

❖ **Clostridium perfringens**

- Five types of *C. perfringens* (A-E) are recognized.
- Human disease is caused by types A and C.
- All types produce *alpha* toxin, a major lethal toxin.

Pathogenicity:

- *C. perfringens* type A1: Causes gas gangrene (myonecrosis), anaerobic cellulitis, puerperal infection and septicaemia.
- *C. perfringens* type A2: Causes food-poisoning, usually within 8-12 hours of ingesting contaminated meat.

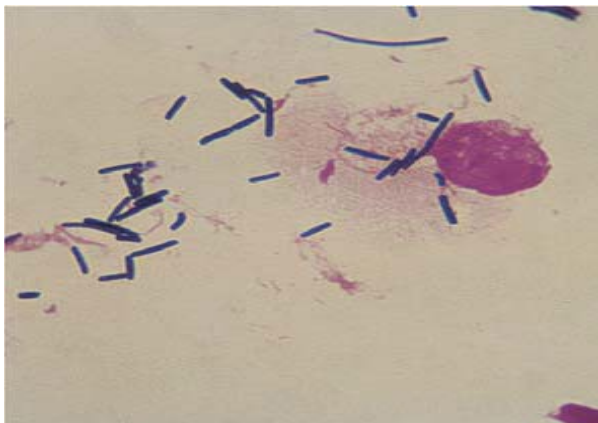
Specimens:

- 1- Material from wounds, necrotic tissue, and exudate to investigate gas gangrene.
- 2- Faeces and suspected food to investigate food poisoning.

Morphology: *C. perfringens* is a Gram positive thick brick-shaped rod.

Culture: *C. perfringens* is a facultative anaerobe which can be cultured, both anaerobically and microaerophilically.

Blood agar: Large *beta*-haemolytic colonies are produced.



C. perfringens - Gram staining - Gram positive rods.

❖ **Clostridium tetani**

Pathogenicity:

- *C. tetani* causes tetanus (lockjaw), a serious often fatal disease caused by the neurotoxin (tetanospasmin) produced by *C. tetani* when it multiplies in the tissues.

Laboratory Features:

Most patients with tetanus can be diagnosed clinically. Occasionally laboratory investigation may be required.

Morphology: *C. tetani* is a Gram positive.

Culture: *C. tetani* is anaerobe.

❖ **Neisseria gonorrhoeae**

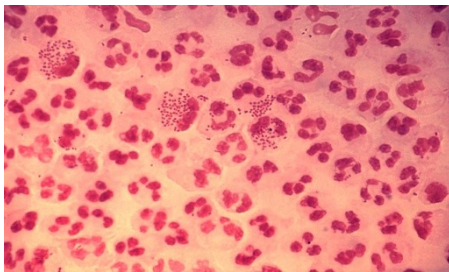
Pathogenicity:

- *N. gonorrhoeae* causes Gonorrhoea, the urogenital tract infection.
- Gonorrhoea is sexually transmitted.

Specimens: Urethral and cervical exudate, urine.

Morphology: *N. gonorrhoeae* is Gram negative diplococcus.

Culture: *N. gonorrhoeae* is an aerobe or facultative anaerobe.



N. gonorrhoeae - Gram negative - Diplococcus

◆ **Enterobacteria**

- Large group of Gram negative rods.
- Aerobes and facultative anaerobes.
- They are naturally found in the intestinal tract, in soil and water.
- Cause primary and opportunistic infections in humans.
- Belong mainly to the following genera:

***Lactose
fermenting***

- *Escherichia*¹
- *Klebsiella*¹

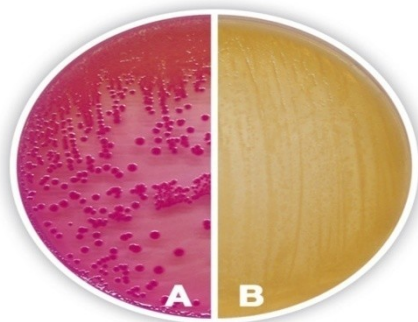
- *Enterobacter*^{1,2}
- *Citrobacter*^{1,2}

***Non-lactose
fermenting***

- *Salmonella*
- *Shigella*
- *Proteus*
- *Morganella*
- *Yersinia*

- *Providencia*²
- *Serratia*²
- *Edwardsiella*²
- *Hafnia*²

- 1 Often referred to as coliforms.
- 2 Less common human pathogen, often opportunistic or hospital-acquired.



A: Lactose fermenting

B: Non - Lactose fermenting

❖ ***Escherichia coli***

Pathogenicity:

E. coli causes:

- 1- Urinary tract infections.
- 2- Infections of wounds, peritonitis, sepsis and endotoxin induced shock.
- 3- Meningitis and bacteraemia in neonates.
- 4- Diarrhoeal disease: infantile gastroenteritis, traveller's diarrhoea, dysentery, and haemorrhagic diarrhoea which may progress to haemolytic uraemic syndrome.

***E. coli* strains associated with diarrhoeal disease:**

- 1- ETEC (Enterotoxigenic *E. coli*).
- 2- EPEC (Enteropathogenic *E. coli*).
- 3- EIEC (Enteroinvasive *E. coli*).
- 4- EHEC (Enterohaemorrhagic *E. coli*) - Serogroup 0157:H7

5- EaggEC (Enteraggregative *E. coli*).

Specimens: Depending on site of infection, specimens include urine, pus, faeces, cerebrospinal fluid, and blood for culture.

Morphology: *E. coli* is a Gram negative.

Culture: *E. coli* is an aerobe and facultative anaerobe.

Blood agar: The colonies may appear mucoid. Some strains are haemolytic.

MacConkey agar: *E. coli* ferments lactose, producing smooth pink colonies.



E.coli on MacConkey agar - ferments lactose - pink colonies

❖ **Shigella species**

Based on antigenic structure and biochemical reactions, *Shigella* organisms are divided into four subgroups:

- 1- Subgroup A: *Shigella dysenteriae*
- 2- Subgroup B: *Shigella flexneri*
- 3- Subgroup C: *Shigella boydii*
- 4- Subgroup D: *Shigella sonnei*

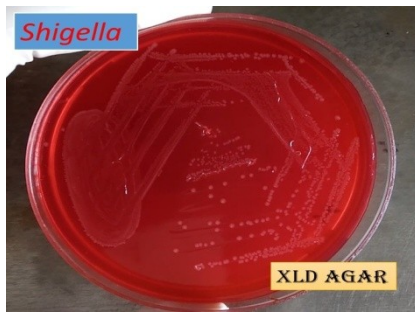
Pathogenicity: *Shigella* species cause bacillary dysentery, or Shigellosis.

Specimens: A fresh faecal specimen is required to isolate *Shigella* species. Transport medium.

Morphology: Shigellae are Gram negative.

Culture: Shigellae are aerobes and facultative anaerobes. Selective medium is required.

Xylose Lysine Deoxycholate XLD agar: Shigellae produce red-pink colonies.



Red-pink colonies

❖ **Salmonellae**

Classification of salmonellae:

- All pathogenic salmonellae belong to a single species, *Salmonella enterica* which is subdivided into 7 subspecies (subsp.).
- *S. enterica* subsp. *enterica* has over 2000 serovars which can cause disease in humans.

Pathogenicity:

The following diseases are caused by *Salmonella*:

- 1- Enteric fever (Typhoid and paratyphoid).
- 2- Diarrhoeal disease (Enterocolitis).
- 3- Bacteraemia.

Specimens:

- 1- Enteric Fever:
 - Specimens include blood, faeces, and urine for culture.
- 2- Diarrhoeal Disease:
 - Faeces and blood for culture.
- 3- Bacteraemia:
 - Blood for culture.

Morphology: Salmonellae are Gram negative rods.

Culture:

- Salmonellae are aerobes and facultative anaerobes.
- A selective medium is required to isolate salmonellae from faecal specimens.

Columbia agar-broth medium: is recommended because this can be used for all salmonellae and other pathogens that cause bacteraemia.

Blood agar: Salmonellae produce grey-white nonhaemolytic colonies.

XLD agar:

- Salmonellae produce H_2S , form pink red colonies with black centres.
- Salmonellae do not produce H_2S , form pink red colonies without black centres.



Salmonellae on Blood agar - Grey-white - non haemolytic colonies

❖ **Vibrio cholera**

Pathogenicity: *V. cholerae* causes cholera.

- Two serogroups of *V. cholera* cause epidemic cholera:
 - 1- *V. cholerae* 01
 - 2- *V. cholerae* 0139

Specimens:

- faecal:
 - ✓ To test directly for *V. cholera* antigen.
 - ✓ To isolate *V. cholerae* in culture.
- Transport medium (Alkaline peptone water) may required.

Morphology: *V. cholerae* is a Gram negative, curved rod (vibro), with a single flagellum at one end.



Culture: *V. cholerae* is an aerobe and facultative anaerobe.

Alkaline peptone water: *V. cholerae* grows rapidly, usually within 4–6 hours.

Blood agar: *V. cholerae* 01 and 0139 grow on blood agar, often producing *beta* haemolytic colonies.



V. cholerae on Blood agar, *beta* haemolytic colonies

❖ **Helicobacter pylori**

- *H. pylori* are Gram-negative rods, spirally shaped.
- Cultures from stomach biopsies are grown on enriched mediums and selective mediums under microaerobic conditions for three to four days.
- It grows slowly, forming grey translucent colonies.
- **Blood agar:** Colonies are slightly *beta*-haemolytic.

❖ **Brucella species**

- *Brucella abortus*, *B. melitensis*, and *B. suis* cause brucellosis, a classic zoonosis that affects cattle, goats, and pigs.
- The pathogens can be transmitted to humans directly from diseased animals or indirectly in food, causing undulant fever or Bang's disease.

Caution: Brucellae are highly infectious.

Specimens: Blood or bone marrow for culture.

Morphology: Brucellae are small Gram negative, coccobacilli or short rods.

Culture:

- *Brucella* species are difficult to isolate.
- Brucellae are aerobic.
- *B. abortus* requiring a carbon dioxide enriched atmosphere.

Tryptone soya (tryptic soy) medium: is recommended for the isolation of *Brucella* species.

Class3

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With my best wishes.