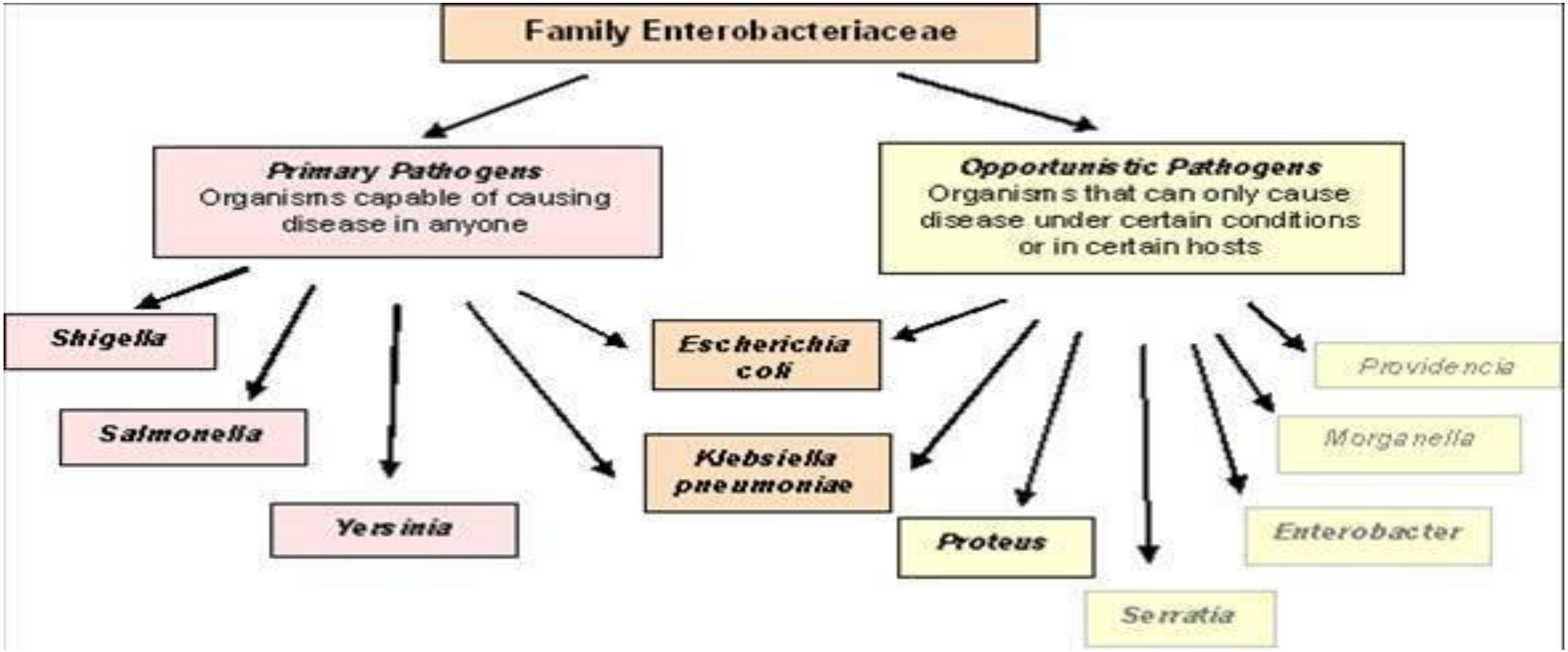
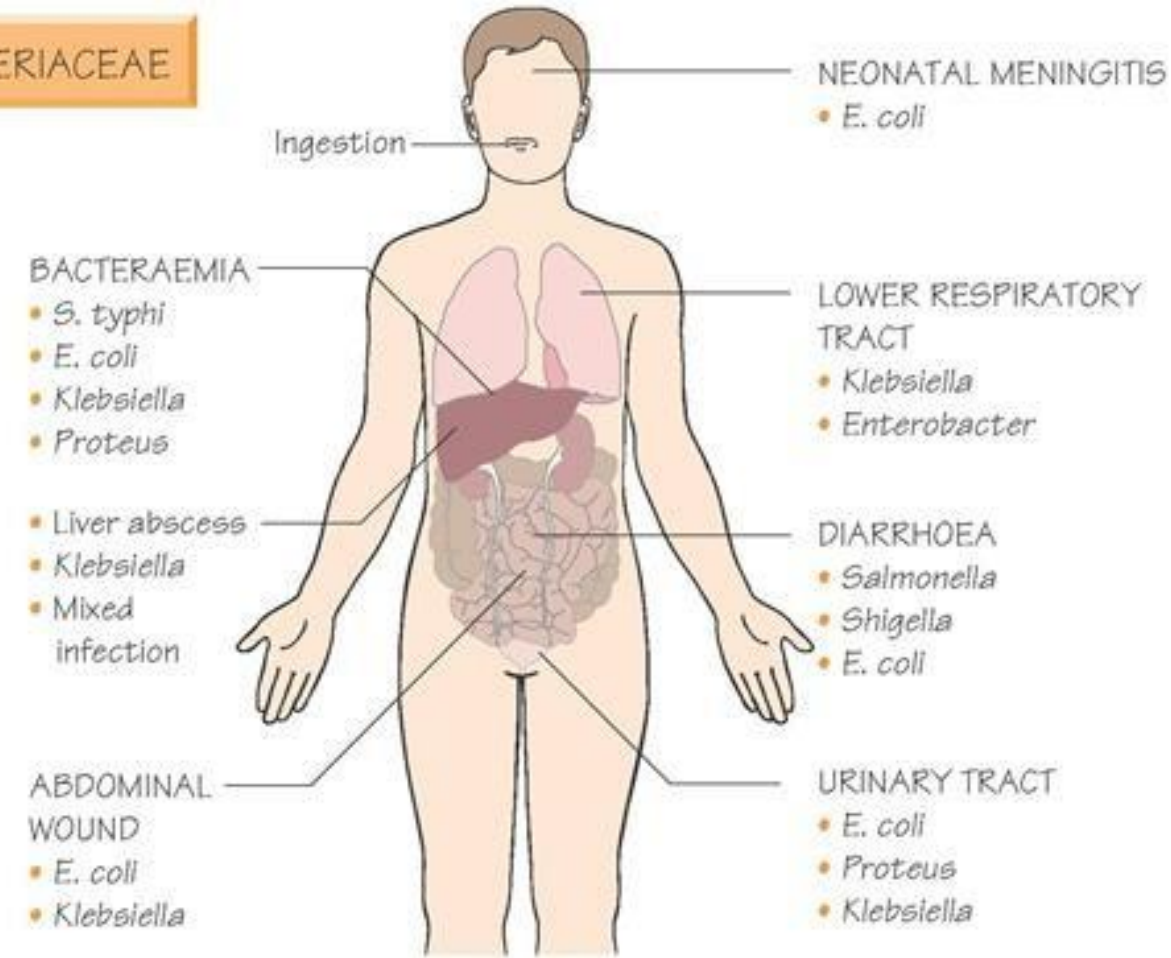
Family Enterobacteriaceae

Members - Family Enterobacteriaceae



INFECTION BY ENTEROBACTERIACEAE



Family Enterobacteriaceae

- Some are commensals & some are pathogens.
- Found in soil, water, plants.
- Principal habitat - lower GIT
- Infections may be sporadic or occur in outbreaks

Members are

- Gram-negative bacilli
- Non-spore-forming
- Facultative anaerobes
- All ferment glucose and some ferment other sugars
- Reduce nitrate to nitrite
- Produce catalase
- **Do not produce oxidase**
- Most are motile - peritrichous flagellae

- Produce relatively large, dull gray, dry / mucoid colonies on blood agar
- Haemolysis variable
- Biochemical profile can make species identification

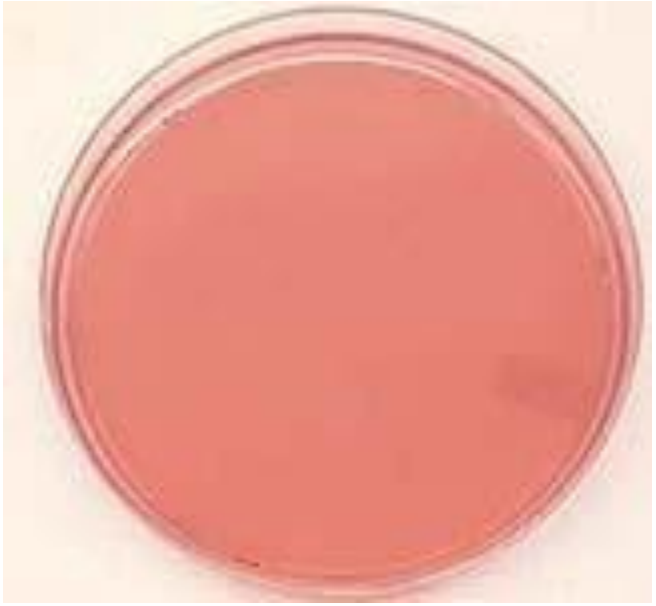
Culture media use to detect the organisms

1. Non selective media

Use for primary isolation

Eg: Blood agar

2.Selective media



Isolation media

Eg: MacConkey agar

1.Contains **lactose.**

pH indicator-Neutral red

Lactose fermenters produce pink colour colonies.

Eg:*E.coli*, Klebsiella

3. Highly selective media

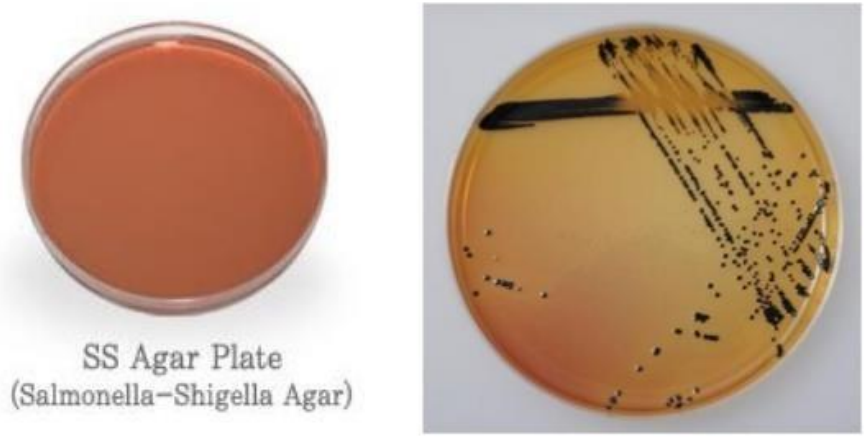
Made highly selective by adding inhibitors in higher concentrations.

Eg: SS agar.

-Inhibit growth of coliforms.

-Allows to grow Salmonella , Shigella only.

Salmonella Shigella agar



SS Agar Plate
(Salmonella–Shigella Agar)

- For isolation and differential medium for pathogenic Gram-negative bacilli in particular, Salmonella and Shigella. Inhibitor for Coliforms.

Dr. Nabil El Aila
General Microbiology

4.Enrichment media

Enhance the growth of certain bacterial specieswhile inhibiting unwanted microorganisms.

Eg:Selenite broth.

-Inhibitory to *E.coli* & other coliforms

-Enhance the growth of Salmonella,Shigella.

Motility

Bacteria can move by flagella.

Tests can be used to detect the motility

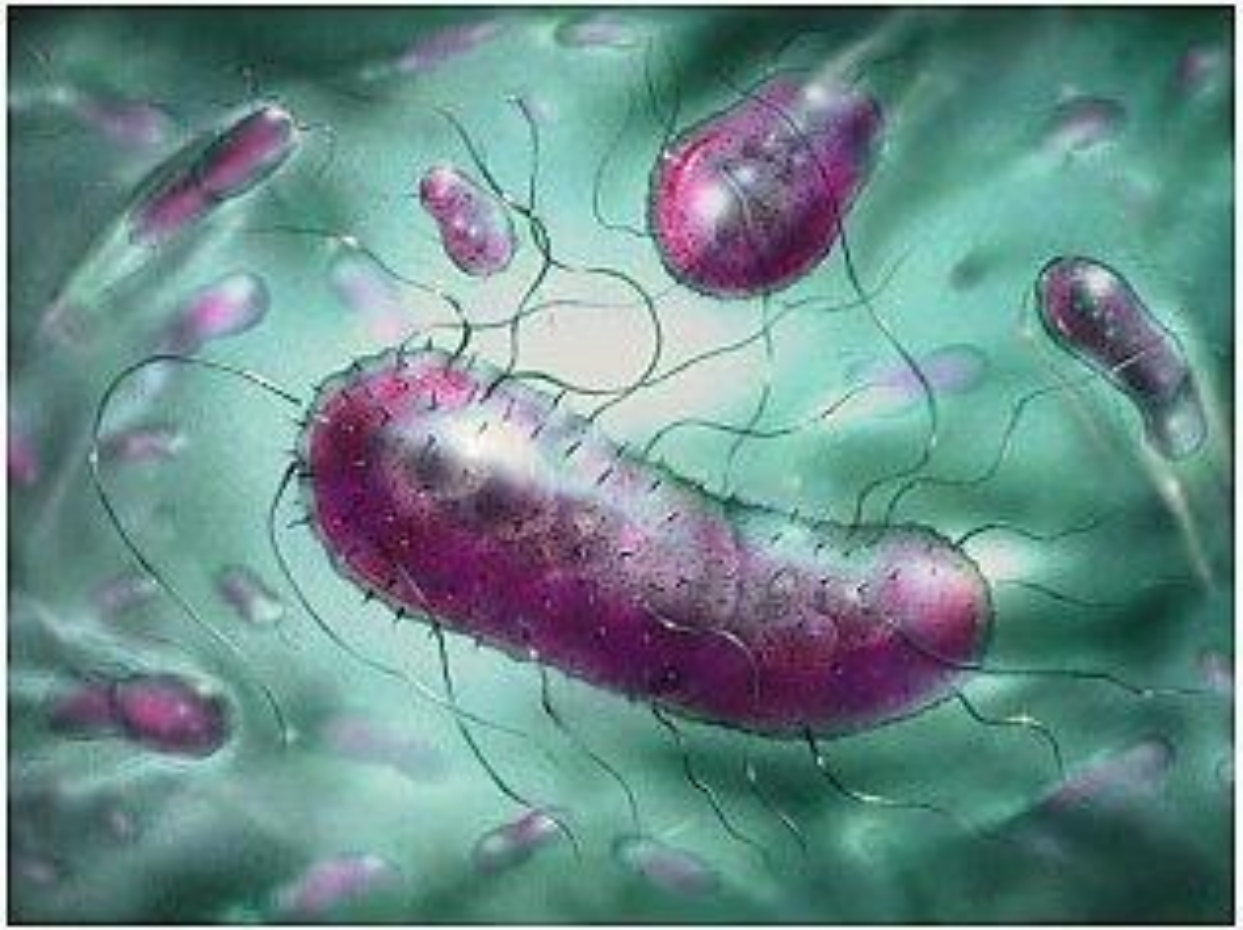
1. Hanging drop technique

Non motile	**Motile**
Shigella	Proteus
Klebsiella	Salmonella
	E. coli

Ix

1. Gram staining
2. Culture
   - Immediately after collection
   - On BA/ MA / selective media
   - Overnight incubation at 37^0C
3. Biochemical investigations
4. Serotyping
   - Using type specific antisera

Escherichia coli



Clinical manifestations

Intestinal

- ♣ Diarrhoea
- ♣ Dysentery

Extra intestinal

- ♣ UTI (Most common cause)
- ♣ Wound infections
- ♣ Pneumonia (nosocomial)
- ♣ Neonatal meningitis
- ♣ Abscess
- ♣ Peritonitis
- ♣ Billiary tract infections

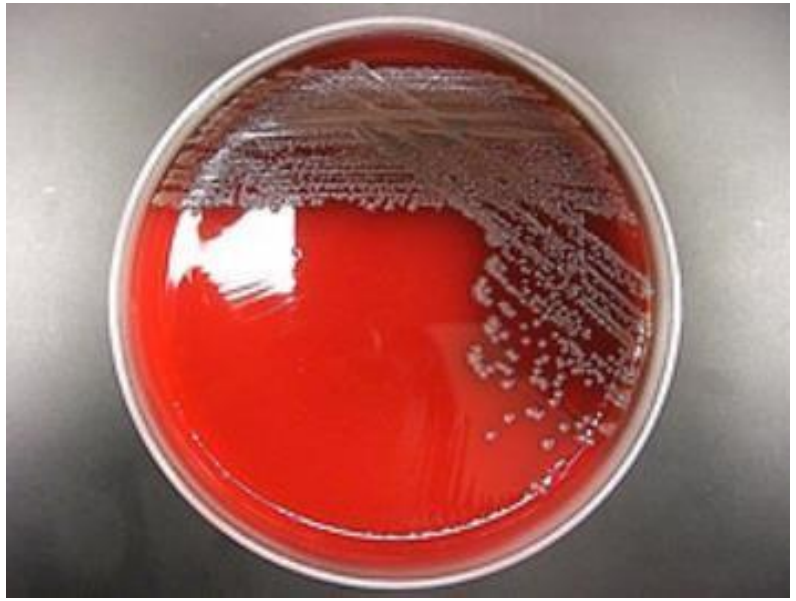
Bacteremia / Septicemia /Endotoxic shock

Escherichia coli

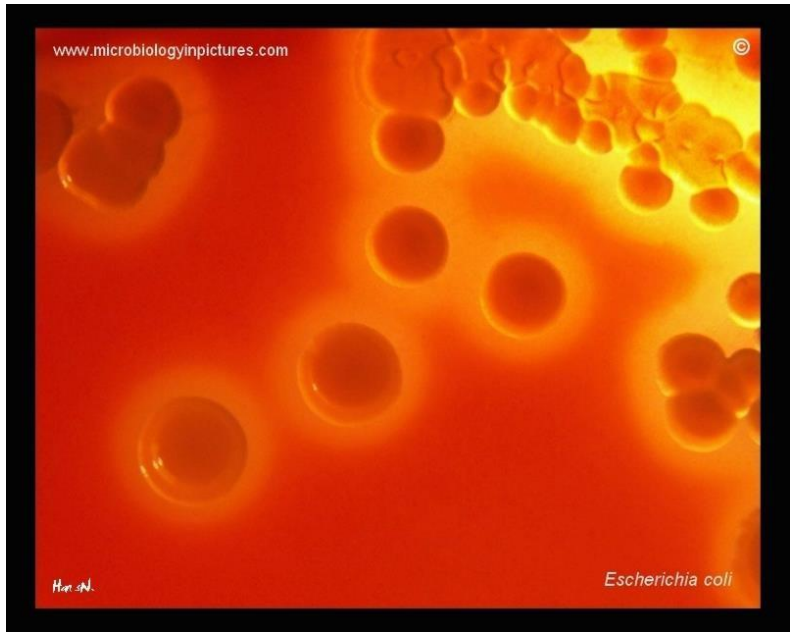
- Common member of normal flora of the Large intestine.
- Most commonly encountered pathogen from the Enterobacteriaceae Family

Cultural characteristics

- Grow on ordinary culture media
  - Eg: Nutrient agar
    Nutrient broth
    BA

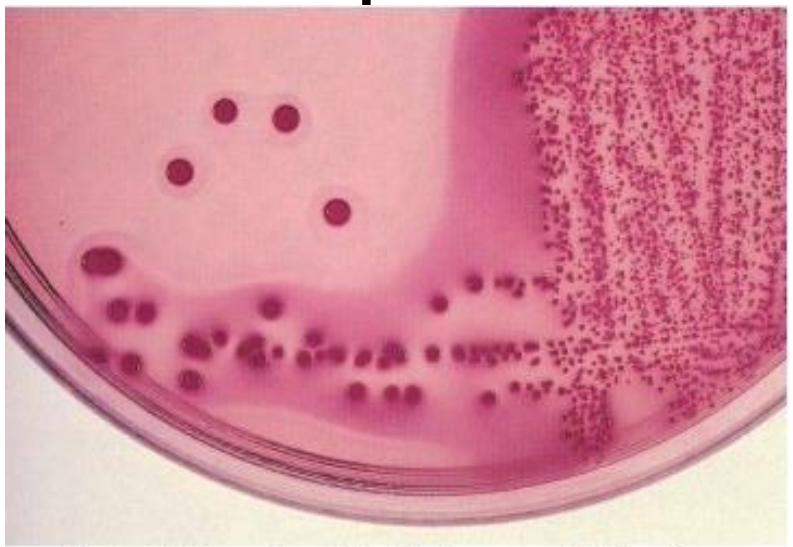


- Some strains show β haemolysis on blood agar



Cultural characteristics

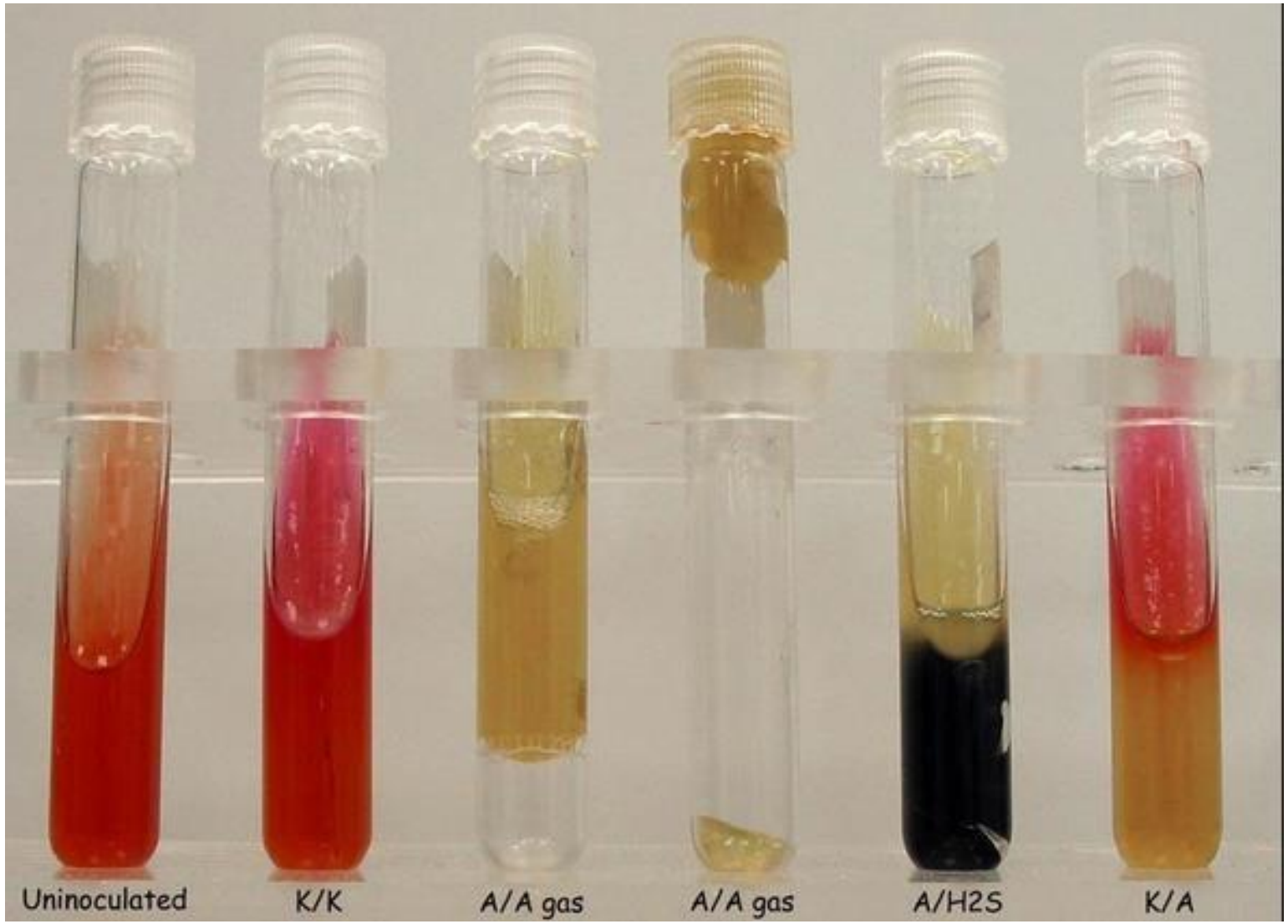
- Bile tolerant
  - Grow on MacConkey agar
  - Form smooth, glossy, pink colour colonies
  - Ferment **lactose** & produce acid & gas



Escherichia coli on MacConkey agar. Pink colony pigment is due to lactose fermentation.

- Optimal temperature for growth 36-37^{o}C

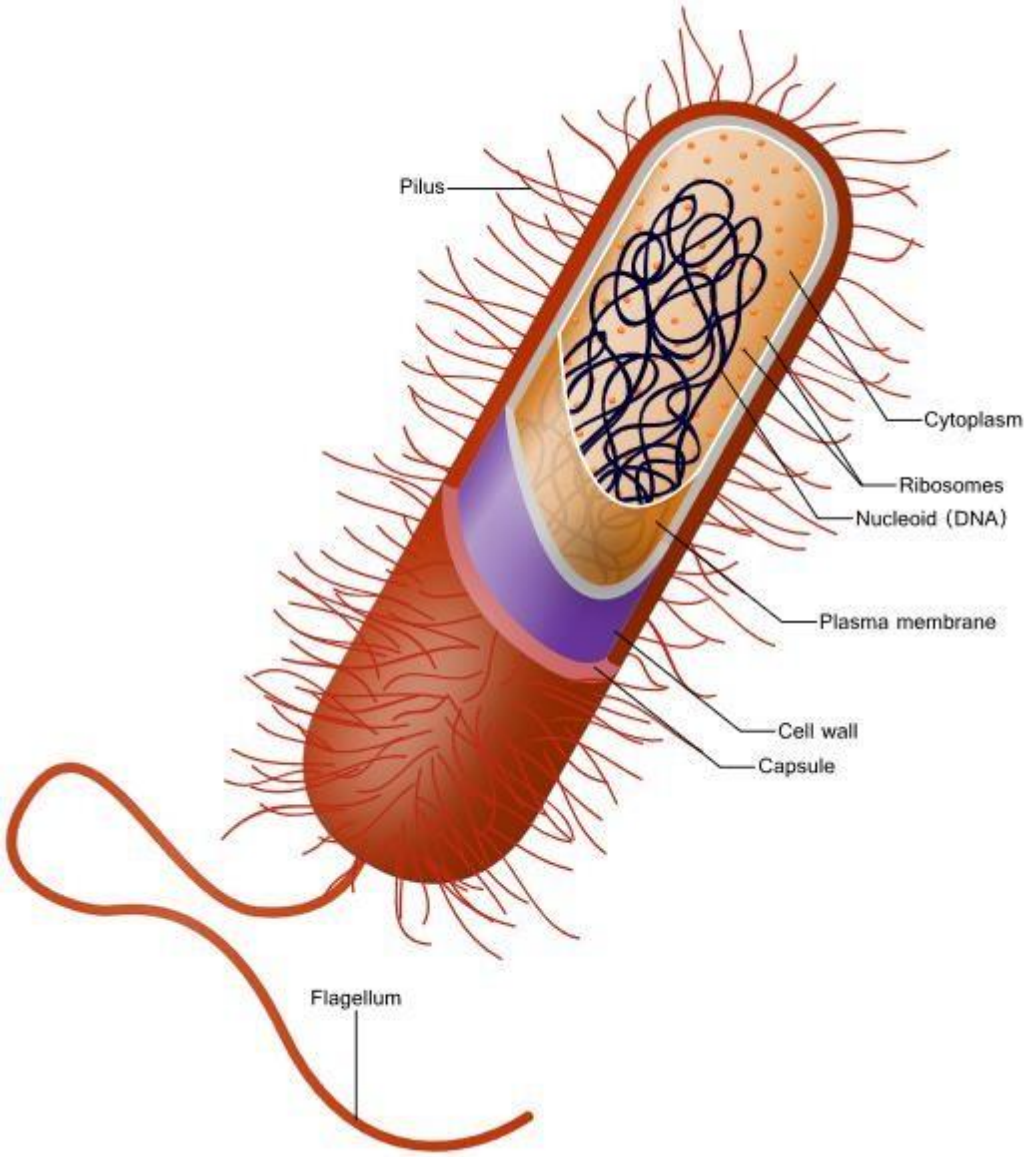
Ferment lactose, glucose & produce acid & gas



Antigenic structure

Serotyping based on 3 types of antigens.

1. **O** antigen(Cell wall lypopolysaccaride)
2. **H** antigen (Flagella protein)
3. **K** antigen (Capsular polysaccharide /envelop)



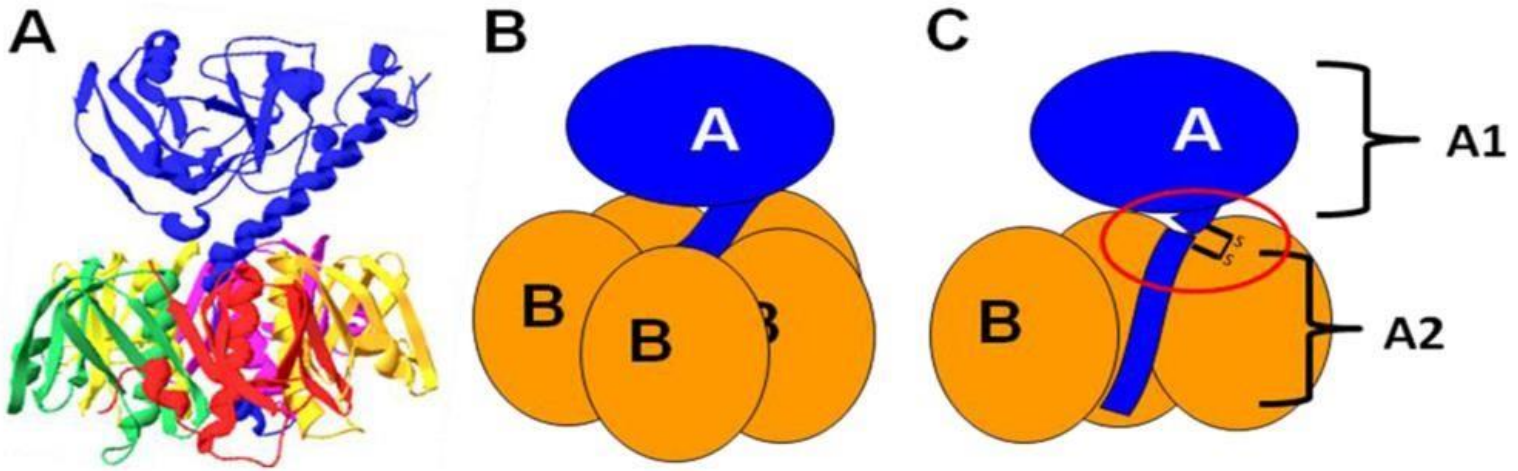
Virulence factors

1. Toxins

Eg: Enterotoxin

Haemolysin

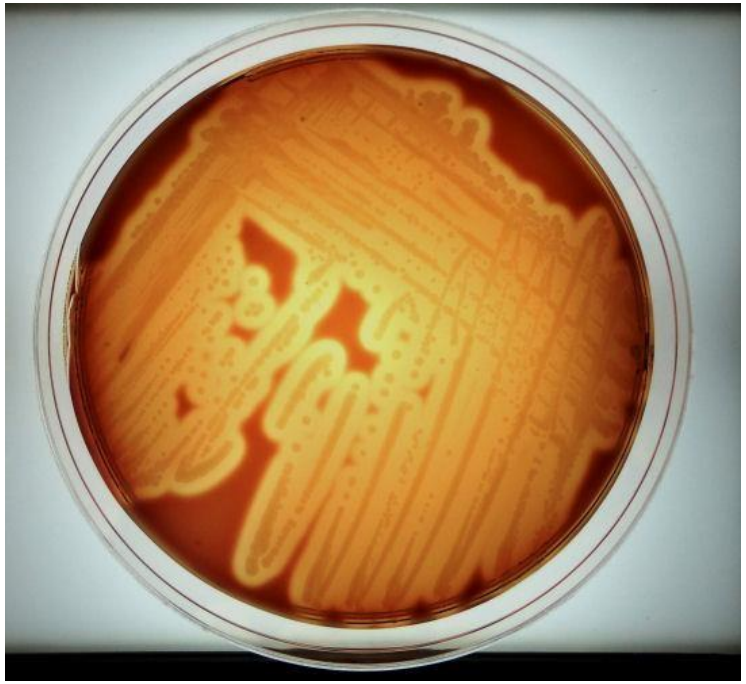
Verotoxin



Enterotoxin

Haemolysin

- Mainly from *E. coli* isolated from extra intestinal sites



2. Adhesin

3. Capsule

Diarrhoael diseases

- Mainly by 5 strains
- Defined on the basis of distinct virulence characteristics

1. Enterotoxigenic *E.coli* (ETEC).
2. Enteroinvasive *E.coli* (EIEC).
3. Verocytotoxin producing *E.coli* (VTEC).
4. Enterotopathogenic *E.coli* (EPEC).
5. Enteroaggregative *E.coli* (EAEC)

Lab diagnosis

Specimens

Depend on the site of the infection

1. Feces/ rectal swabs ← Acute diarrhoea
2. Urine ← UTI
3. Pus ← Wound
4. CSF ← Pyogenic meningitis

Rx

- Wide range of antibiotics can be used
- But resistance developed (Plasmid mediated)
- Therefore ABST is necessary
- For diarrhoeal diseases specific treatment is not necessary except in life threatening conditions

Control

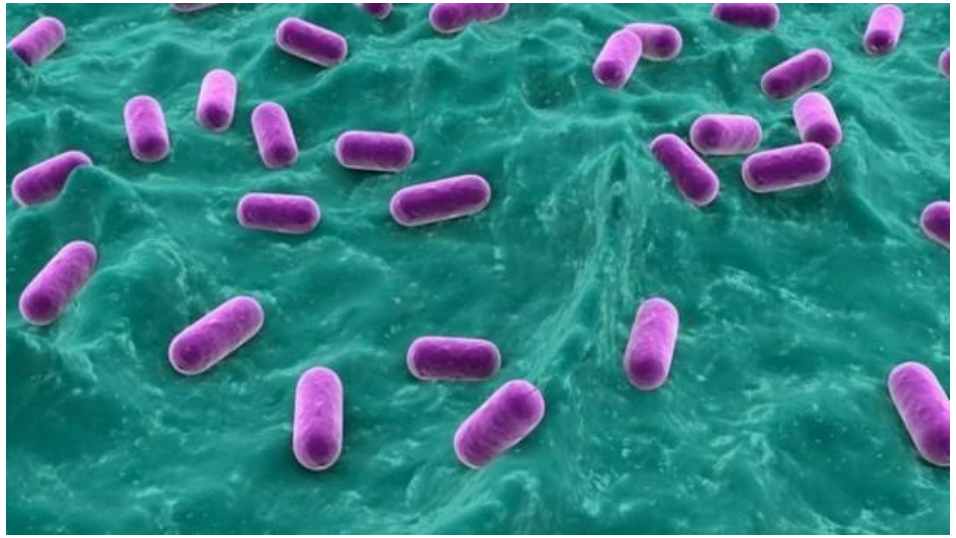
Sanitary measures

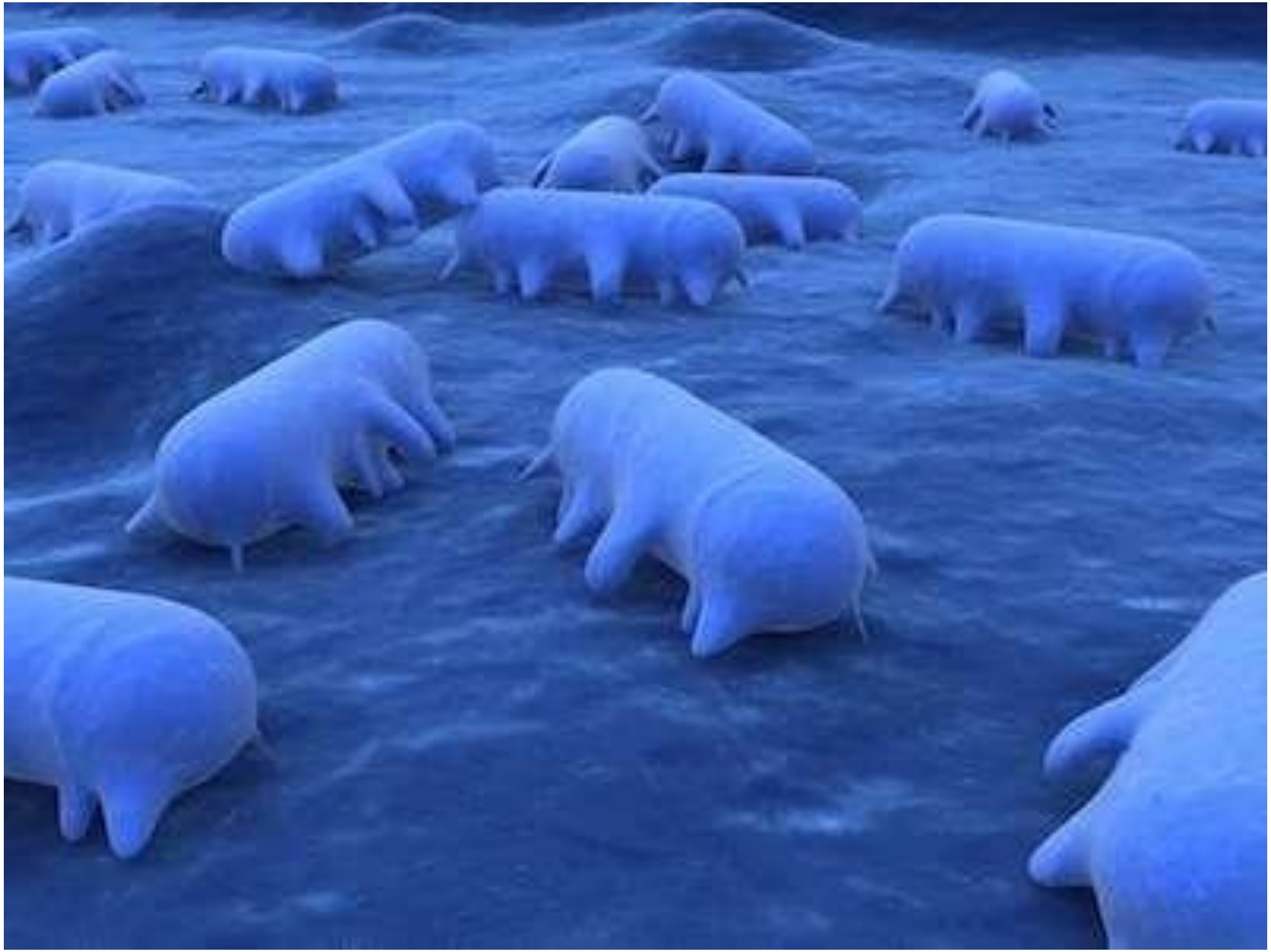
Prevent fecal oral transmission

- ♦ Hand washing
- ♦ Proper preparation of food
- ♦ Chlorination of water supplies
- ♦ Proper disposal of excreta

Salmonella

Salmonella





Clinical importance

1. Diarrhoeal diseases

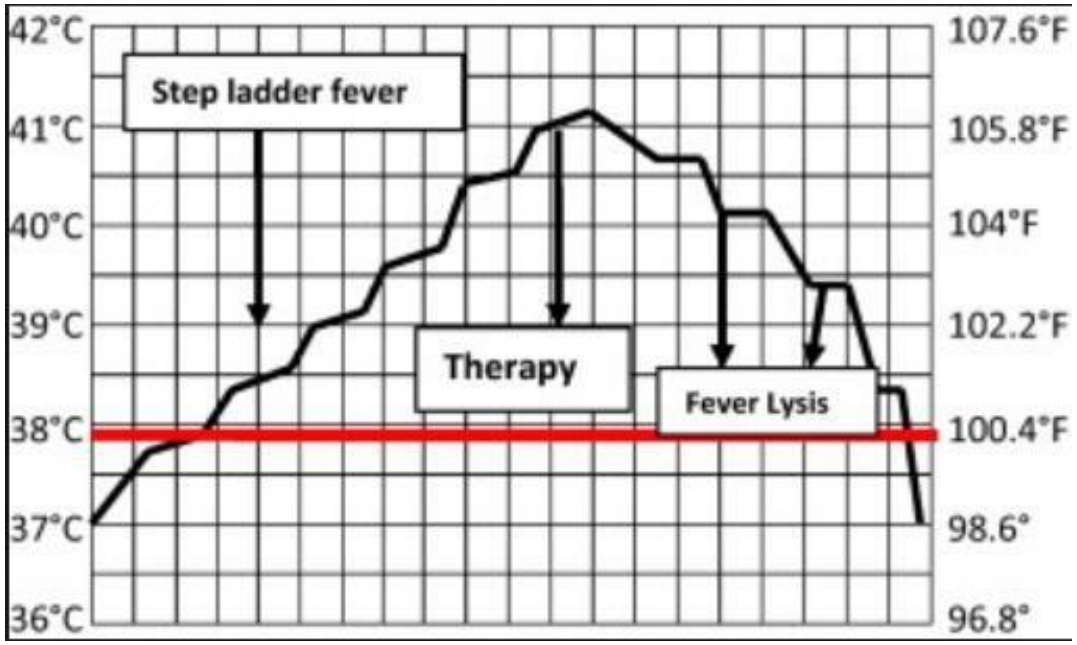
    Gastroenteritis (food poisoning) (Vast majority)

2. Enteric fevers

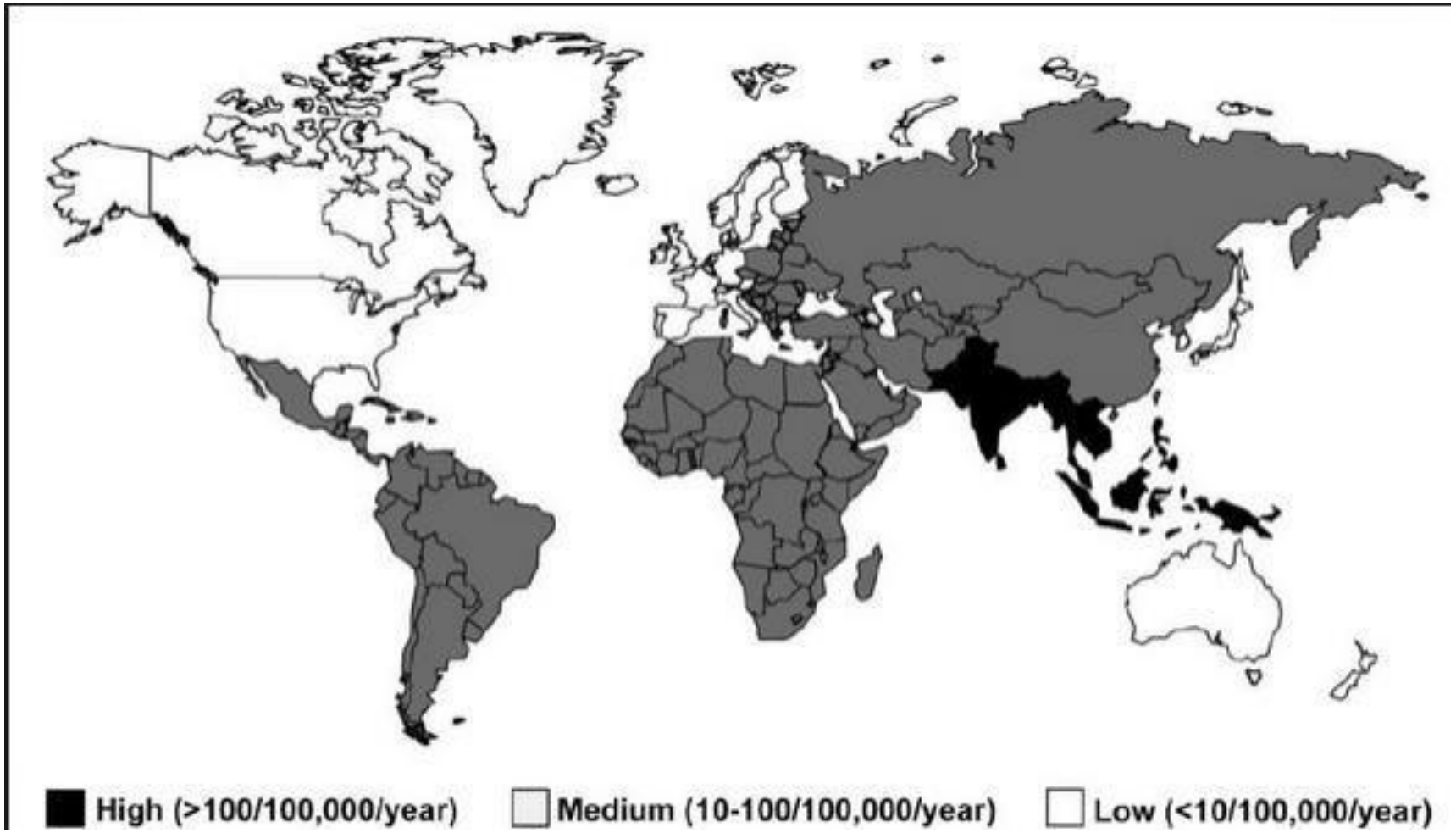
    Typhoid fever

    Paratyphoid fever

Typhoid fever

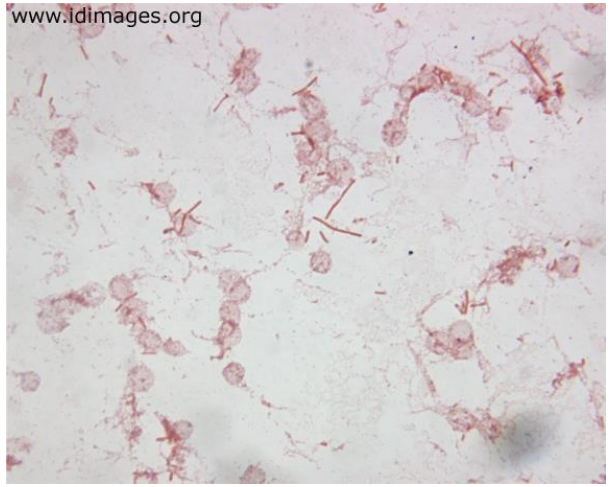


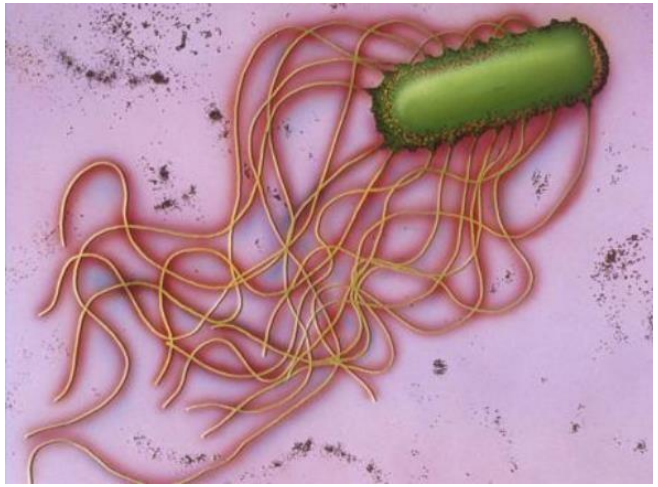
Epidemiology of typhoid fever



Features of the organism

- Motile with peritrichous flagella
- All are capsulated except *S. typhi*
- Only a single species - *S. enterica*
- Has more than 2,200 serotypes
- Normal habitat – animal intestine





Cultural characteristics

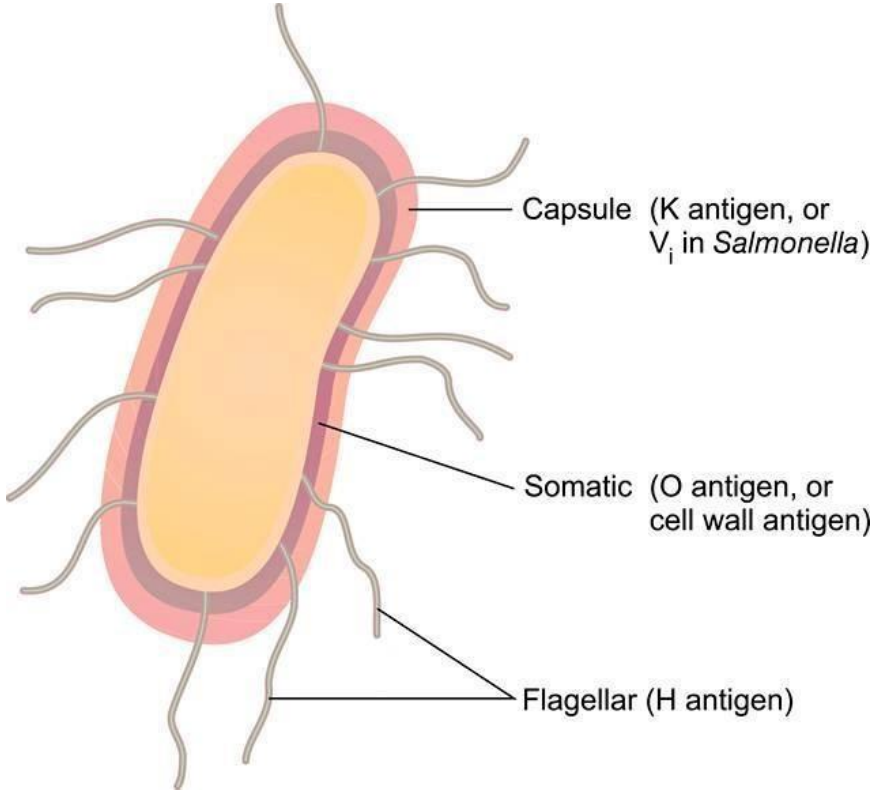
- Grow readily on ordinary media
- Selective medium is needed to suppress other bacteria
- Bile tolerant
- Growth temperature 15-45^{0}C (optimal at 37^{0}C)

Antigenic structure

Posses 3 major antigens.

1. Somatic antigen (O)

Occur on the surface of the outer membrane



2. Flagellar antigen (H)

3. Capsular antigen (Vi)

Superficial antigen overlying the Oantigen

Present only in few serotypes

Eg: *S. typhi*

Ix

1.Culturespecimen differ according to the stage of the illness

A. Blood culture

- Organisms can be isolated from blood cultures of > 90% of typhoid patients during 1st / 52 of illness
- Obtain 5-10 ml of blood before antibi

Appropriate otics

2. Feaces/ urine culture

- Chance of isolation is high during $2^{nd} – 3^{rd}$ / 52 of illness

3. Bone marrow culture

- Rarely useful
- Do only if bone marrow biopsy has been performed

Serology

♠Detection of antibody in patients by the widal test.

Widal test

♠Detecting antibody in the patient's blood for somatic(0) flagellar(H) & capsular (Vi) antigen of the organism.

- Pared sera should be taken in 10-14 days apart

- Progressive increase (4 fold rise) in antibody titre suggests current infection

- Widal test is **often unreliable**

  4 fold rise can only be demonstrated in about 50% of untreated & 25% of antibiotic treated

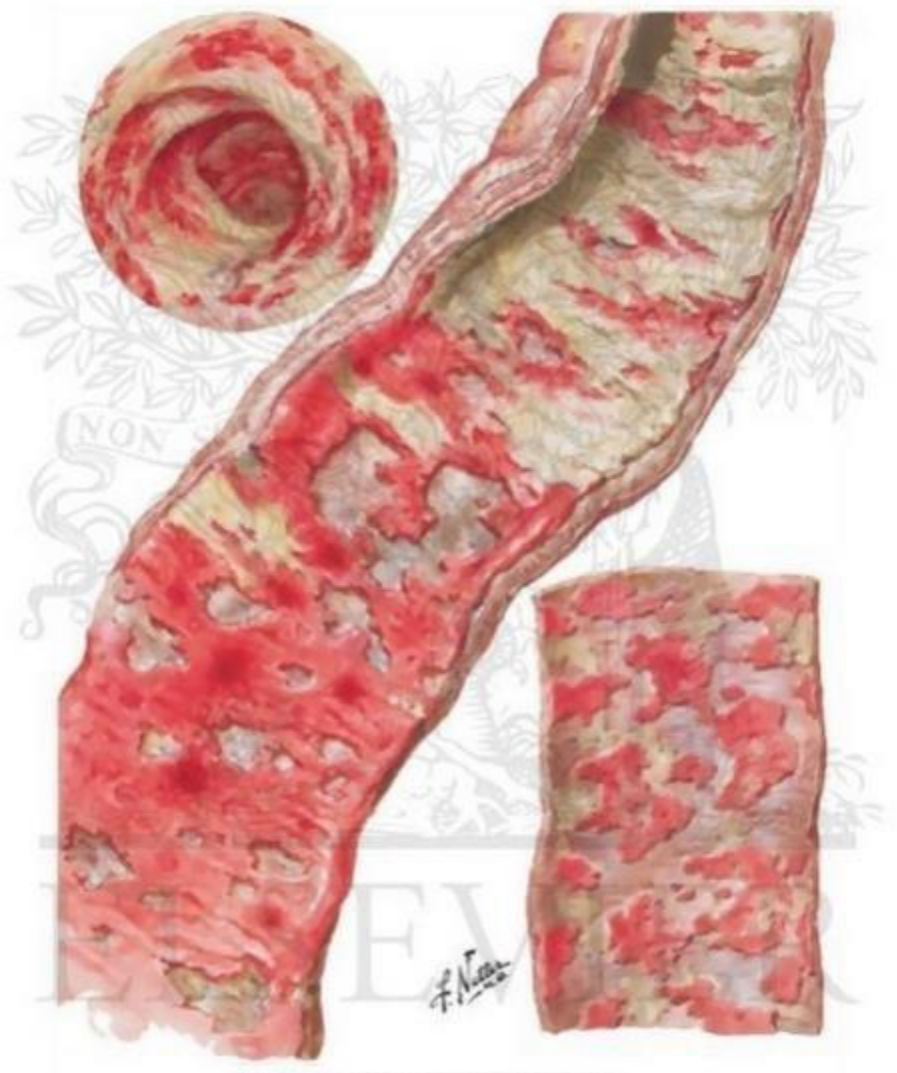
Food poisoning salmonella

- ♠ *S. typhimurium*
- ♠ *S. enteritidis*
- ♠ *S. virchow*
- ♠ *S. agona*

SHIGELLA

Clinical Importance

►Bacillary dysentery



- Genus contain 4 species (according to O antigen) in descending order of severity of symptoms)

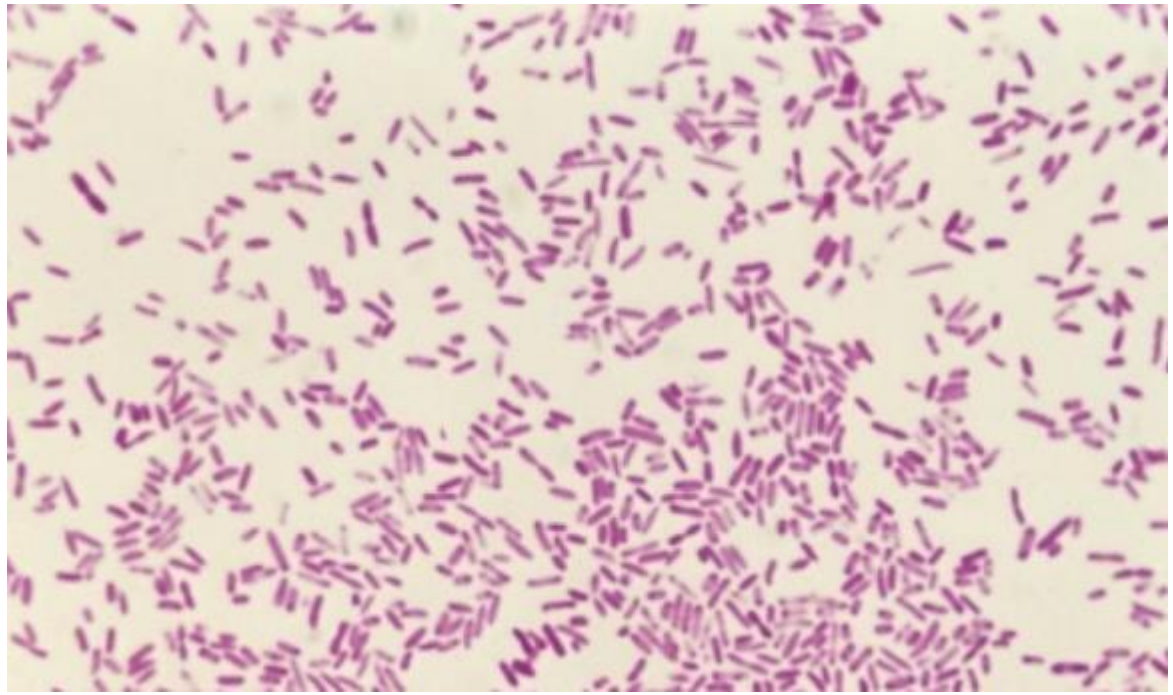
- Group A *Shigella dysenteriae*
- Group B *S. boydii*
- Group C *S. flexineri*
- Group D *S. sonnei*

Epidemiology

Shigellosis is predominantly caused by ***S. sonnei*** in **industrialized countries**, whereas ***S. flexneri*** prevails in the **developing world**

Features.

- ♣ Gram (-)ve bacilli.
- ♣ Non motile.
- ♣ Non capsulate.
- ♣ Facultative anaerobic.



Transmission

- **Main mode : faeco- oral route**
- **Infective dose small**(10 organisms)

Virulence factors

Toxins

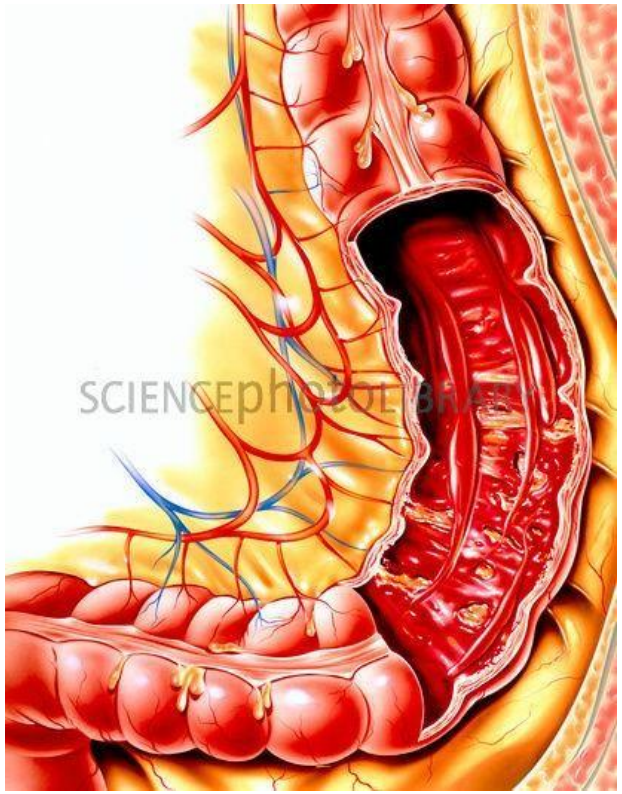
1. Exotoxins. act as,
    - Enterotoxin
    - Neurotoxin
    - Shiga toxin
        - Produce by *S. dysentriae* type 1

Virulence factors

Toxins

2. Endotoxins

Cause diarrhoae & subsequent intestinal ulcerations.



Gross of Intestinal pathologic changes aused by acute bacterial dysentery

Lab diagnosis

1.Specimens

- ♣ Fresh stool
- ♣ Mucus fleks
- ♣ Rectal swabs

    collect with aseptic preparation

Prevention

- Interrupt the faeco – oral route.
- No vaccine available.