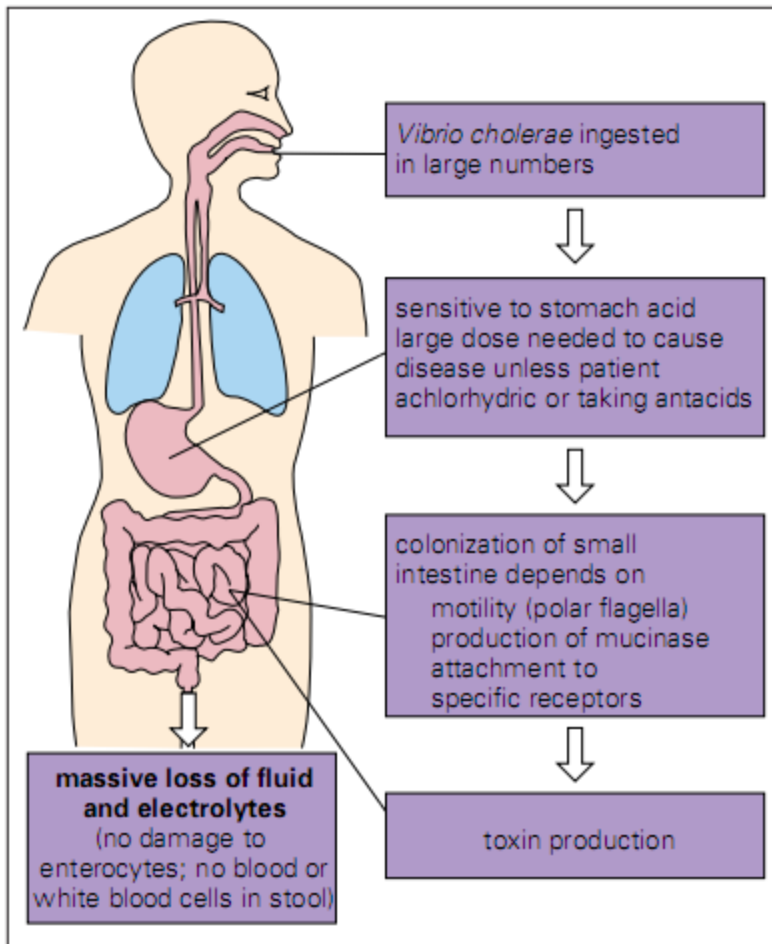
## Ulcer

Gastric inflammation may lead to duodenal or gastric ulcer. Severe complications include bleeding ulcer and perforated ulcer.

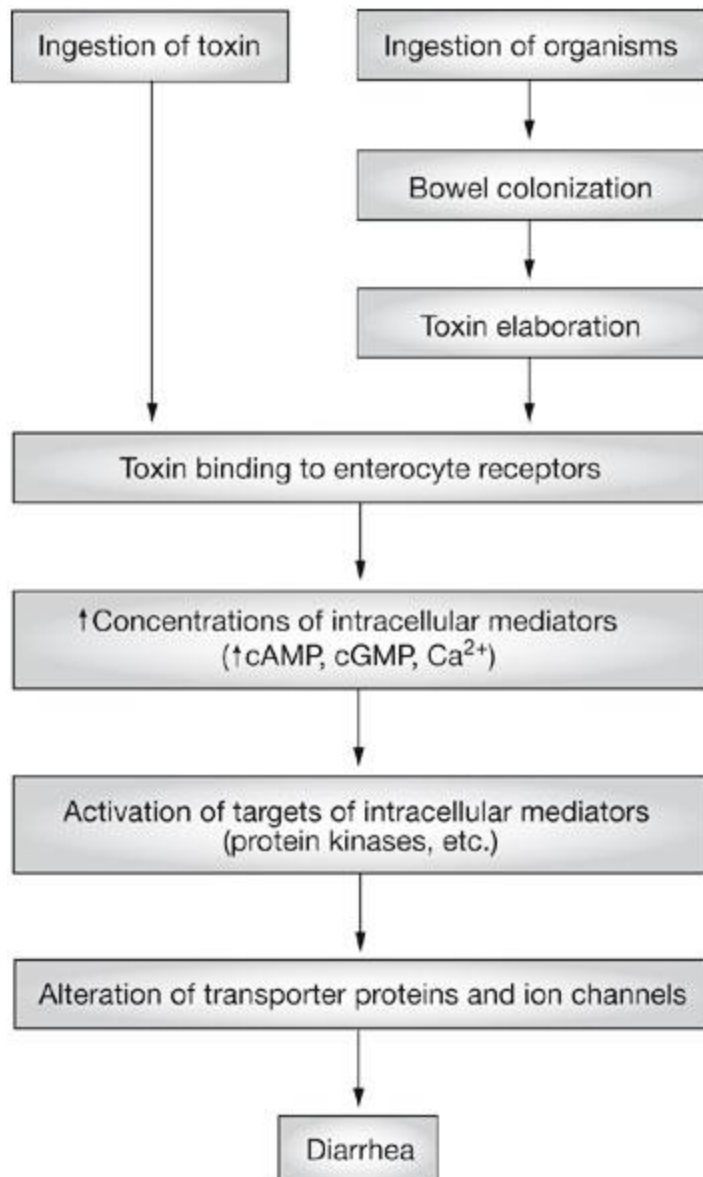


© The Nobel Committee for Physiology or Medicine

**Cholera** is an infection of the small intestine by some strains of the bacterium *Vibrio cholerae*. Symptoms may range from none, to mild, to severe. The classic symptom is large amounts of watery diarrhea that lasts a few days. Vomiting and muscle cramps may also occur. Diarrhea can be so severe that it leads within hours to severe dehydration and electrolyte imbalance. This may result in sunken eyes, cold skin, decreased skin elasticity, and wrinkling of the hands and feet. The dehydration may result in the skin turning bluish. Symptoms start two hours to five days after exposure. **Cholera** is usually transmit by water contaminated with feces from a person with the infection.



**Fig. 20.17** The production of an enterotoxin is central to the pathogenesis of cholera, but the organisms must possess other virulence factors to allow them to reach the small intestine and to adhere to the mucosal cells.



**Schema illustrating mechanisms of pathogenesis for enterotoxin-mediated bacterial diarrheas.**

Bacterial enterotoxin (either ingested in food or produced by ingested pathogens) binds to receptors on the surface of enterocytes. This receptor binding results in an increase in concentrations of either cellular cAMP, cGMP, or Ca<sup>2+</sup>, which causes the activation of various protein kinases. This kinase activation leads to altered electrolyte transport, resulting in the onset of diarrhea.



*Escherichia coli* (*E.coli*) is a major cause of gastrointestinal infections

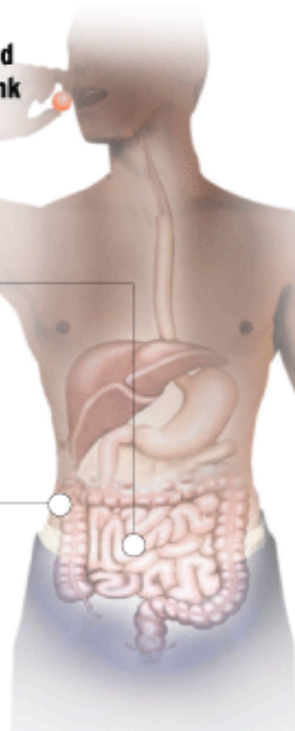
pathogenic group	epidemiology	laboratory diagnosis*
enterotoxigenic <i>E. coli</i> (ETEC)	<p>most important bacterial cause of diarrhea in children in developing countries</p> <p>most common cause of travellers' diarrhea</p> <p>water contaminated by human or animal sewage may be important in spread</p>	<p>isolate organisms from feces</p> <p>test for production of LT (but not ST) by immunologic techniques e.g. ELISA</p> <p><i>test for production of STs by detecting accumulation of fluid in ligated ileal loops of experimental animals (not in routine use)</i></p> <p><i>gene probes specific for LT and ST genes available for detection of ETEC in feces and in food and water samples</i></p>
enteroinvasive <i>E. coli</i> (EIEC)	<p>important cause of diarrhea in areas of poor hygiene</p> <p>infections usually foodborne; no evidence of animal or environmental reservoir</p>	<p>isolate organisms from feces;</p> <p><i>test for enteroinvasive potential in tissue culture cells</i></p>
verotoxin-producing <i>E. coli</i> (EHEC)	<p>serotype O157 most important EHEC in human infections</p> <p>outbreaks and sporadic cases occur worldwide</p> <p>food and unpasteurized milk important in spread</p>	<p>isolate organisms from feces</p> <p>proportion of EHEC in fecal sample may be very low (often &lt;1% of <i>E. coli</i> colonies) usually sorbitol non-fermenters</p> <p><i>EHEC-producing colonies can be identified with DNA probes in colony hybridization tests</i></p>
enteropathogenic <i>E. coli</i> (EPEC)	<p>EPEC strains belong to particular O serotypes</p> <p>cause sporadic cases and outbreaks of infection in babies and young children</p> <p>importance in adults not known</p>	<p>isolate organisms from feces</p> <p><b>determine serotype of several colonies with polyvalent antisera for known EPEC types</b></p> <p><i>adhesion to tissue culture cells can be demonstrated by a fluorescence actin staining test</i></p>

**Fig. 20.6** *Escherichia coli* is a major cause of gastrointestinal infection, particularly in developing countries and in travellers. There is a range of pathogenic mechanisms within the species,

resulting in more or less invasive disease. \*Specialized tests are given in italics. (ELISA, enzyme-linked immunosorbent assay; LT, heat-labile enterotoxin; ST, heat-stable enterotoxin.)

# Salmonella infection

Almost any kind of food or beverage can carry the bacteria that causes salmonella infection, although meat and eggs the most are common sources.



**Contaminated food or drink**

**How salmonella progresses**

Bacteria travel to small intestine, adhere to lining; begin life cycle

In severe cases, bacteria break through intestinal wall to bloodstream; can be deadly if not properly treated

**Symptoms**

**Within 12-72 hours**  
Nausea, vomiting, fever, diarrhea abdominal cramps

**4-7 days** Illness ranges from mild to severe; most people recover without treatment

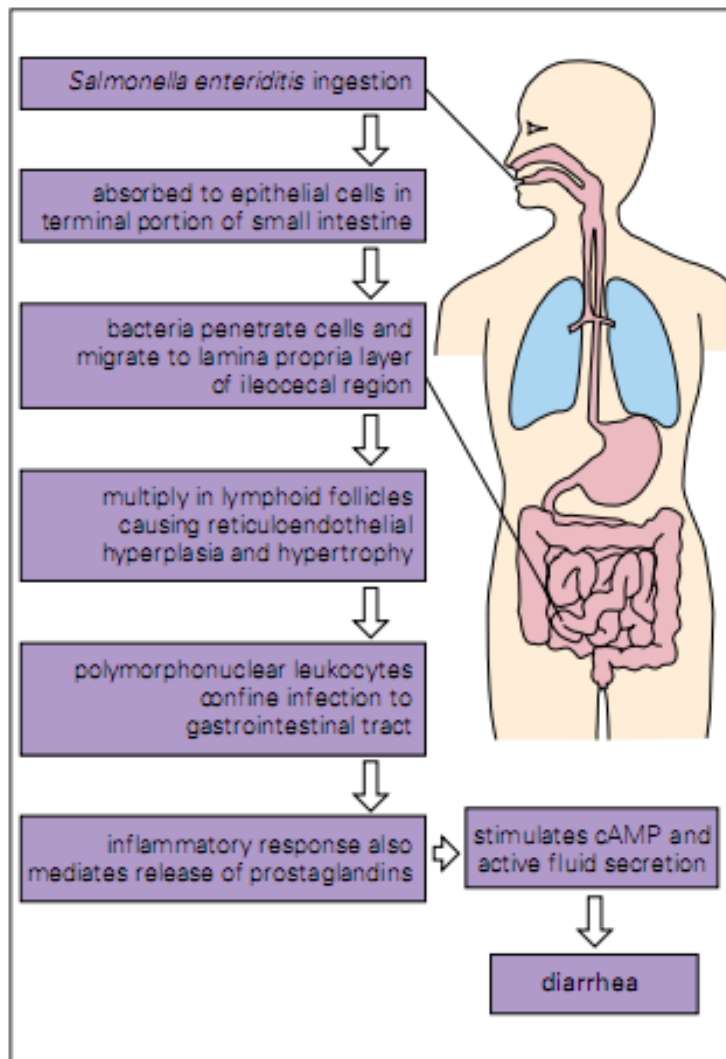
**Severe cases** More likely with infants, elderly, people with impaired immune systems

**Treatment**

Oral or injected antibiotics, usually for 2 weeks

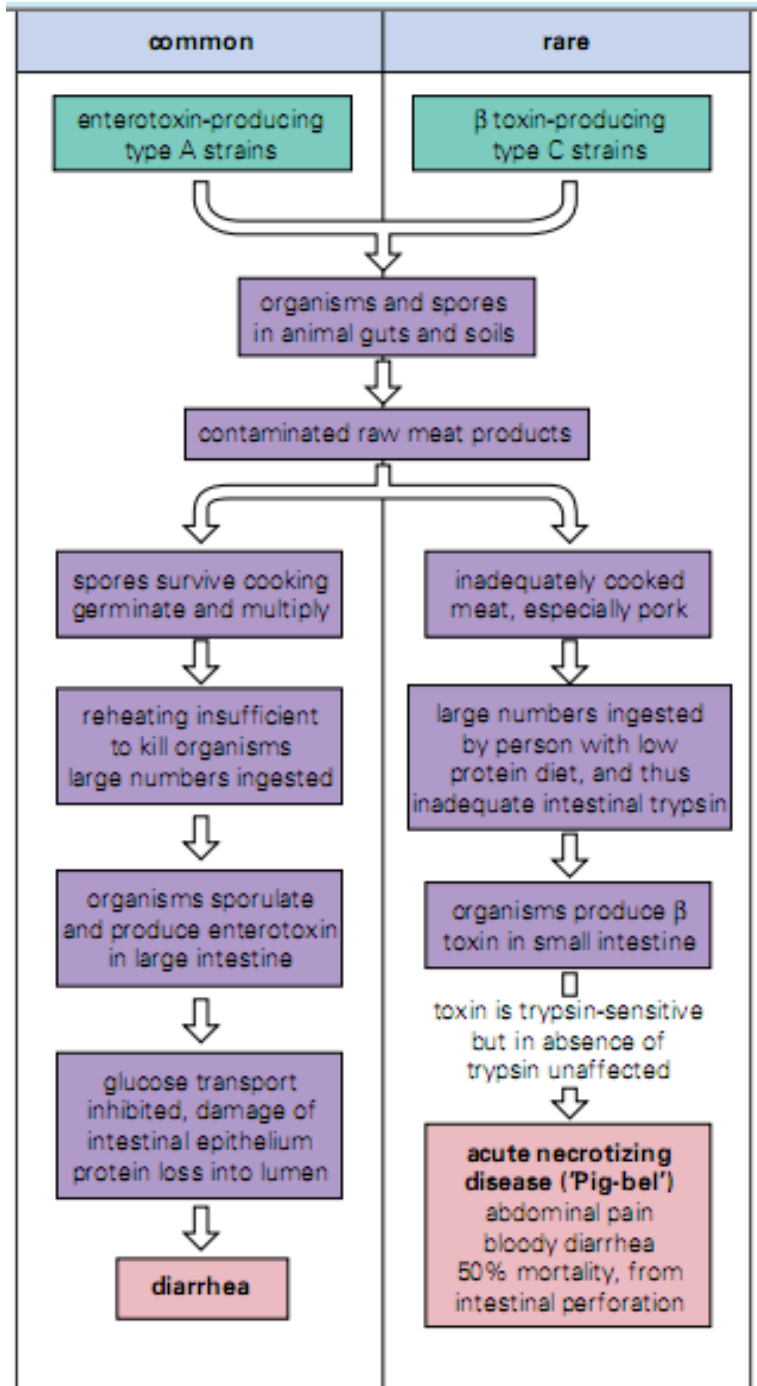
McClatchy-Tribune

Source: U.S. Food and Drug Administration, Current Medical Diagnosis & Treatment, Mayo Clinic



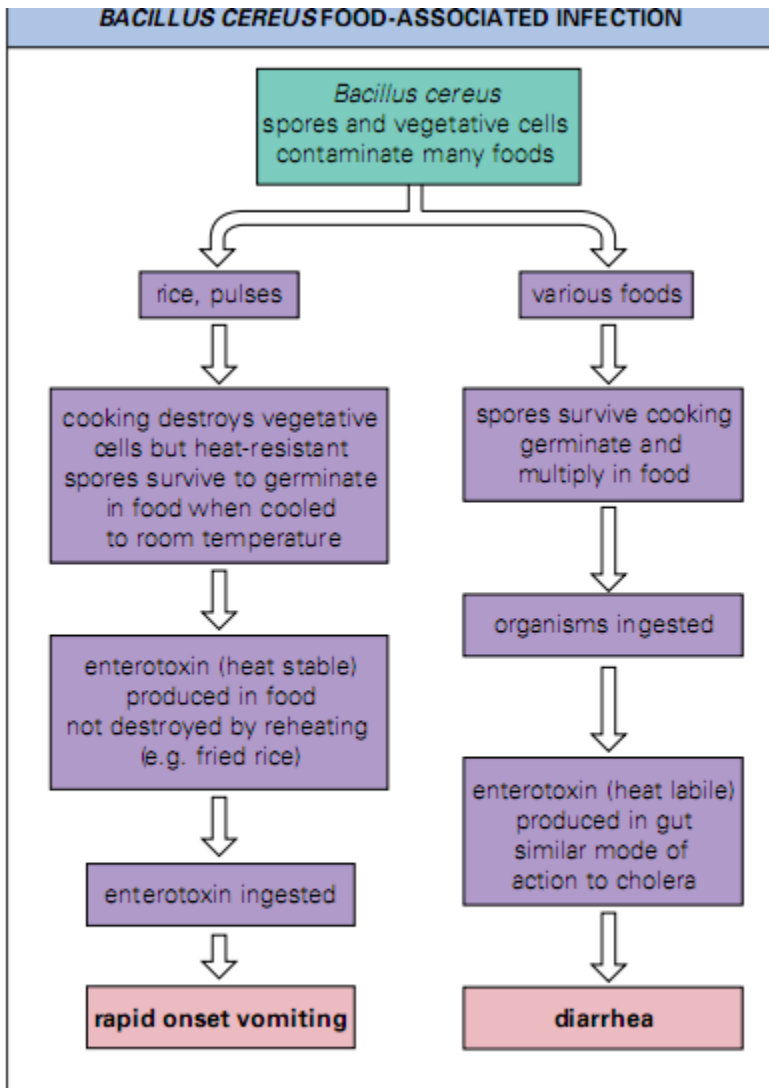
**Fig. 20.11** The passage of salmonellae through the body to the gut. The vast majority of salmonellae cause infection localized to the gastrointestinal tract and do not invade beyond the gut mucosa. They do not produce enterotoxins. (cAMP, cyclic adenosine monophosphate.)

*Clostridium perfringens* is linked with two forms of food – associated infection. The common , enterotoxin-mediated infection is usually acquired by eating meat that have been cooked enough to kill vegetative cell of bacteria but no spores . As the food cools the spores germinate . If reheating before consumption is inadequate , large numbers of organisms are ingested . The rare form associated with  $\beta$  toxin-producing strains cause a sever necrotizing disease.



*Bacillus cereus* spores and vegetative cells contaminated many foods ,and food associated infection takes one of two forms:

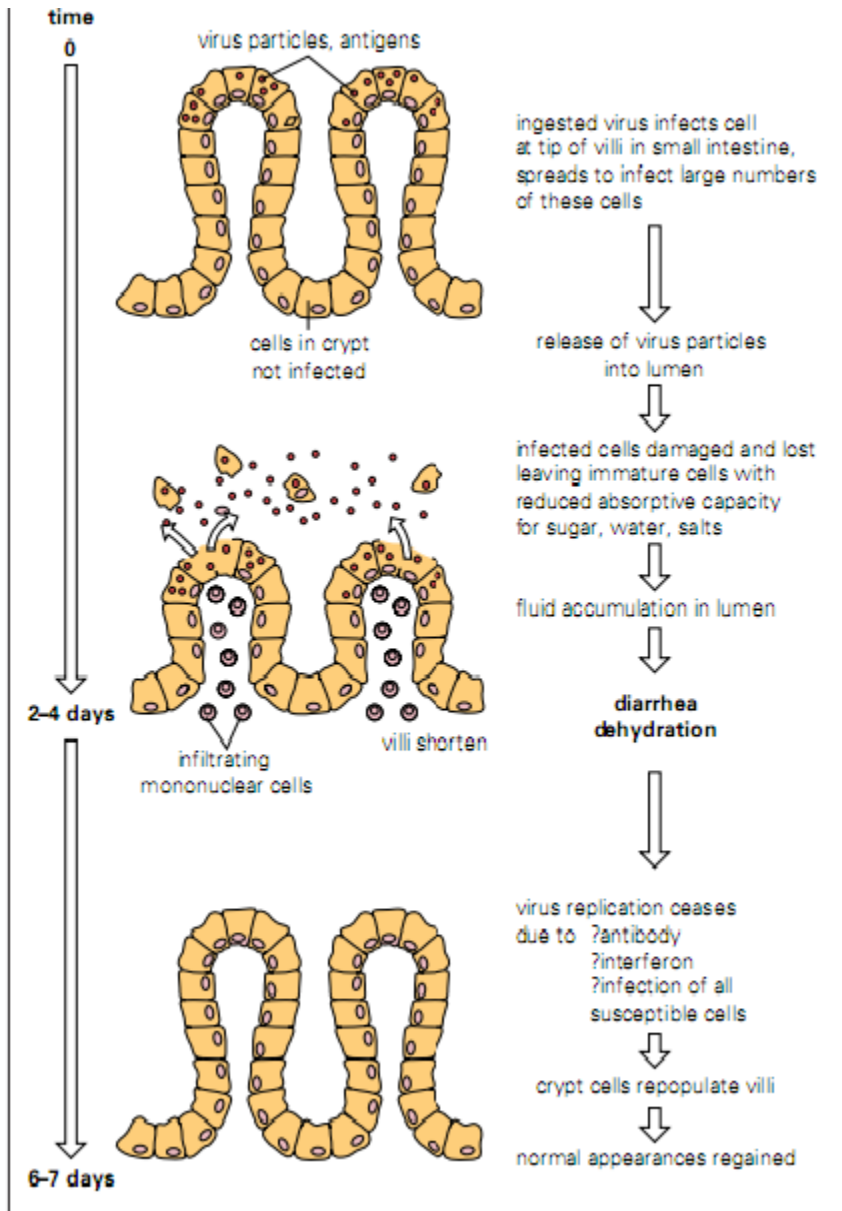
- Diarrhea resulting from the production of enterotoxin in the gut.
- Vomiting due to the ingestion of enterotoxin in food.



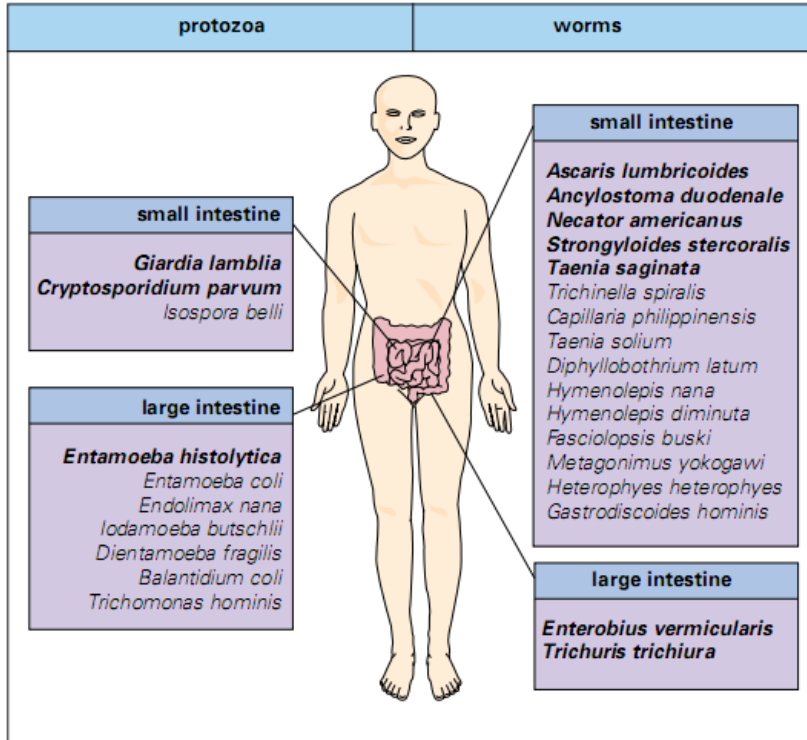
**Fig. 20.22** *Bacillus cereus* can cause two different forms of food-associated infection. Both involve toxins.

### Rotavirus

Replication of rotavirus causes diarrhea by damaging transport mechanisms in the gut .



Parasites and the gastrointestinal tract



**Fig. 20.30** Gastrointestinal parasites of man. The majority of these infections are found in developing countries, but all species also occur in the developed world and some have recently come to prominence because of their association with AIDS. The most important parasite species are highlighted in bold type.