

❖ Part 3: Gastrointestinal Gram-Negative Rods:

All of the organisms covered in this part are routinely found in the gastrointestinal (GI) tract of humans or other animals. Many also have alternative habitats in soil or water. All are relatively hardy but are sensitive to drying, and all grow in the presence or absence of oxygen, being facultative anaerobes. Fecal contamination is important in the transmission of organisms cause GI diseases ,Gram-negative enteric rods discussed in this part are listed in bellow:-

- 1- Compylobacter spp.
- 2- Escherichia spp.
- 3- Helicobacter spp.
- 4- Klipseilla spp.
- 5- Protues spp.
- 6- Salmonella spp.
- 7- Shigilla spp.
- 8- Vibrio spp.
- 9- Yersinia spp.

❖ Genus :- Escherichia Species :- Escherichia coli

Escherichia coli is part of the normal flora of the colon in humans and other animals but can be pathogenic both within and outside of the GI tract.

❖ Clinical significance: intestinal disease

Transmission of intestinal disease is commonly by the fecal-oral route, with contaminated food and water serving as vehicles for transmission. At least five types of intestinal infections that differ in pathogenic mechanisms have been identified :-

- **Enterotoxigenic *E. coli* ETEC:** (cause Watery diarrhea)are a common cause of traveler'sndiarrhea. Transmission occurs through food and water contaminated with human waste or by person-to-person contact.
- **Enteropathogenic *E. coli* EPEC:** Watery diarrhea of long duration, mostly in infants, often in developing countries especially in locations with poor sanitation. Newborns become infected perinatally.
- **Enterohemorrhagic *E. coli* EHEC:** Bloody diarrhea; Hemorrhagic colitis and hemolytic uremic syndrome (HUS)
- **Enteroinvasive *E. coli* EIEC:** EIEC cause a dysentery-like syndrome with fever and bloody stools.(Bloody diarrhea)
- **Enteroadgregative *E. coli* EAEC:** Persistent watery diarrhea in children and patients infected with HIV
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❖ Clinical significance: extraintestinal disease:

1. Urinary tract infection: *E. coli* is the most common cause of urinary tract infection {UTI}, including cystitis and pyelonephritis.Women are particularly at risk for infection

2. Neonatal meningitis: *E. coli* is a major cause of this disease occurring within the first month of life. The source of infection is frequently the mother's GI tract with perinatal exposure.

3-Nosocomial (hospital-acquired) infections: These include sepsis/bacteremia, endotoxic shock, and pneumonia.

❖ **Laboratory identification**

1. Intestinal disease: Because *E. coli* is normally part of the intestinal flora, detection in stool cultures of disease-causing strains is difficult and not usually attempted.

2-Extraintestinal disease: Isolation of *E. coli* from normally sterile body sites (eg, the bladder, blood, or cerebrospinal fluid) is diagnostically significant.

❖ **Prevention and treatment**

Intestinal disease can best be prevented by care in selection, preparation, and consumption of food and water.

Gram (-) rods

Escherichia species

Gram-negative rods

E. coli (Gram stain)

MacConkey agar

- Short rods
- Facultative anaerobe
- Ferments glucose
- Most strains ferment lactose
- Catalase positive
- Oxidase negative
- Culture on MacConkey agar

Escherichia coli

- Urinary tract infection (UTI)
 - 1 Ciprofloxacin
 - 1 Trimethoprim/sulfamethoxazole
- Local or systemic disease
 - Test for sensitivity
 - Empiric therapy may include:
 - 1 Ampicillin
 - 1 Cefotaxime
 - 1 An aminoglycoside
 - 1 Ciprofloxacin
 - 1 Trimethoprim/sulfamethoxazole
- Meningitis in infants
 - 1 Cefotaxime

❖ **2- Genus: Salmonella**

Species : Salmonella enteritidis

Salmonella typhi

Salmonella typhimurium

Members of the genus *Salmonella* can cause a variety of diseases, including gastroenteritis and enteric (typhoid) fever.

Epidemiology

Salmonella are widely distributed in nature. Serovar Typhi is an exclusively human pathogen, whereas other serovars are associated with animals and foods (eg, eggs and poultry). Fecal-oral transmission occurs, and *Salmonella* serovar Typhi transmission may involve chronic carriers. Young children and older adults are particularly susceptible to *Salmonella* infection

Pathogenesis : *Salmonella* invade epithelial cells of the small intestine. Disease may remain localized or become systemic,

Clinical significance

1. Gastroenteritis: This localized disease (also called salmonellosis) is caused primarily by serovars Enteritidis and Typhimurium.

Enteric or typhoid fever: This is a severe, life-threatening systemic illness, characterized by fever and, frequently, abdominal symptoms

3. Other sites of *Salmonella* infection: Sustained bacteremia is often associated with vascular *Salmonella* infections that occur when bacteria seed atherosclerotic plaques.

Laboratory identification

In patients with diarrhea, *Salmonella* can typically be isolated from stools on culture media .For patients with enteric fever, appropriate specimens include blood, bone marrow, urine, stool, and tissue from typical rose spots (if they are present).

Treatment and prevention

For gastroenteritis in uncompromised hosts, antibiotic therapy is often not needed and may prolong the convalescent carrier state. For enteric fever, appropriate antibiotics include beta-lactams and fluoroquinolones ,Prevention of *Salmonella* infection is accomplished by proper sewage disposal, correct handling of food, and good personal hygiene.

Gram (-) rods

Salmonella species

● Short, flagellated rods
● Facultative anaerobes
● Ferment glucose
● Do not ferment lactose
● Catalase positive
● Oxidase negative
● Culture on MacConkey agar

Serovars Enteritidis and Typhimurium

- Enterocolitis (gastroenteritis, food poisoning)

Antibiotics are not normally used except in immunocompromised individuals to prevent systemic spread of the infection. They may be used in individuals older than age 50 years to prevent seeding of atherosclerotic plaques.

Serovar Typhi

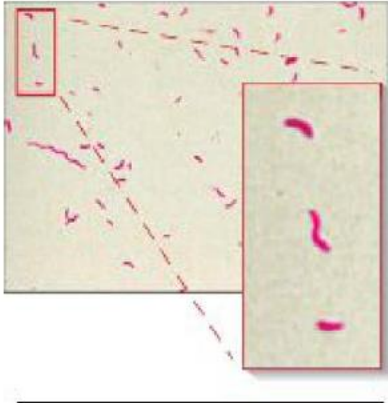
- Enteric (typhoid) fever and paratyphoid fever

1 Ceftriaxone
1 Ciprofloxacin

Salmonella enterica serovar Typhi
Salmonella species on MacConkey agar

❖ 3- Genus: Campylobacter Species :Campylobacter jejuni Campylobacter fetus

Members of the genus *Campylobacter* are curved, spiral, or S-shaped organisms that microscopically resemble vibrios see figure bellow, Most *Campylobacter* are microaerophilic (ie, they require oxygen but at lower concentrations than that found in air). *Campylobacter* infect the intestine and can cause ulcerative, inflammatory lesions in the jejunum, ileum, or colon. Rarely, bacteremia may occur.



❖ Epidemiology

Campylobacter are widely distributed in nature as commensals of many different vertebrate species, including mammals and fowl, both wild and domestic.

❖ Pathogenesis and clinical significance

Campylobacter may cause both intestinal and extraintestinal disease. Infections (eg, with *Campylobacter*) have longer incubation periods and require colonization by the bacterium. *C. jejuni* typically causes an acute enteritis in otherwise healthy individuals following a 1-7 day incubation. The disease lasts days to several weeks and, generally, is self-limiting. Symptoms may be both systemic (fever, headache, myalgia) and intestinal (abdominal cramping and diarrhea, which may or may not be bloody). *Campylobacter jejuni* is associated with both traveler's diarrhea and pseudoappendicitis (symptoms simulating appendicitis without inflammation of the appendix). Bacteremia (often transient) may occur, most often in infants and older adults. Complications include septic abortion, reactive arthritis,

❖ Laboratory identification

Campylobacter can be isolated from feces using special selective media and microaerophilic conditions. Because of their small size, presumptive diagnosis can be made on the basis of finding curved organisms with rapid, darting motility in a wet mount of feces.

Treatment and prevention

Diarrhea should be treated symptomatically with fluid and electrolyte replacement. For patients with more severe symptoms (eg, high fever, bloody diarrhea, worsening illness, or illness of more than 1 week's duration), antibiotics should be administered.

Gram (-) rods **Campylobacter species**

Campylobacter jejuni

- Acute enteritis
- Traveler's diarrhea
- Pseudoappendicitis
- ☑ Erythromycin
- ☑ Ciprofloxacin

Campylobacter jejuni

Campylobacter jejuni
(Preston selective medium)

- Curved, spiral, or S-shaped rods
- Single, polar flagellum, resulting in characteristic darting motion
- Microaerophilic
- Do not ferment carbohydrates
- Culture on selective medium (blood agar containing antibiotics to inhibit growth of other fecal flora)