

The background is a dark blue gradient with several overlapping circles of varying sizes and colors (light blue and white). Some circles are solid, while others are dotted. There are also thin white lines and dashed white lines crossing the circles.

Microbial Diseases of the Digestive System

Normal Microbial Flora of the Digestive System

- Mouth
 - 1 ml saliva = millions of bacteria
- Stomach and small intestine
 - Few organisms due to HCl and rapid movement of food
- Large intestine
 - 100 billion bacteria per gram of feces
 - 40 % of fecal mass is microbial cell material
 - *Lactobacillus, Bacteriodes, Enterobacter, E. coli, Proteus spp.*

Bacterial Diseases of Lower G.I.

• Infections

- Pathogens enters G.I. Tract and multiples
- Bacteria may penetrate the intestinal mucosa or may pass to other systemic organs
- Delay in appearance of symptoms while pathogen increases in number or invades tissue
- Usually a fever

• Intoxications

- Ingestion of a preformed toxin
- Sudden onset of symptoms (few hours)
- Fever not always present

Bacterial Diseases of Lower G.I.

- Diarrhea – infections and intoxications
 - Blood or mucus - dysentery
- Abdominal cramps, nausea and vomiting
 - Defense mechanism to rid body of harmful material
- Gastroenteritis
 - Inflammation of stomach or intestinal mucosa

Campylobacter Gastroenteritis

- *Campylobacter jejuni*
 - Gram (-), microaerophilic spiral
- Most common cause of food borne illness in the U.S.
- Found in the intestines of many animals, especially poultry
 - Almost all retail chicken is contaminated
 - 60 % of cattle is contaminated
 - 2 million cases per year

Escherichia Gastroenteritis

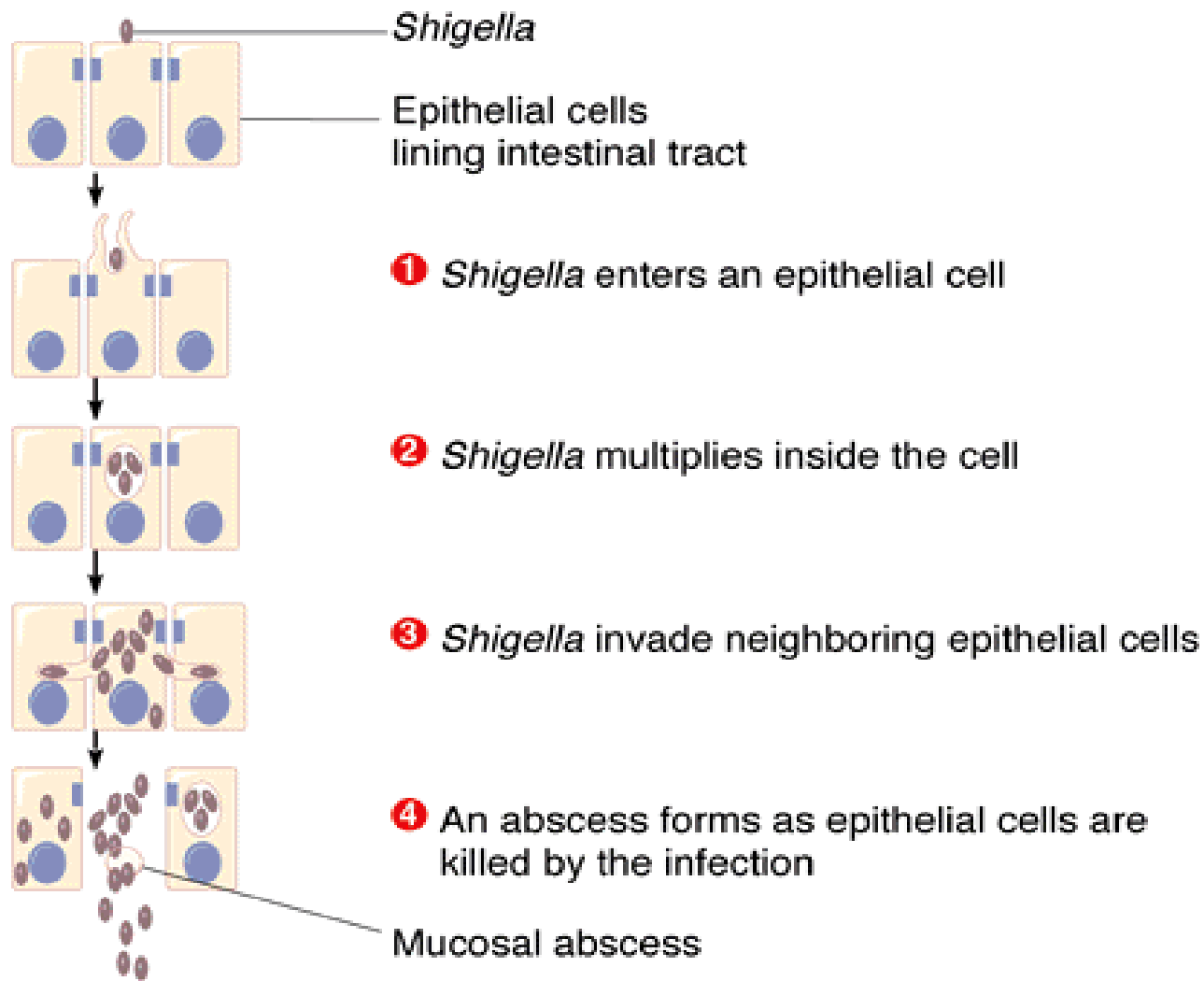
- 1. ETEC - enterotoxigenic *E. coli*
 - Not invasive
 - Enterotoxin – watery diarrhea
- 2. EIEC - enteroinvasive *E. coli*
 - Invades intestinal wall
 - Inflammation, fever & Shigella-like dysentery
- 3. EHEC - enterohemorrhagic *E. coli*
 - *E. coli* O157: H7
 - Found in intestines of animals, especially cattle
 - Hemorrhagic colitis – inflammation of colon with bleeding
 - HUS – Hemolytic Uremic Syndrome
 - Blood in urine leading to kidney failure (kidneys effected by toxin)

Shigellosis (Bacillary Dysentery)

- Bacterial infection - *Shigella sp.* Gram (-), facultative, rods
 - *Shigella sonnei*
 - *Shigella dysenteriae*
 - *Shigella flexneri*
 - *Shigella boydii*
- Incubation period:
 - 12 hours to 2 weeks
- Usually fever
- Mild case of Shigellosis
 - Traveler's Diarrhea
 - Montezuma's Revenge
 - Green Apple Two Step
 - *Shigella sonnei*

Toxin

- **Shiga toxin – Kiyoshi Shiga**
 - Unusually virulent
 - Bacteria invade intestinal mucosa – produce toxin
 - Severe diarrhea with blood in stool (dysentery)
 - Toxin inhibits Protein Synthesis
 - Cells lining G.I. tract are shed
 - Up to 20 bowels movements a day



20,000 – 30,000 cases per year in U.S.

5 – 15 deaths

Shigella dysenteriae – more severe - Mortality Rate = 20 %

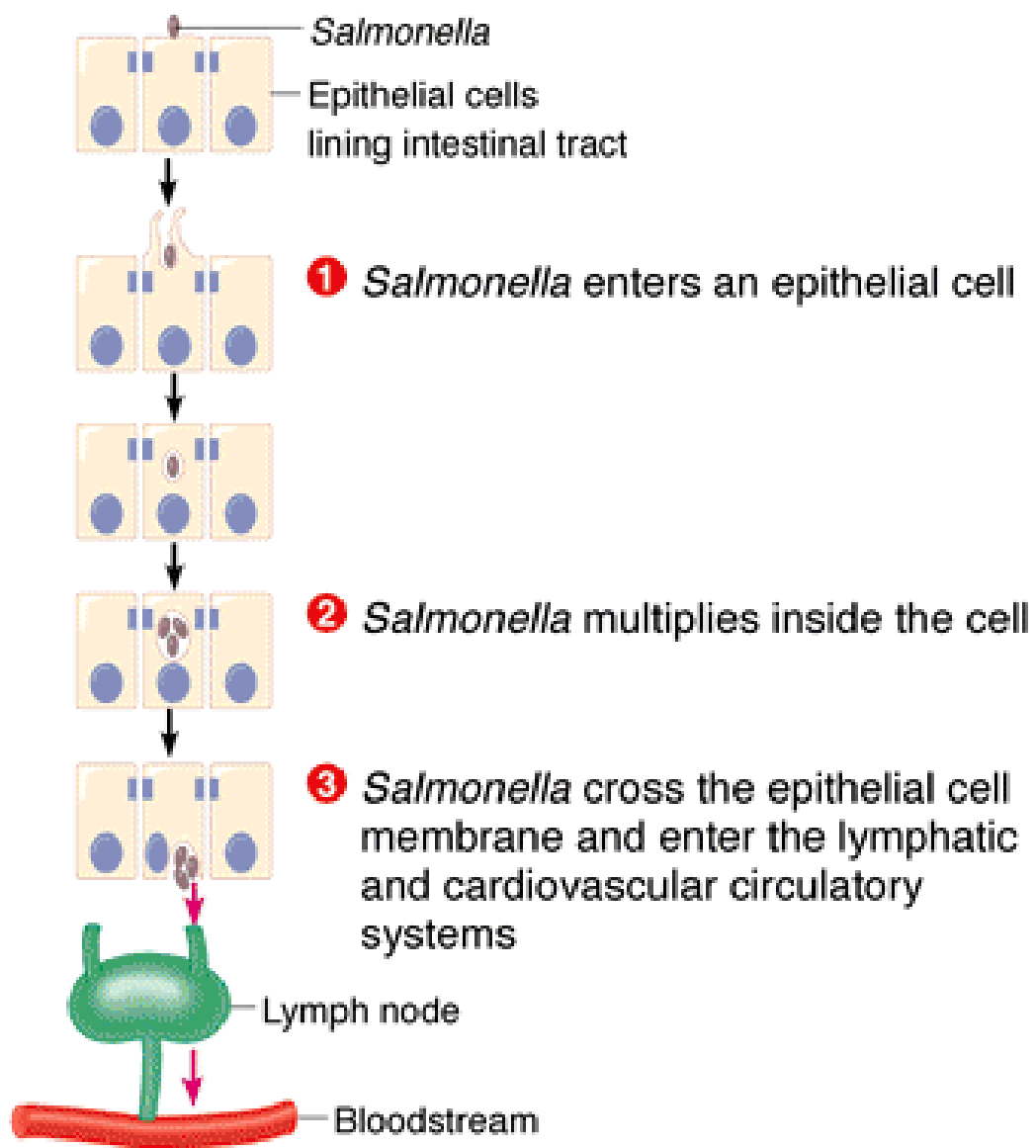
Salmonellosis

(Salmonella Gastroenteritis)

- Bacterial Infection – *Salmonella sp.*
- *Salmonella*
 - Gram (-), facultative, non-spore forming rods
 - Found in G.I. Tract of humans and many animals
 - All are considered pathogenic
- Taxonomy
 - Use serotype rather than species
 - Over 2000 serotypes (50 common in U.S.)
 - *Salmonella arizonae* *Salmonella brazil*
 - *Salmonella atlanta* *Salmonella pakistan*
 - *Salmonella berlin* *Salmonella californica*

Salmonellosis

- Incubation time 12 – 36 hours
- Bacteria invade the intestinal mucosa and multiply
- May pass thru mucosa into lymphatic or circulatory system and become systemic
- Fever, abdominal pain, cramps and diarrhea



Salmonellosis

- 1 billion *Salmonella* per gram of feces
- Mortality rate < 1 %
 - Higher in infants and elderly
- Recovery in a few days
 - Some may shed bacteria in feces for 6 months

Salmonellosis

- Contamination
 - Meats, poultry, eggs, pet reptiles (turtles)
- Undercooked or Raw Eggs
 - Hollandaise sauce
 - Cookie batter
 - Caesar salads
 - “Sunny side up” fried eggs

Typhoid Fever

- *Salmonella typhi* - most virulent *Salmonella*
- Only found in humans (feces)
- Systemic disease
 - Spreads thru body, found in blood, urine, feces
- Mortality rate 1-2 %, used to be 10 %
 - Was common before days of proper sewage treatment
 - Still common in Third World countries

Typhoid Mary

- Mary Mallon – cook in N.Y.
- carrier
 - Responsible for several outbreaks and many deaths
 - Refused to leave her job
- 1 – 3 % become chronic carriers
 - Microbe lives in gallbladder and is shed in feces

Cholera

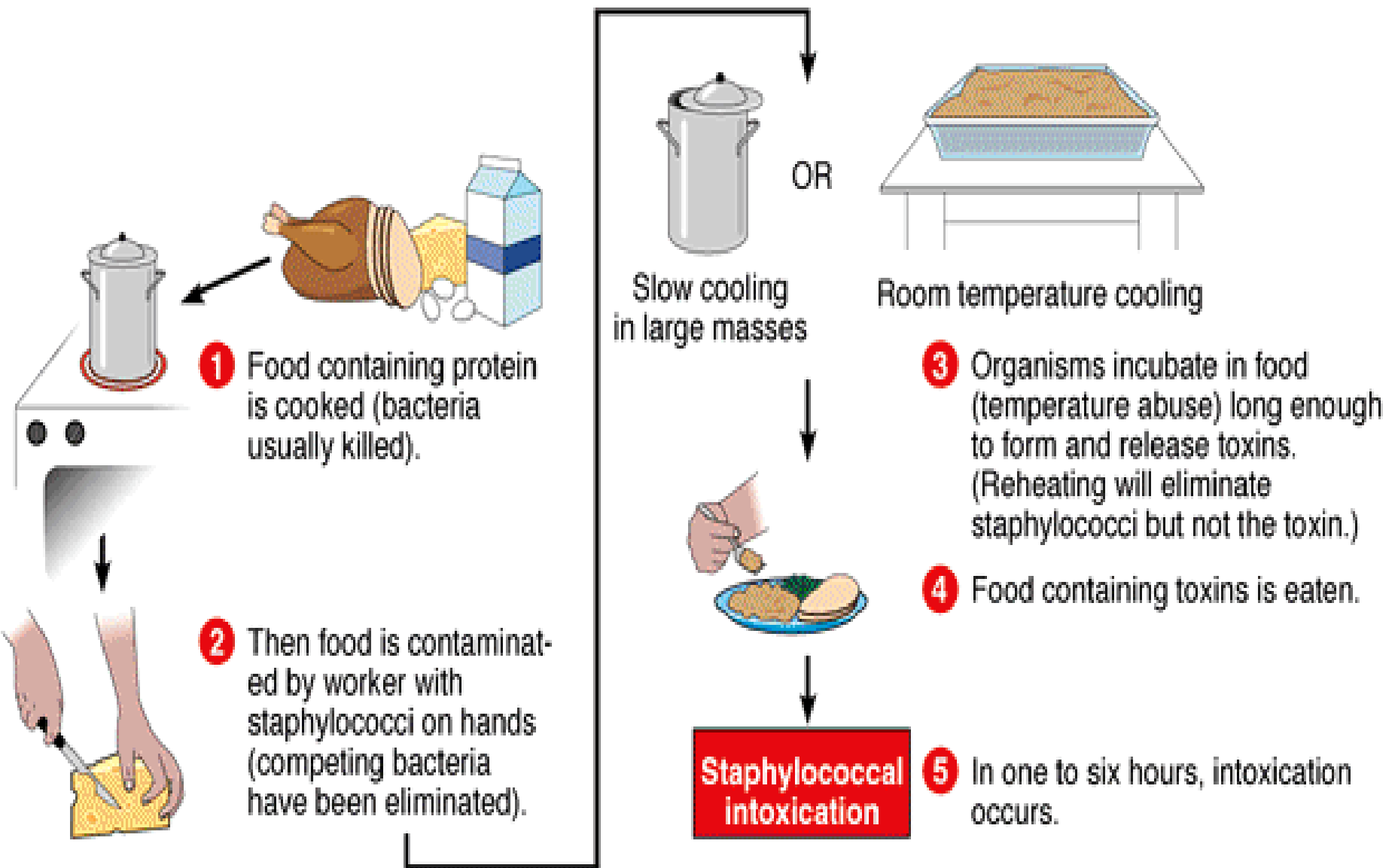
- *Vibrio cholerae* - Gram (-) curved rod
- Endemic in Asia and India
- Cholera toxin
 - Secretion of Cl^- leads to H_2O loss and diarrhea
 - 12 – 20 liters of fluid per day (3 – 5 gallons)

Food Poisoning from Seafood

- *Vibrio parahaemolytica*
 - Found in salt H₂O estuaries
 - Associated with poisoning from
 - Raw oysters
 - Shell fish
 - Shrimp
 - crabs

Staphylococcal Food Poisoning (Staphylococcal intoxication)

- Ingesting an enterotoxin by *Staph. aureus*
- *Staphylococci*
 - High resistance to heat
 - Resistant to drying out
 - Resistant to high osmotic pressures
 - Resistant to high salt conc.
- Found in nasal passages and hands
 - Contaminate food



* 1 million bacteria per gram of food to produce enough enterotoxin to cause illness

Most reliable method of preventing Staphylococcal intoxication:

- Adequate refrigeration during storage to prevent toxin production
- Toxin
 - Triggers vomiting reflex center of brain
 - Abdominal cramps & diarrhea
 - Recovery usually complete in 24 hours.
 - Mortality rate – 0 % in healthy people

Peptic Ulcers

- *Helicobacter pylori* – microaerophilic spiral
- 30% - 50 % of normal pop. are infected, but only 15% of those develop ulcers



- Urea Breath Test
 - Swallow radio-active urea
 - If positive, patient will exhale radio-active CO_2 within 30 minutes

Hepatitis

- Inflammation of the liver
- Viral Hepatitis - 2nd most frequently reported infectious disease in the U.S.
- 5 different viruses
 - Hepatitis A
 - Hepatitis B
 - Hepatitis C
 - Hepatitis D
 - Hepatitis E

Hepatitis A (Infectious Hepatitis)

- HAV ss RNA no envelope
 - Enters via oral route, multiplies in G.I. Tract spreads to liver
 - Virus is shed in feces
 - HAV is resistant to normal chlorine disinfectants used for water
 - HAV can survive several days on surfaces (cutting boards)
- 50% of infections are subclinical
 - Symptoms
 - Nausea diarrhea abdominal discomfort
 - Fever chills jaundice
- Recovery results in lifelong Immunity
 - No chronic Hepatitis A

Hepatitis B (Serum Hepatitis)

- HBV ds DNA envelope
- Transmitted by blood, semen, saliva, breast milk
- 50% cases asymptomatic
 - Symptoms
 - Loss of appetite fever joint pains jaundice
- 10% become chronic carriers of HBV
 - Chronic carriers are 200 times more likely to develop liver cancer
- HBV Vaccination required in Illinois Schools
 - Recommended for high risk individuals (health care workers)

Hepatitis C (Non A, Non B Hepatitis)

- HCV ss RNA envelope

