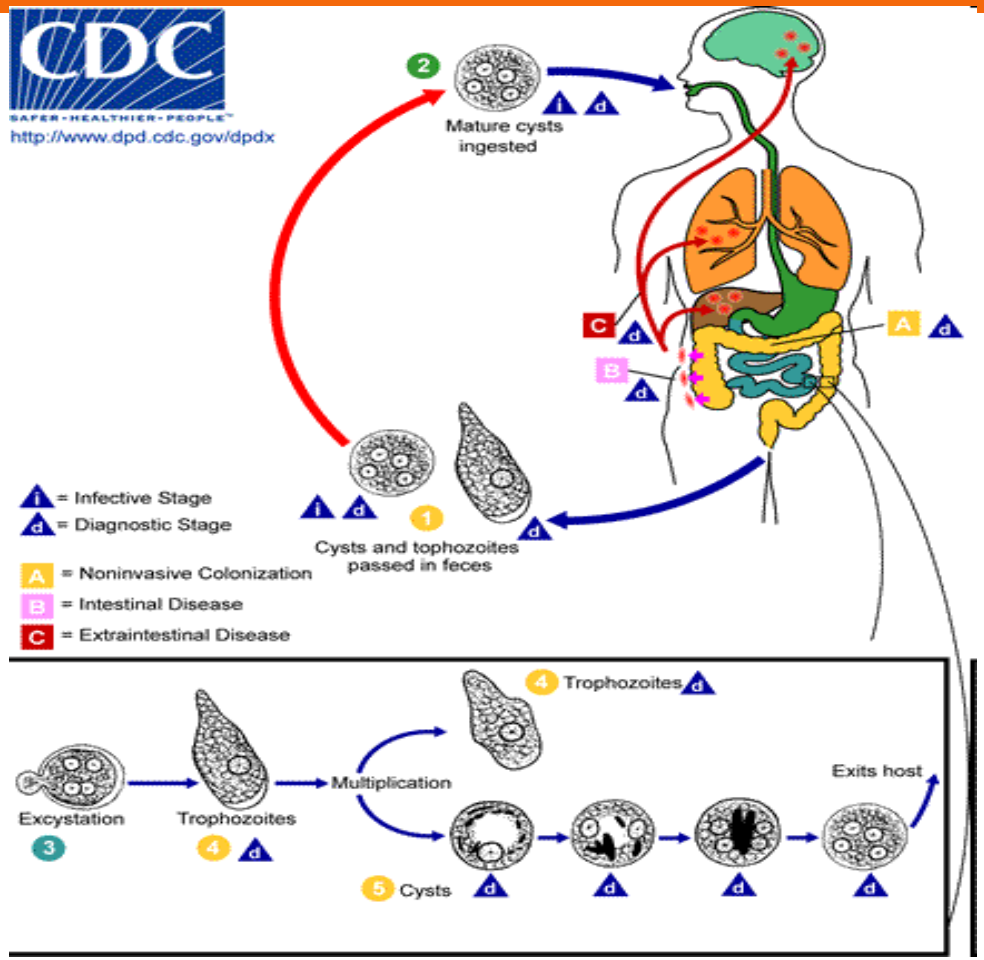
Food and waterborne diseases

Amebiasis (Entameba histolytica)

- Several protozoan species in the genus *Entameba* infect humans, but not all of them are associated with disease.
- *Entameba histolytica* is well recognized as a pathogenic ameba, associated with intestinal and extraintestinal infections.
- The other species are important because they may be confused with *E. histolytica* in diagnostic investigations.

Life cycle


CDC
SAFER·HEALTHIER·PEOPLE™
http://www.dpd.cdc.gov/dpdx
2
Mature cysts ingested
i
d
C
d
A
d
B
d
i = Infective Stage
d = Diagnostic Stage
A = Noninvasive Colonization
B = Intestinal Disease
C = Extraintestinal Disease
i
d
1
Cysts and tophozoites passed in feces
d
4 Trophozoites d
Multiplication
Exits host
Excystation
3
Trophozoites
4
d
5 Cysts
d
d
d
d

Amebiasis 1.

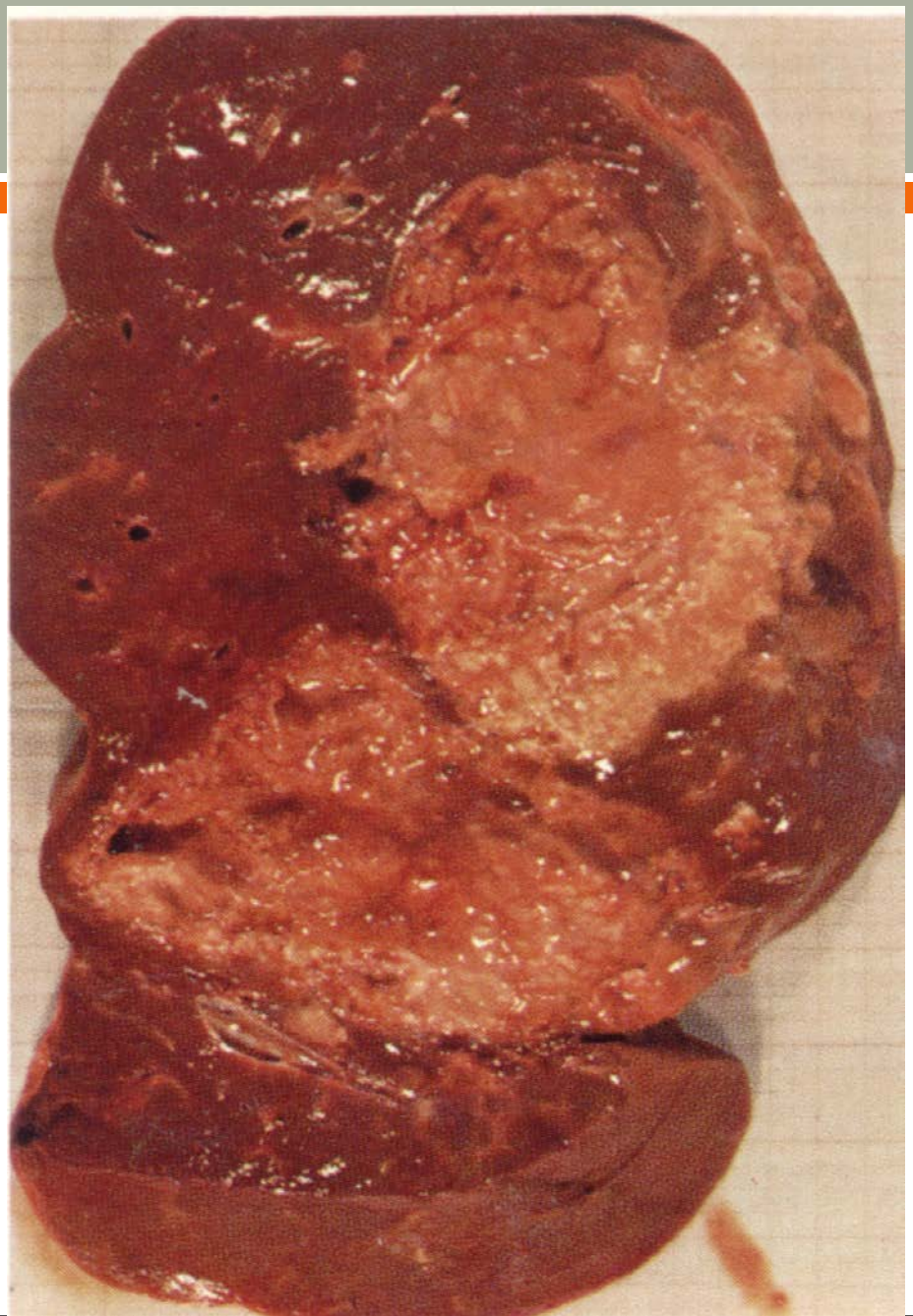
- Cysts and trophozoites are passed in feces
- Cysts are typically found in formed stool, whereas trophozoites are typically found in diarrheal stool.
- ***Infection by EntAmeba histolytica occurs by ingestion of mature cysts in fecally contaminated food, water, or hands.***
- Excystation occurs in the small intestine and trophozoites are released, which migrate to the large intestine.
- The trophozoites multiply by binary fission and produce cysts , and both stages are passed in the feces
- Because of the protection conferred by their walls, the cysts can survive days to weeks in the external environment and are responsible for transmission.
- Trophozoites passed in the stool are rapidly destroyed once outside the body, and if ingested would not survive exposure to the gastric environment.

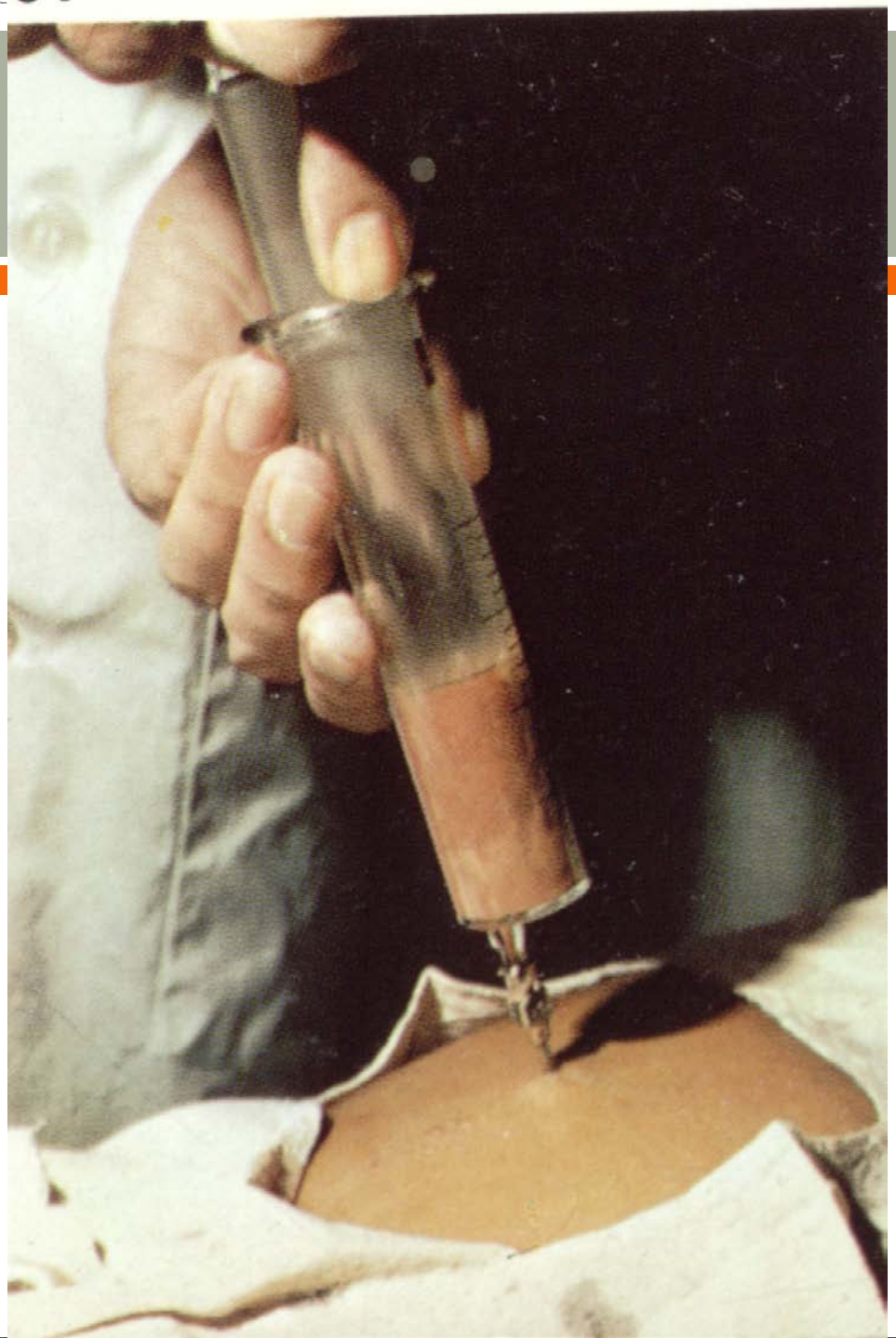
Amebiasis 2.

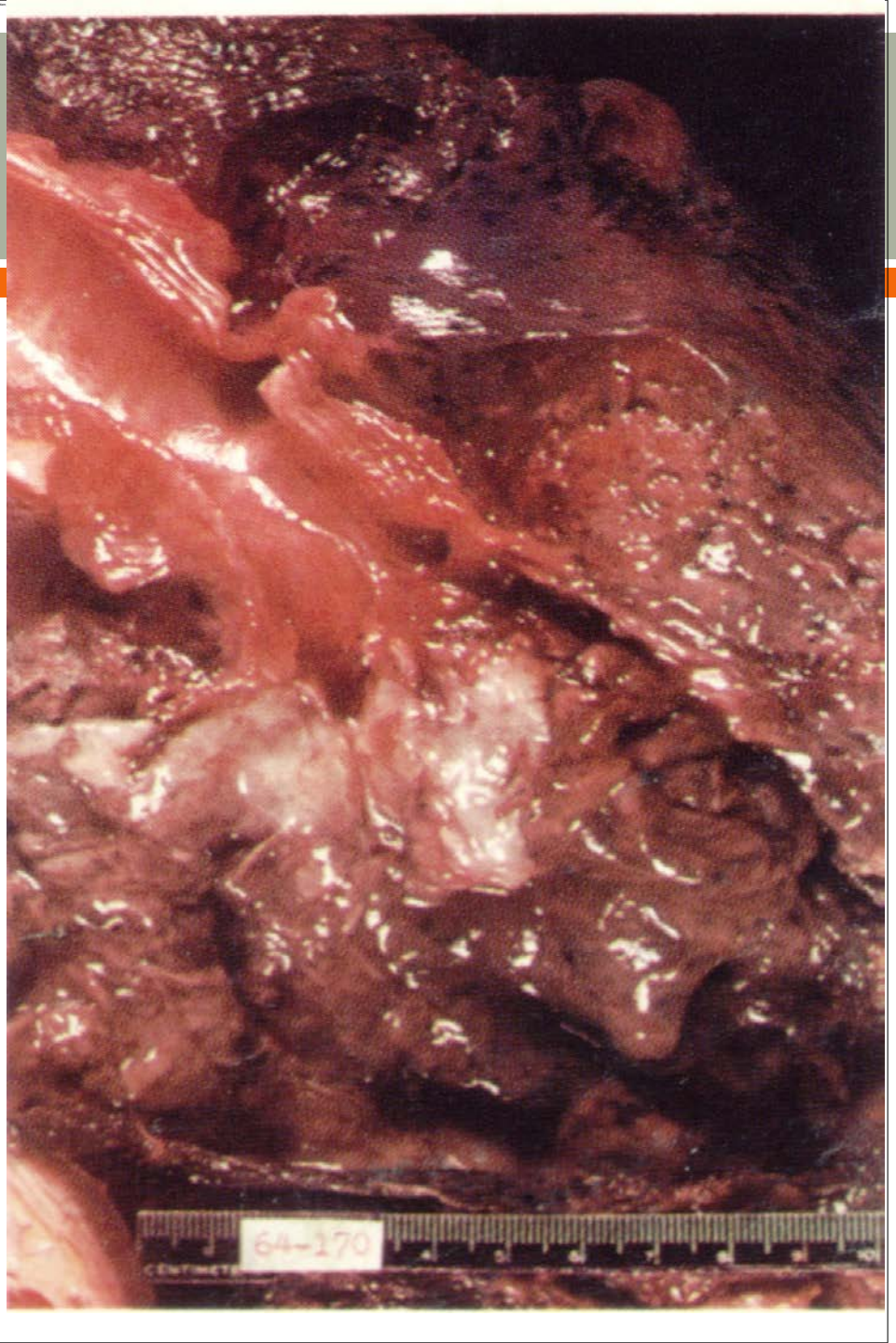
- In many cases, the trophozoites remain confined to the intestinal lumen (noninvasive infection) of individuals who are asymptomatic carriers, passing cysts in their stool.
- In some patients the trophozoites invade the intestinal mucosa (intestinal disease), or, through the bloodstream, extraintestinal sites such as the liver, brain, and lungs (extraintestinal disease), with resultant pathologic manifestations.
- It has been established that the invasive and noninvasive forms represent two separate species, respectively *E. histolytica* and *E. dispar*.
- These two species are morphologically indistinguishable unless *E. histolytica* is observed with ingested red blood cells (erythrophagocystosis).
- Transmission can also occur through exposure to fecal matter during sexual contact (in which case not only cysts, but also trophozoites could prove infective).

Amebiasis 4.

- **Clinical Features:**
  A wide spectrum, from asymptomatic infection ("luminal amebiasis"), to invasive intestinal amebiasis (dysentery, colitis, appendicitis, toxic megacolon, amebomas), to invasive extraintestinal amebiasis (liver abscess, peritonitis, pleuropulmonary abscess, cutaneous and genital amebic lesions).



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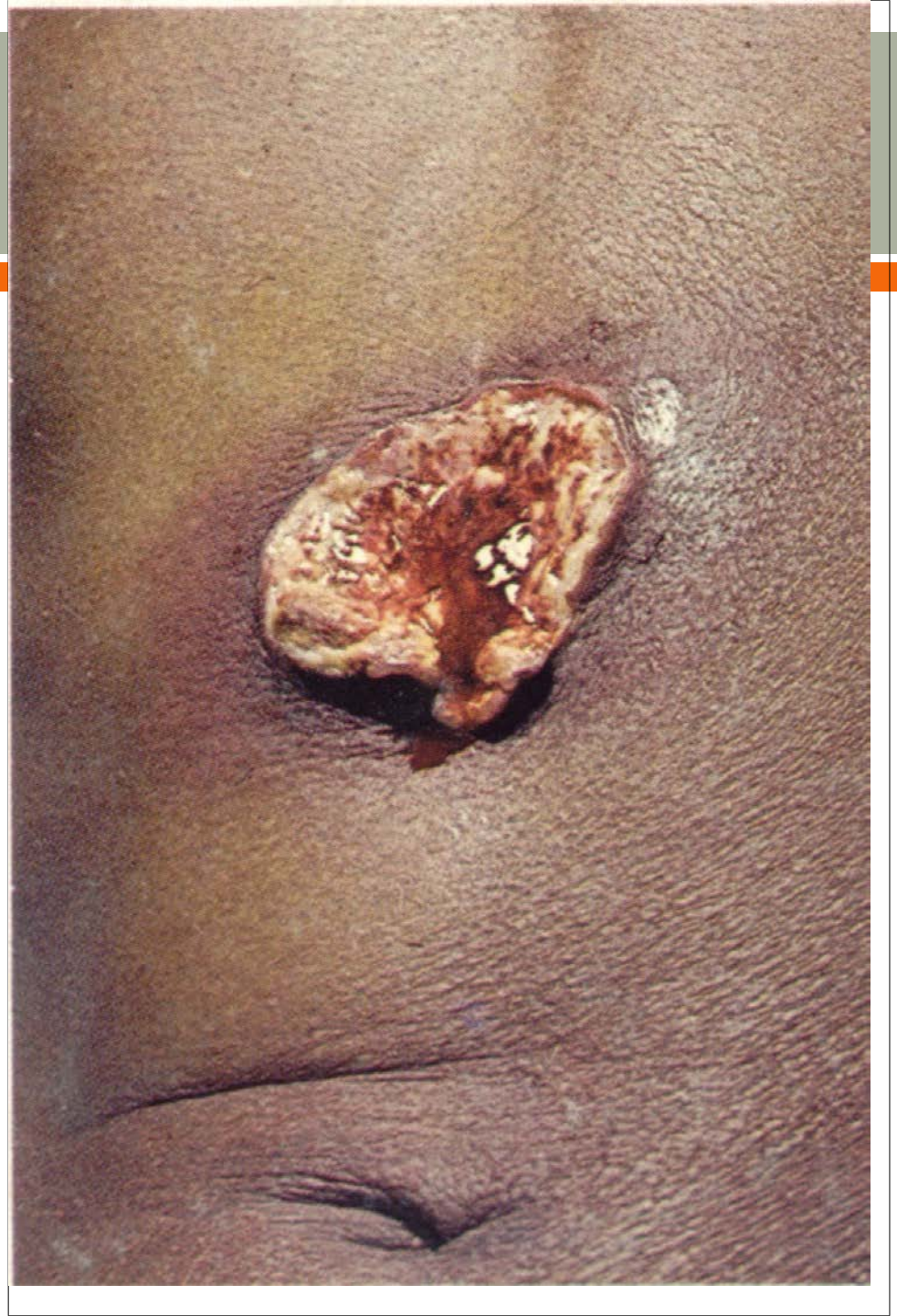
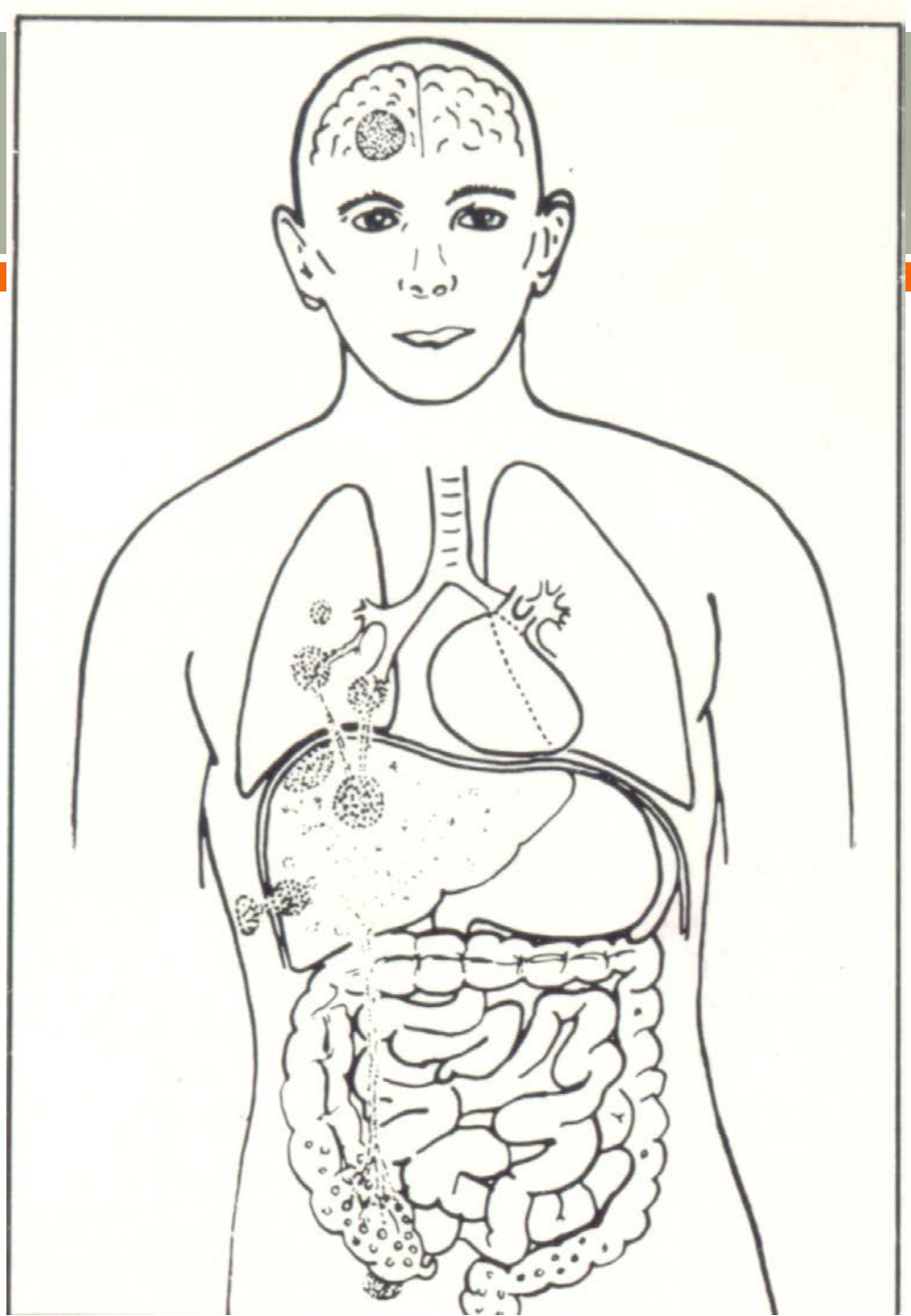
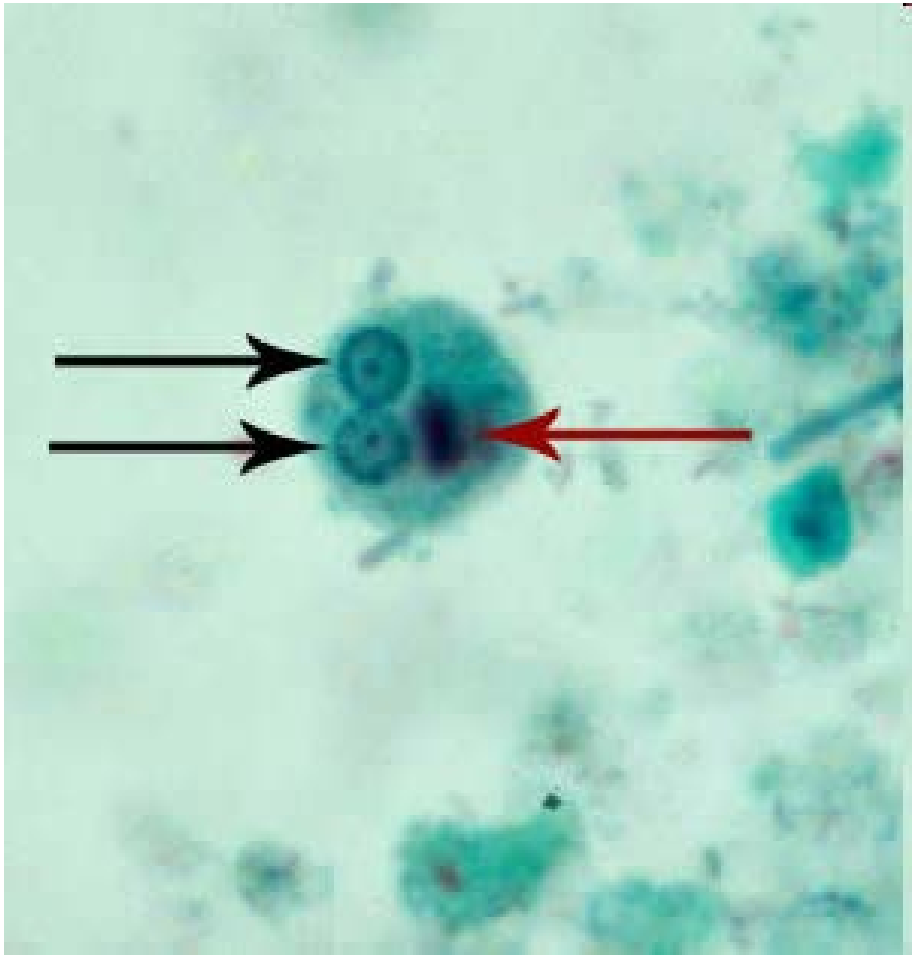




Amebiasis 3

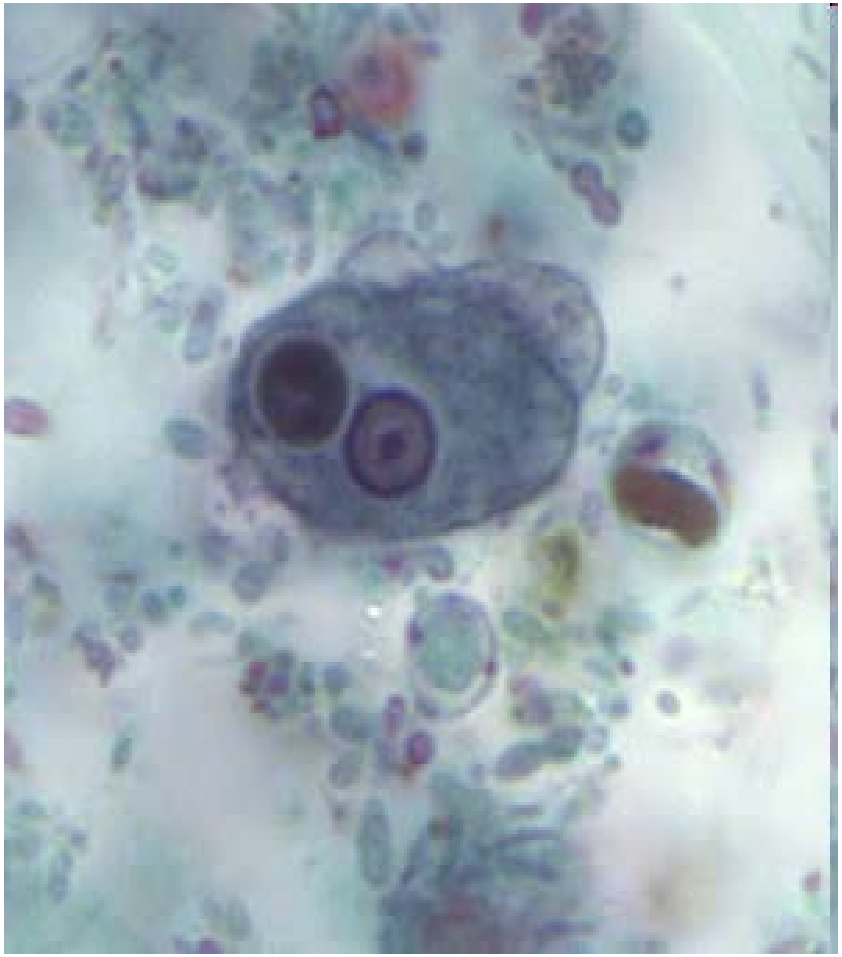
- **Geographic Distribution:**
  Worldwide, with higher incidence of amebiasis in developing countries. In industrialized countries, risk groups include male homosexuals, travelers and recent immigrants, and institutionalized populations.

Microscopy 1



Two to three nuclei are visible in the focal plane (black arrows), and the cysts contain chromatoid bodies with typically blunted ends (red arrows).

Microscopy 2.

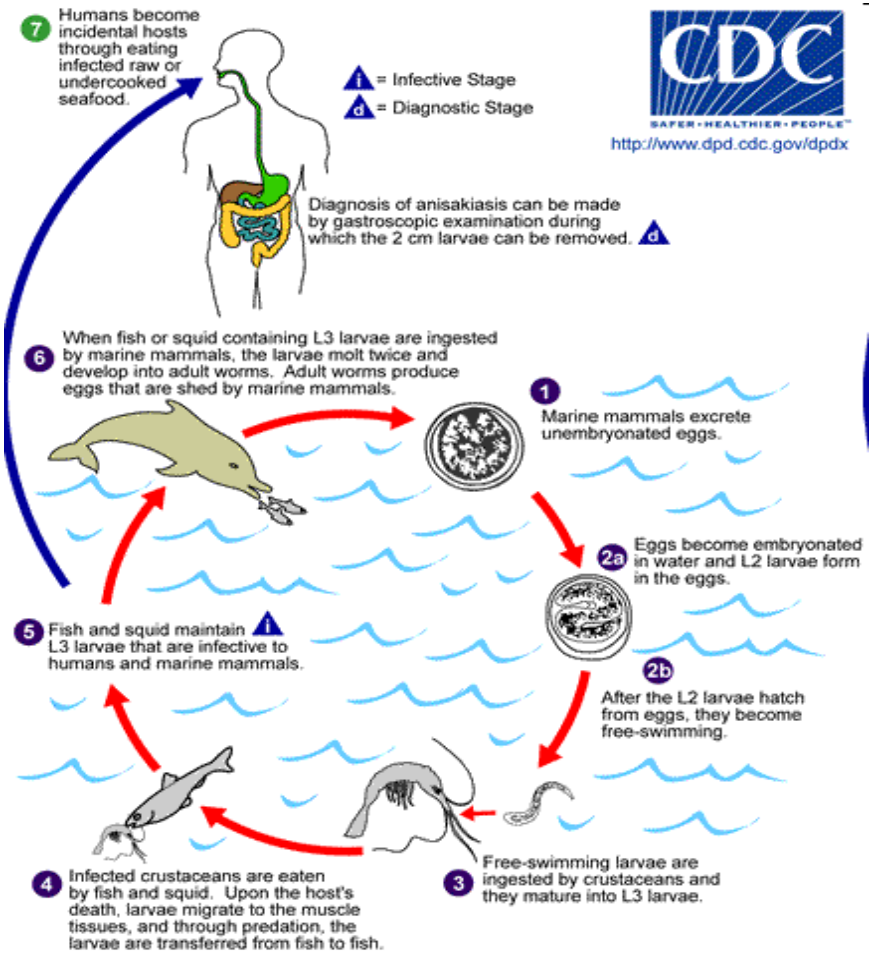


Trophozoite of *E. histolytica* with ingested erythrocytes stained with trichrome. The ingested erythrocyte appears as a dark inclusion. Erythrophagocytosis is the only characteristic that can be used to differentiate morphologically *E. histolytica* from the nonpathogenic *E. dispar*.

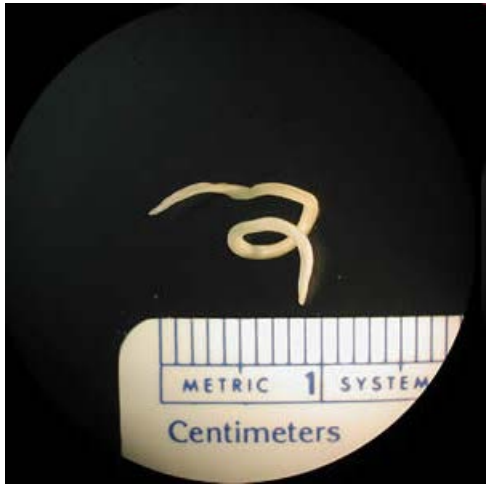
Treatment:

- For asymptomatic infections, iodoquinol, paromomycin, or diloxanide furoate (not commercially available in Hungary) are the drugs of choice.
- For symptomatic intestinal disease, or extraintestinal, infections (e.g., hepatic abscess), the drugs of choice are metronidazole or tinidazole, immediately followed by treatment with iodoquinol, paromomycin, or diloxanide furoate.

Anisakiasis



Geographic Distribution: Worldwide, with higher incidence in areas where raw fish is eaten (e.g., Japan, Pacific coast of South America, the Netherlands).



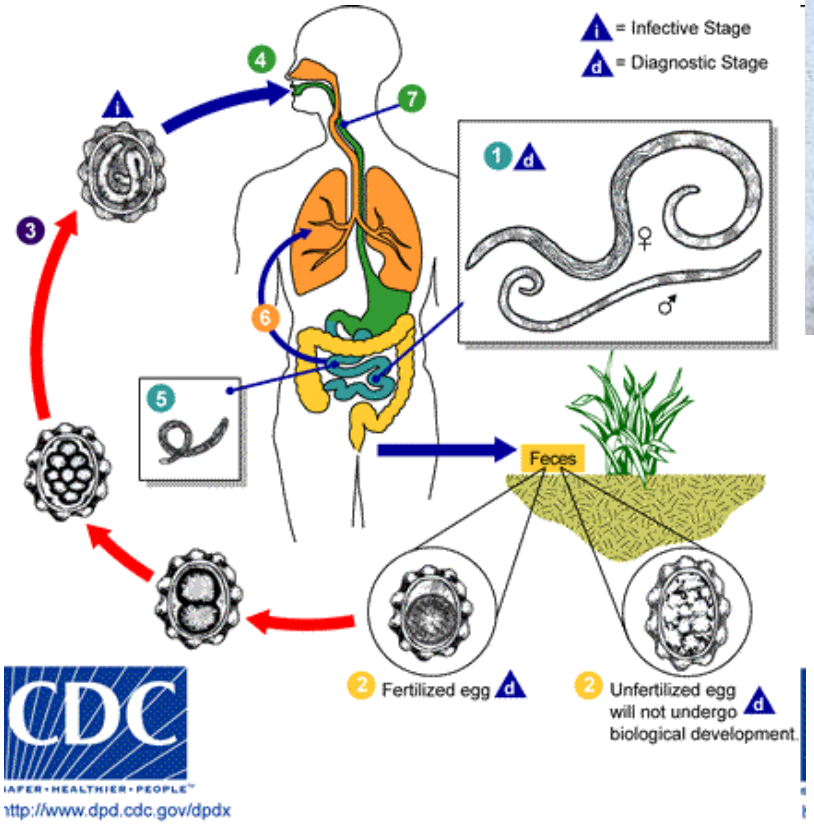
Anisakiasis

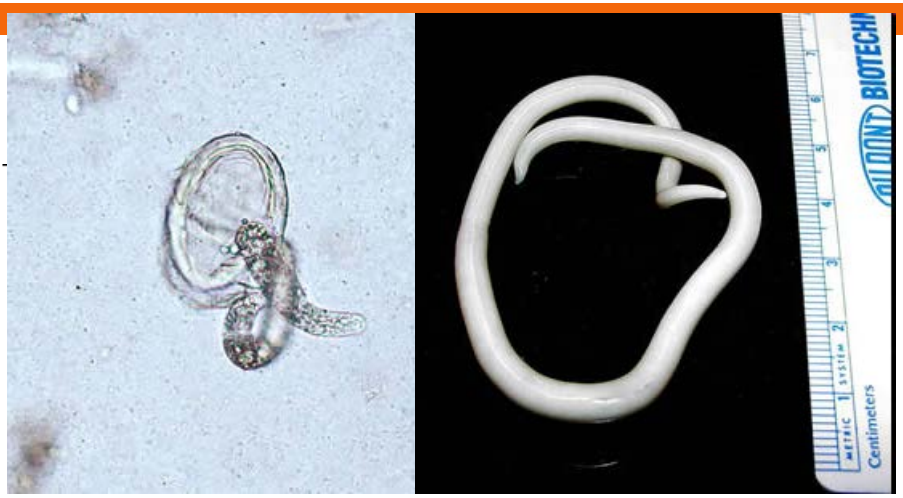
- **Clinical Features:**
  Within hours after ingestion of infected larvae, violent abdominal pain, nausea, and vomiting may occur. Occasionally the larvae are coughed up. If the larvae pass into the bowel, a severe eosinophilic granulomatous response may also occur 1 to 2 weeks following infection, causing symptoms mimicking Crohn's disease.
- **Laboratory Diagnosis:**
  Diagnosis can be made by gastroscopic examination during which the 2 cm larvae are visualized and removed, or by histopathologic examination of tissue removed at biopsy or during surgery.
- **Treatment:**
  The treatment of choice is surgical or endoscopic removal.

Ascariasis

- **Causal Agent:**
  Ascaris lumbricoides is the largest nematode (roundworm) parasitizing the human intestine. (Adult females: 20 to 35 cm; adult male: 15 to 30 cm.)
- Adult worms live in the lumen of the small intestine.
- A female may produce approximately 200,000 eggs per day, which are passed with the feces
- Unfertilized eggs may be ingested but are not infective.
- Fertile eggs embryonate and become infective after 18 days to several weeks, depending on the environmental conditions (optimum: moist, warm, shaded soil).
- After infective eggs are swallowed , the larvae hatch , invade the intestinal mucosa, and are carried via the portal, then systemic circulation to the lungs
- The larvae mature further in the lungs (10 to 14 days), penetrate the alveolar walls, ascend the bronchial tree to the throat, and are swallowed
- Upon reaching the small intestine, they develop into adult worms
- Between 2 and 3 months are required from ingestion of the infective eggs to oviposition by the adult female.
- Adult worms can live 1 to 2 years.

Life cycle, treatment





The drugs of choice for treatment of ascariasis are albendazole with mebendazole, ivermectin, and nitazoxanide as alternatives.

Ascariasis

- **Treatment:**
  The drugs of choice for treatment of ascariasis are albendazole with mebendazole, ivermectin, and nitazoxanide as alternatives.

Botulism

- Botulism is a rare but serious paralytic illness caused by a nerve toxin that is produced by the bacterium *Clostridium botulinum*.
- There are three main kinds of botulism.
- Foodborne botulism is caused by eating foods that contain the botulism toxin.
- Wound botulism is caused by toxin produced from a wound infected with *Clostridium botulinum*.
- Infant botulism is caused by consuming the spores of the botulinum bacteria, which then grow in the intestines and release toxin.

Botulism

- The classic symptoms of botulism include double vision, blurred vision, drooping eyelids, slurred speech, difficulty swallowing, dry mouth, and muscle weakness.
- Infants with botulism appear lethargic, feed poorly, are constipated, and have a weak cry and poor muscle tone.
- These are all symptoms of the muscle paralysis caused by the bacterial toxin. If untreated, these symptoms may progress to cause paralysis of the arms, legs, trunk and respiratory muscles.
- In foodborne botulism, symptoms generally begin 18 to 36 hours after eating a contaminated food, but they can occur as early as 6 hours or as late as 10 days.

Botulism

- Physicians may consider the diagnosis if the patient's history and physical examination suggest botulism.
- However, these clues are usually not enough to allow a diagnosis of botulism.
- Other diseases such as Guillain-Barré syndrome, stroke, and myasthenia gravis can appear similar to botulism, and special tests may be needed to exclude these other conditions.
- The most direct way to confirm the diagnosis is to demonstrate the botulinum toxin in the patient's serum or stool by injecting serum or stool into mice and looking for signs of botulism.
- The bacteria can also be isolated from the stool of persons with foodborne and infant botulism.
- These tests can be performed at some state health department laboratories and at CDC.

Botulism

- The respiratory failure and paralysis that occur with severe botulism may require a patient to be on a breathing machine (ventilator) for weeks, plus intensive medical and nursing care.
- After several weeks, the paralysis slowly improves. If diagnosed early, foodborne and wound botulism can be treated with an equine antitoxin which blocks the action of toxin circulating in the blood.
- This can prevent patients from worsening, but recovery still takes many weeks.
- Physicians may try to remove contaminated food still in the gut by inducing vomiting or by using enemas.
- Wounds should be treated, usually surgically, to remove the source of the toxin-producing bacteria followed by administration of appropriate antibiotics.
- Good supportive care in a hospital is the mainstay of therapy for all forms of botulism.

Brucellosis

- Brucellosis is an infectious disease caused by the bacteria of the genus *Brucella*.
- Various *Brucella* species affect sheep, goats, cattle, deer, elk, pigs, dogs, and several other animals.
- Humans become infected by coming in contact with animals or animal products that are contaminated with these bacteria.
- In humans brucellosis can cause a range of symptoms that are similar to the flu and may include fever, sweats, headaches, back pains, and physical weakness.
- Severe infections of the central nervous systems or lining of the heart may occur.
- Brucellosis can also cause long-lasting or chronic symptoms that include recurrent fevers, joint pain, and fatigue.

Brucellosis

- Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animal health programs.
- Areas currently listed as high risk are the Mediterranean Basin (Portugal, Spain, Southern France, Italy, Greece, Turkey, North Africa), South and Central America, Eastern Europe, Asia, Africa, the Caribbean, and the Middle East.
- Unpasteurized cheeses, sometimes called "village cheeses," from these areas may represent a particular risk for tourists.

Brucellosis

- Usually, doxycycline and rifampin are used in combination for 6 weeks to prevent reoccuring infection.
- Depending on the timing of treatment and severity of illness, recovery may take a few weeks to several months.
- Mortality is low (<2%), and is usually associated with endocarditis.

Campylobacteriosis

- Campylobacteriosis is an infectious disease caused by bacteria of the genus *Campylobacter*.
- Most people who become ill with campylobacteriosis get diarrhea, cramping, abdominal pain, and fever within two to five days after exposure to the organism.
- The diarrhea may be bloody and can be accompanied by nausea and vomiting.
- The illness typically lasts one week. Some infected persons do not have any symptoms. In persons with compromised immune systems, *Campylobacter* occasionally spreads to the bloodstream and causes a serious life-threatening infection.

Campylobacteriosis

- Almost all persons infected with *Campylobacter* recover without any specific treatment.
- Patients should drink extra fluids as long as the diarrhea lasts. In more severe cases, antibiotics such as erythromycin or a fluoroquinolone can be used, and can shorten the duration of symptoms if given early in the illness.
- Your doctor will decide whether antibiotics are necessary.

Cholera

- Cholera is an acute, diarrheal illness caused by infection of the intestine with the bacterium *Vibrio cholerae*.
- The infection is often mild or without symptoms, but sometimes it can be severe.
- Approximately one in 20 infected persons has severe disease characterized by profuse watery diarrhea, vomiting, and leg cramps. In these persons, rapid loss of body fluids leads to dehydration and shock.
- Without treatment, death can occur within hours.

Cholera

- A person may get cholera by drinking water or eating food contaminated with the cholera bacterium. In an epidemic, the source of the contamination is usually the feces of an infected person.
- The disease can spread rapidly in areas with inadequate treatment of sewage and drinking water.

- The cholera bacterium may also live in the environment in brackish rivers and coastal waters.
- Shellfish eaten raw have been a source of cholera, and a few persons in the United States have contracted cholera after eating raw or undercooked shellfish from the Gulf of Mexico.
- The disease is not likely to spread directly from one person to another; therefore, casual contact with an infected person is not a risk for becoming ill.

„Rice-water stool”

Cholera bed 1

Cholera bed 2.

Cholera patient before rehydration

Cholera patient after rehydration

Cholera

- Cholera can be simply and successfully treated by immediate replacement of the fluid and salts lost through diarrhea.
- Patients can be treated with oral rehydration solution, a prepackaged mixture of sugar and salts to be mixed with water and drunk in large amounts.
- This solution is used throughout the world to treat diarrhea.
- Severe cases also require intravenous fluid replacement.
- With prompt rehydration, fewer than 1% of cholera patients die.
- Antibiotics shorten the course and diminish the severity of the illness, but they are not as important as rehydration.
- Persons who develop severe diarrhea and vomiting in countries where cholera occurs should seek medical attention promptly.

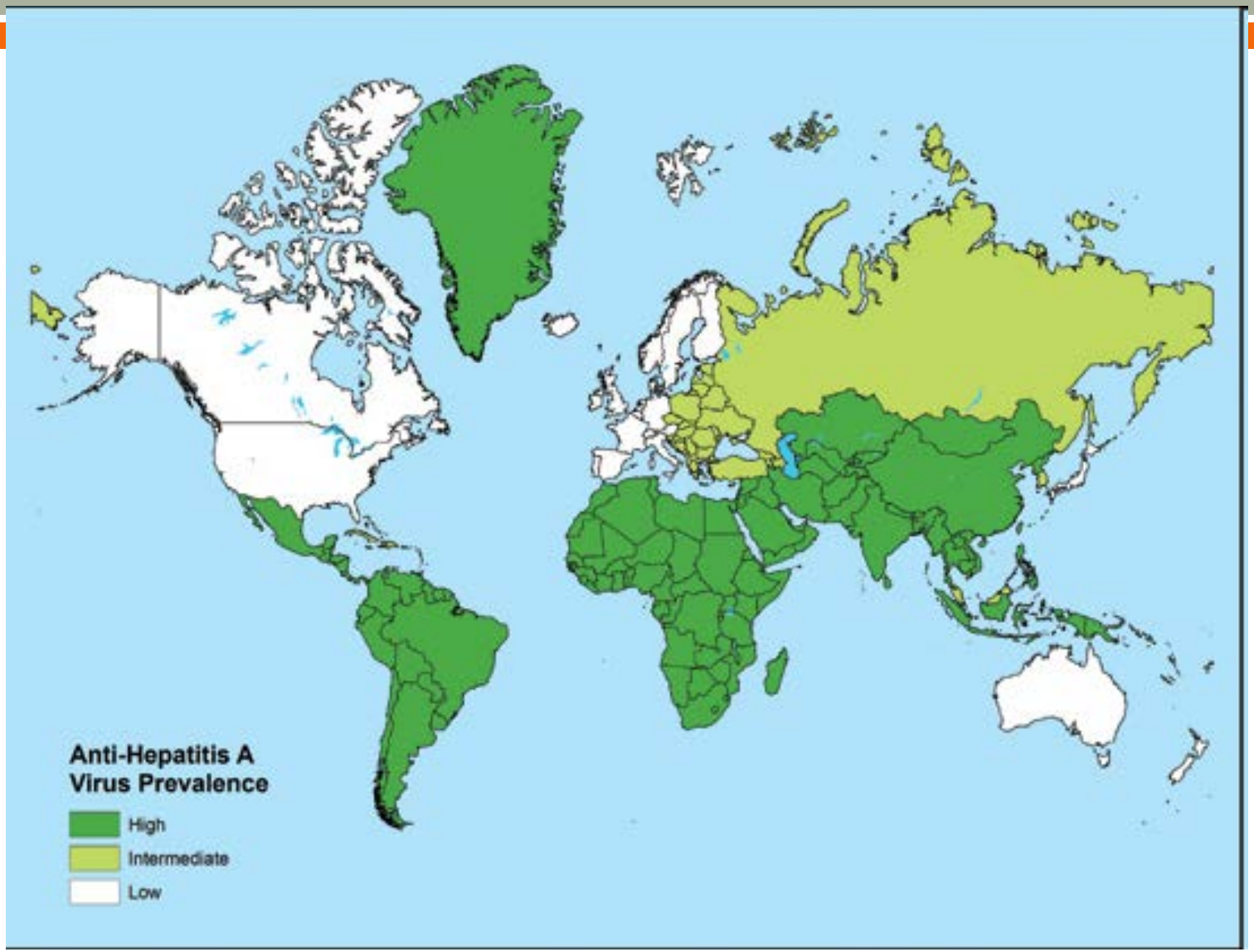
Hepatitis A

- The clinical case definition for acute viral hepatitis is
  - 1) discrete onset of symptoms (e.g., nausea, anorexia, fever, malaise, or abdominal pain) and
  - 2) jaundice or elevated serum aminotransferase levels.
- Because the clinical characteristics are the same for all types of acute viral hepatitis, hepatitis A diagnosis must be confirmed by a positive serologic test for immunoglobulin M (IgM) antibody to hepatitis A virus, or the case must meet the clinical case definition and occur in a person who has an epidemiologic link with a person who has laboratory-confirmed hepatitis A (i.e., household or sexual contact with an infected person during the 15–50 days before the onset of symptoms).

How is HAV transmitted?

- **Person-to-person transmission through the fecal-oral route** (i.e., ingestion of something that has been contaminated with the feces of an infected person) is the primary means of HAV transmission in the United States. Most infections result from close personal contact with an infected household member or sex partner.
- Common-source outbreaks and sporadic cases also can occur from **exposure to fecally contaminated food or water**. Uncooked HAV-contaminated foods have been recognized as a source of outbreaks. Cooked foods also can transmit HAV if the temperature during food preparation is inadequate to kill the virus or if food is contaminated after cooking, as occurs in outbreaks associated with infected food handlers. Waterborne outbreaks are infrequent in developed countries with well-maintained sanitation and water supplies.

Geographical distribution



Who should receive protection against hepatitis A before travel?

- All susceptible persons traveling to or working in countries that have high or intermediate rates of hepatitis A should be vaccinated or receive immune globulin (IG) before traveling.
- Persons from developed countries who travel to developing countries are at high risk for hepatitis A.
- The risk for hepatitis A exists even for travelers to urban areas, those who stay in luxury hotels, and those who report that they have good hygiene and that they are careful about what they drink and eat.

Listeriosis

- Listeriosis, a serious infection caused by eating food contaminated with the bacterium *Listeria monocytogenes*, has recently been recognized as an important public health problem in the United States.
- The disease affects primarily persons of advanced age, pregnant women, newborns, and adults with weakened immune systems.
- However, persons without these risk factors can also rarely be affected.
- The risk may be reduced by following a few simple recommendations.

Listeriosis

- A person with listeriosis has fever, muscle aches, and sometimes gastrointestinal symptoms such as nausea or diarrhea.
- If infection spreads to the nervous system, symptoms such as headache, stiff neck, confusion, loss of balance, or convulsions can occur.
- Infected pregnant women may experience only a mild, flu-like illness; however, infections during pregnancy can lead to miscarriage or stillbirth, premature delivery, or infection of the newborn.

Listeriosis

- At increased risk are:
- Pregnant women - They are about 20 times more likely than other healthy adults to get listeriosis. About one-third of listeriosis cases happen during pregnancy.
- Newborns - Newborns rather than the pregnant women themselves suffer the serious effects of infection in pregnancy.
- Persons with weakened immune systems
- Persons with cancer, diabetes, or kidney disease
- Persons with AIDS - They are almost 300 times more likely to get listeriosis than people with normal immune systems.
- Persons who take glucocorticosteroid medications
- The elderly

Listeriosis

- *Listeria monocytogenes* is found in soil and water.
- Vegetables can become contaminated from the soil or from manure used as fertilizer.

- Animals can carry the bacterium without appearing ill and can contaminate foods of animal origin such as meats and dairy products.
- The bacterium has been found in a variety of raw foods, such as uncooked meats and vegetables, as well as in processed foods that become contaminated after processing, such as soft cheeses and cold cuts at the deli counter.
- Unpasteurized (raw) milk or foods made from unpasteurized milk may contain the bacterium.

Toxic fishes

- **What are marine toxins?**
  - Marine toxins are naturally occurring chemicals that can contaminate certain seafood.
  - The seafood contaminated with these chemicals frequently looks, smells, and tastes normal.
  - When humans eat such seafood, disease can result.

Toxic fishes

- **What sort of diseases do marine toxins cause?**
- The most common diseases caused by marine toxins in United States in order of incidence are scombrotoxic fish poisoning, ciguatera poisoning, paralytic shellfish poisoning, neurotoxic shellfish poisoning and amnesic shellfish poisoning.

Scombrotoxic fish poisoning

- Also known as scombroid or histamine fish poisoning, is caused by bacterial spoilage of certain finfish such as tuna, mackerel, bonito, and, rarely, other fish.
- As bacteria break down fish proteins, byproducts such as histamine and other substances that block histamine breakdown build up in fish.
- Eating spoiled fish that have high levels of these histamines can cause in human disease.
- Symptoms begin within 2 minutes to 2 hours after eating the fish.
- The most common symptoms are rash, diarrhea, flushing, sweating, headache, and vomiting.
- Burning or swelling of the mouth, abdominal pain, or a metallic taste may also occur.
- The majority of patients have mild symptoms that resolve within a few hours.
- Treatment is generally unnecessary, but antihistamines or epinephrine may be needed in certain instances.
- Symptoms may be more severe in patients taking certain medications that slow the breakdown of histamine by their liver, such as isoniazide and doxycycline.

Ciguatera poisoning 1.

- Ciguatoxins that cause ciguatera poisoning are actually produced by microscopic sea plants called dinoflagellates.
- These toxins become progressively concentrated as they move up the food chain from small fish to large fish that eat them, and reach particularly high concentrations in large predatory tropical reef fish.
- Barracuda are commonly associated with ciguatoxin poisoning, but eating grouper, sea bass, snapper, mullet, and a number of other fish that live in oceans between latitude 35° N and 35° S has caused the disease.
- These fish are typically caught by sport fishermen on reefs in Hawaii, Guam and other South Pacific islands, the Virgin Islands, and Puerto Rico.

Ciguatera poisoning 2.

- Ciguatoxin usually causes symptoms within a few minutes to 30 hours after eating contaminated fish, and occasionally it may take up to 6 hours.
- Common nonspecific symptoms include nausea, vomiting, diarrhea, cramps, excessive sweating, headache, and muscle aches.
- The sensation of burning or "pins-and-needles," weakness, itching, and dizziness can occur.
- Patients may experience reversal of temperature sensation in their mouth (hot surfaces feeling cold and cold, hot), unusual taste sensations, nightmares, or hallucinations.
- Ciguatera poisoning is rarely fatal. Symptoms usually clear in 1 to 4 weeks.

Paralytic shellfish poisoning 1.

- ***Paralytic shellfish poisoning*** is caused by a different dinoflagellate with a different toxin, than that causing ciguatera poisoning.
- These dinoflagellates have a red-brown color, and can grow to such numbers that they cause red streaks to appear in the ocean called "red tides."
- This toxin is known to concentrate within certain shellfish that typically live in the colder coastal waters of the
- Pacific states and New England, though the syndrome has been reported in Central America.
- Shellfish that have caused this disease include mussels, cockles, clams, scallops, oysters, crabs, and lobsters.

Paralytic shellfish poisoning 2.

- Symptoms begin anywhere from 15 minutes to 10 hours after eating the contaminated shellfish, although usually within 2 hours.
- Symptoms are generally mild, and begin with numbness or tingling of the face, arms, and legs.
- This is followed by headache, dizziness, nausea, and muscular incoordination.
- Patients sometimes describe a floating sensation.
- In cases of severe poisoning, muscle paralysis and respiratory failure occur, and in these cases death may occur in 2 to 25 hours.

Neurotoxic shellfish poisoning

- ***Neurotoxic shellfish poisoning*** is caused by a third type of dinoflagellate with another toxin that occasionally accumulates in oysters, clams, and mussels from the Gulf of Mexico and the Atlantic coast of the southern states.
- Symptoms begin 1 to 3 hours after eating the contaminated shellfish and include numbness, tingling in the mouth, arms and legs, incoordination, and gastrointestinal upset.
- As in ciguatera poisoning, some patients report temperature reversal.
- Death is rare. Recovery normally occurs in 2 to 3 days.

Amnesic shellfish poisoning

- ***Amnesic shellfish poisoning*** is a rare syndrome caused by a toxin made by a microscopic, red-brown, salt-water plant, or diatom called *Nitzchia pungens.*
- The toxin produced by these diatoms is concentrated in shellfish such as mussels and causes disease when the contaminated shellfish are eaten.
- Patients first experience gastrointestinal distress within 24 hours after eating the contaminated shellfish.
- Other reported symptoms have included dizziness, headache, disorientation, and permanent short-term memory loss.
- In severe poisoning, seizures, focal weakness or paralysis, and death may occur.

How can these diseases be diagnosed?

- Diagnosis of marine toxin poisoning is generally based on symptoms and a history of recently eating a particular kind of seafood.
- Laboratory testing for the specific toxin in patient samples is generally not necessary because this requires special techniques and equipment available in only specialized laboratories.
- If suspect, leftover fish or shellfish are available, they can be tested for the presence of the toxin more easily.
- Identification of the specific toxin is not usually necessary for treating patients because there is no specific treatment.

How can these diseases be treated?

- Other than supportive care there are few specific treatments for ciguatera poisoning, paralytic shellfish poisoning, neurotoxic shellfish poisoning, or amnesic shellfish poisoning.
- Antihistamines and epinephrine, however, may sometimes be useful in treating the symptoms of scombrotoxic fish poisoning.
- Intravenous mannitol has been suggested for the treatment of severe ciguatera poisoning.

Salmonellosis 1

- Salmonellosis is an infection with bacteria called *Salmonella*.
- Most persons infected with *Salmonella* develop diarrhea, fever, and abdominal cramps 12 to 72 hours after infection.
- The illness usually lasts 4 to 7 days, and most persons recover without treatment.
- However, in some persons, the diarrhea may be so severe that the patient needs to be hospitalized. In these patients, the *Salmonella* infection may spread from the intestines to the blood stream, and then to other body sites and can cause death unless the person is treated promptly with antibiotics.
- The elderly, infants, and those with impaired immune systems are more likely to have a severe illness.

Salmonellosis 2.

- *Salmonella* infections usually resolve in 5-7 days and often do not require treatment other than oral fluids.
- Persons with severe diarrhea may require rehydration with intravenous fluids.
- Antibiotics, such as ampicillin, trimethoprim-sulfamethoxazole, or ciprofloxacin, are not usually necessary unless the infection spreads from the intestines.
- Some *Salmonella* bacteria have become resistant to antibiotics, largely as a result of the use of antibiotics to promote the growth of food animals.

Salmonellosis 3.

- *Salmonella* live in the intestinal tracts of humans and other animals, including birds. *Salmonella* are usually transmitted to humans by eating foods contaminated with animal feces.
- Contaminated foods usually look and smell normal.
- Contaminated foods are often of animal origin, such as beef, poultry, milk, or eggs, but any food, including vegetables, may become contaminated.
- Thorough cooking kills *Salmonella*. Food may also become contaminated by the hands of an infected food handler who did not wash hands with soap after using the bathroom.

Salmonellosis 4.

- *Salmonella* may also be found in the feces of some pets, especially those with diarrhea, and people can become infected if they do not wash their hands after contact with pets or pet feces.
- Reptiles, such as turtles, lizards, and snakes, are particularly likely to harbor *Salmonella*.
- Many chicks and young birds carry *Salmonella* in their feces.
- People should always wash their hands immediately after handling a reptile or bird, even if the animal is healthy.
- Adults should also assure that children wash their hands after handling a reptile or bird, or after touching its environment.

Shigellosis 1.

- Shigellosis is an infectious disease caused by a group of bacteria called *Shigella*. Most who are infected with *Shigella* develop diarrhea, fever, and stomach cramps starting a day or two after they are exposed to the bacteria.
- The diarrhea is often bloody.
- Shigellosis usually resolves in 5 to 7 days.
- A severe infection with high fever may be associated with seizures in children less than 2 years old.
- Some persons who are infected may have no symptoms at all, but may still pass the *Shigella* bacteria to others.

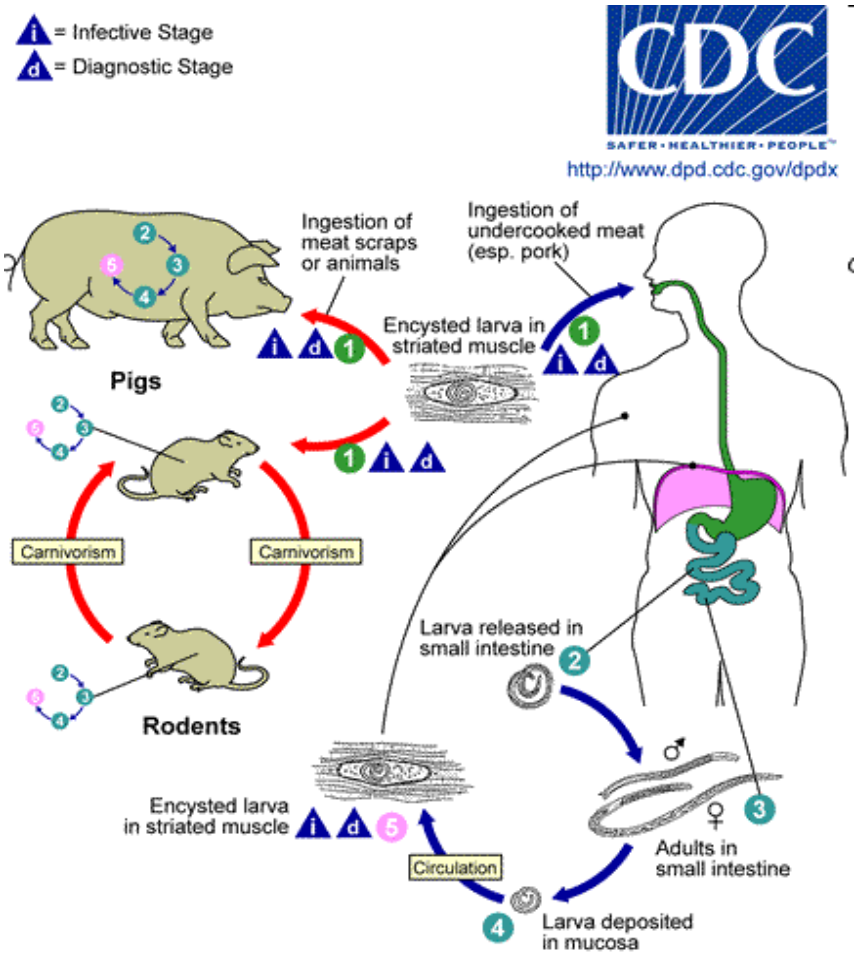
Shigellosis 2.

- Persons with mild infections usually recover quickly without antibiotic treatment.
- However, appropriate antibiotic treatment kills *Shigella* bacteria, and may shorten the illness by a few days.
- The antibiotics commonly used for treatment are ampicillin, trimethoprim/sulfamethoxazole (also known as Bactrim* or Septra*), ceftriaxone (Rocephin*), or, among adults, ciprofloxacin.
- Some *Shigella* bacteria have become resistant to antibiotics.
- This means some antibiotics might not be effective for treatment.
- Using antibiotics to treat shigellosis can sometimes make the germs more resistant.
- Therefore, when many persons in a community are affected by shigellosis, antibiotics are sometimes used to treat only the most severe cases.
- Antidiarrheal agents such as loperamide (Imodium*) or diphenoxylate with atropine (Lomotil*) can make the illness worse and should be avoided.

Trichinellosis 1.

- Trichinellosis (trichinosis) is caused by nematodes (roundworms) of the genus *Trichinella*.
- In addition to the classical agent *T. spiralis* (found worldwide in many carnivorous and omnivorous animals), several other species of *Trichinella* are now recognized, including *T. pseudospiralis* (mammals and birds worldwide), *T. nativa* (Arctic bears), *T. nelsoni* (African predators and scavengers), and *T. britovi* (carnivores of Europe and western Asia).

Trichinellosis 2.



Trichinellosis 3.

- Trichinellosis is acquired by ingesting meat containing cysts (encysted larvae) of *Trichinella*.
- After exposure to gastric acid and pepsin, the larvae are released from the cysts and invade the small bowel mucosa where they develop into adult worms (female 2.2 mm in length, males 1.2 mm; life span in the small bowel: 4 weeks).
- After 1 week, the females release larvae that migrate to the striated muscles where they encyst
- *Trichinella pseudospiralis*, however, does not encyst.
- Encystment is completed in 4 to 5 weeks and the encysted larvae may remain viable for several years.

Trichinellosis 4.

- Ingestion of the encysted larvae perpetuates the cycle.
- Rats and rodents are primarily responsible for maintaining the endemicity of this infection.
- Carnivorous/omnivorous animals, such as pigs or bears, feed on infected rodents or meat from other animals.
- Different animal hosts are implicated in the life cycle of the different species of *Trichinella*.
- Humans are accidentally infected when eating improperly processed meat of these carnivorous animals (or eating food contaminated with such meat).

Trichinellosis 5.

- Light infections may be asymptomatic.
- Intestinal invasion can be accompanied by gastrointestinal symptoms (diarrhea, abdominal pain, vomiting).
- Larval migration into muscle tissues (one week after infection) can cause periorbital and facial edema, conjunctivitis, fever, myalgias, splinter hemorrhages, rashes, and blood eosinophilia.
- Occasional life-threatening manifestations include myocarditis, central nervous system involvement, and pneumonitis.
- Larval encystment in the muscles causes myalgia and weakness, followed by subsidence of symptoms.

Trichinellosis 6.

- Several safe and effective prescription drugs are available to treat trichinellosis.
- Treatment should begin as soon as possible and the decision to treat is based upon symptoms, exposure to raw or undercooked meat, and laboratory test results.
- Steroids are used for infections with severe symptoms, plus mebendazole*, with albendazole* as an alternative.

Typhoid fever

- Typhoid fever is a life-threatening illness caused by the bacterium *Salmonella* Typhi.
- In the United States about 400 cases occur each year, and 75% of these are acquired while traveling internationally.
- Typhoid fever is still common in the developing world, where it affects about 21.5 million persons each year.

How is typhoid fever spread?

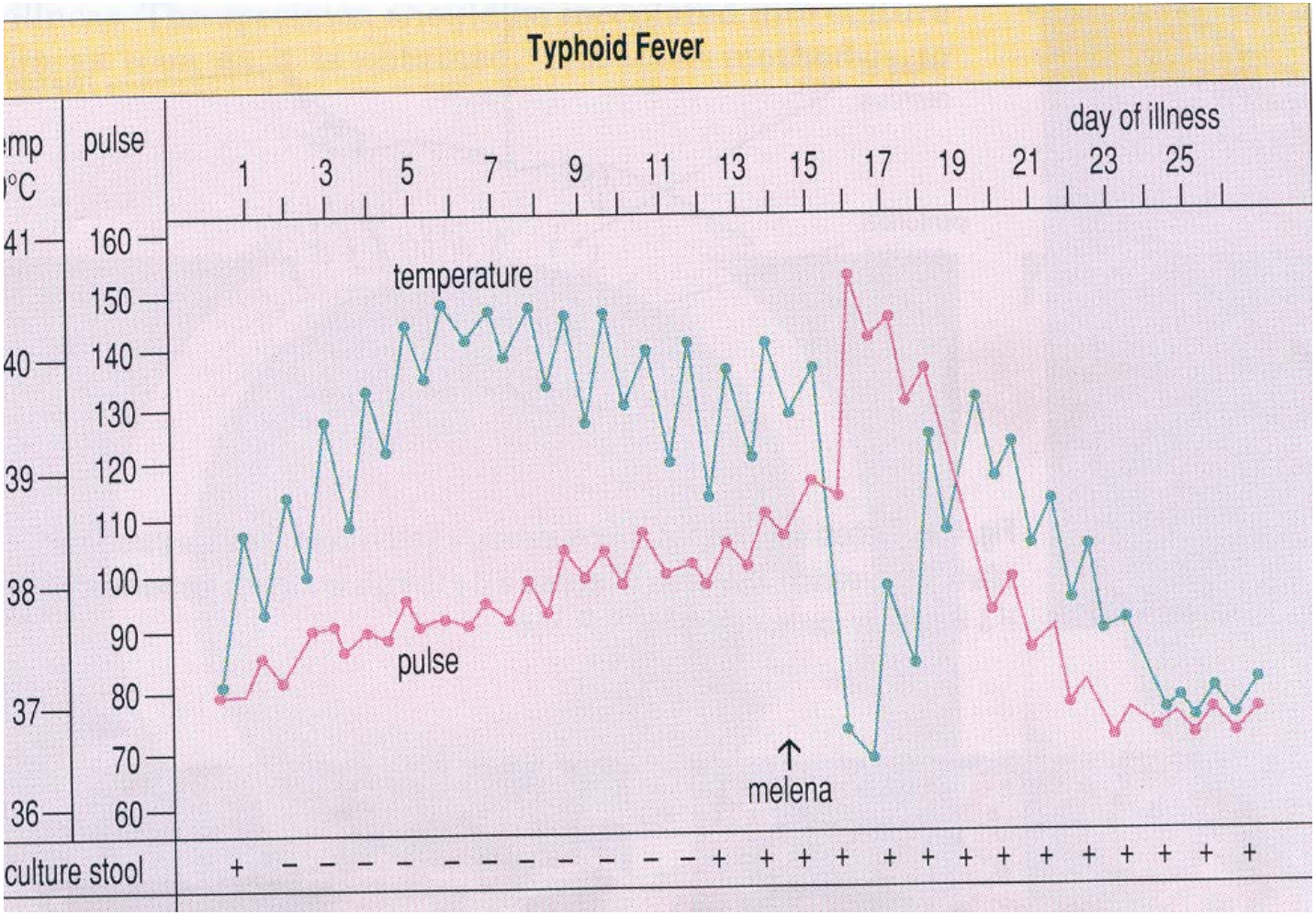
- *Salmonella* Typhi lives only in humans.
- Persons with typhoid fever carry the bacteria in their bloodstream and intestinal tract.
- In addition, a small number of persons, called carriers , recover from typhoid fever but continue to carry the bacteria.
- Both ill persons and carriers shed *S.* Typhi in their feces (stool).

- You can get typhoid fever if you eat food or drink beverages that have been handled by a person who is shedding *S.* Typhi or if sewage contaminated with *S.* Typhi bacteria gets into the water you use for drinking or washing food.
- Therefore, typhoid fever is more common in areas of the world where handwashing is less frequent and water is likely to be contaminated with sewage.

What are the signs and symptoms of typhoid fever?

- Persons with typhoid fever usually have a sustained fever as high as 103° to 104° F (39° to 40° C).
- They may also feel weak, or have stomach pains, headache, or loss of appetite.
- In some cases, patients have a rash of flat, rose-colored spots.
- The only way to know for sure if an illness is typhoid fever is to have samples of stool or blood tested for the presence of *S. Typhi* .

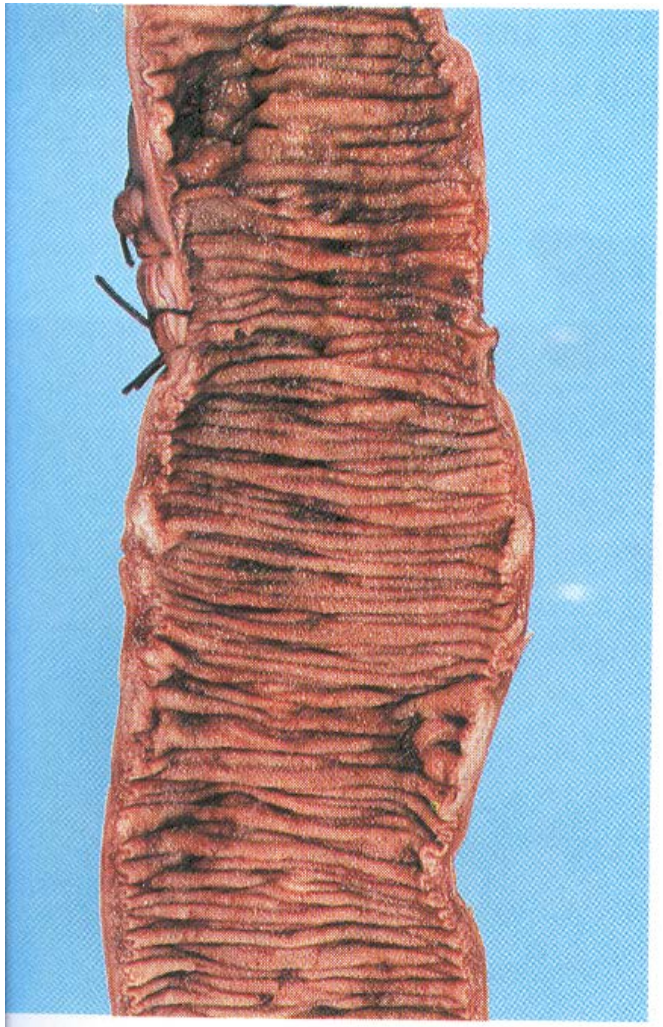
Typhoid fever chart



Typhoid roseola 1.

Typhoid roseola 2.

Perforation of the small intestine due to typhoid fever



Typhoid fever

- Three commonly prescribed antibiotics are used: ampicillin, trimethoprim-sulfamethoxazole, and ciprofloxacin.
- Persons given antibiotics usually begin to feel better within 2 to 3 days, and deaths rarely occur.
- However, persons who do not get treatment may continue to have fever for weeks or months, and as many as 20% may die from complications of the infection.