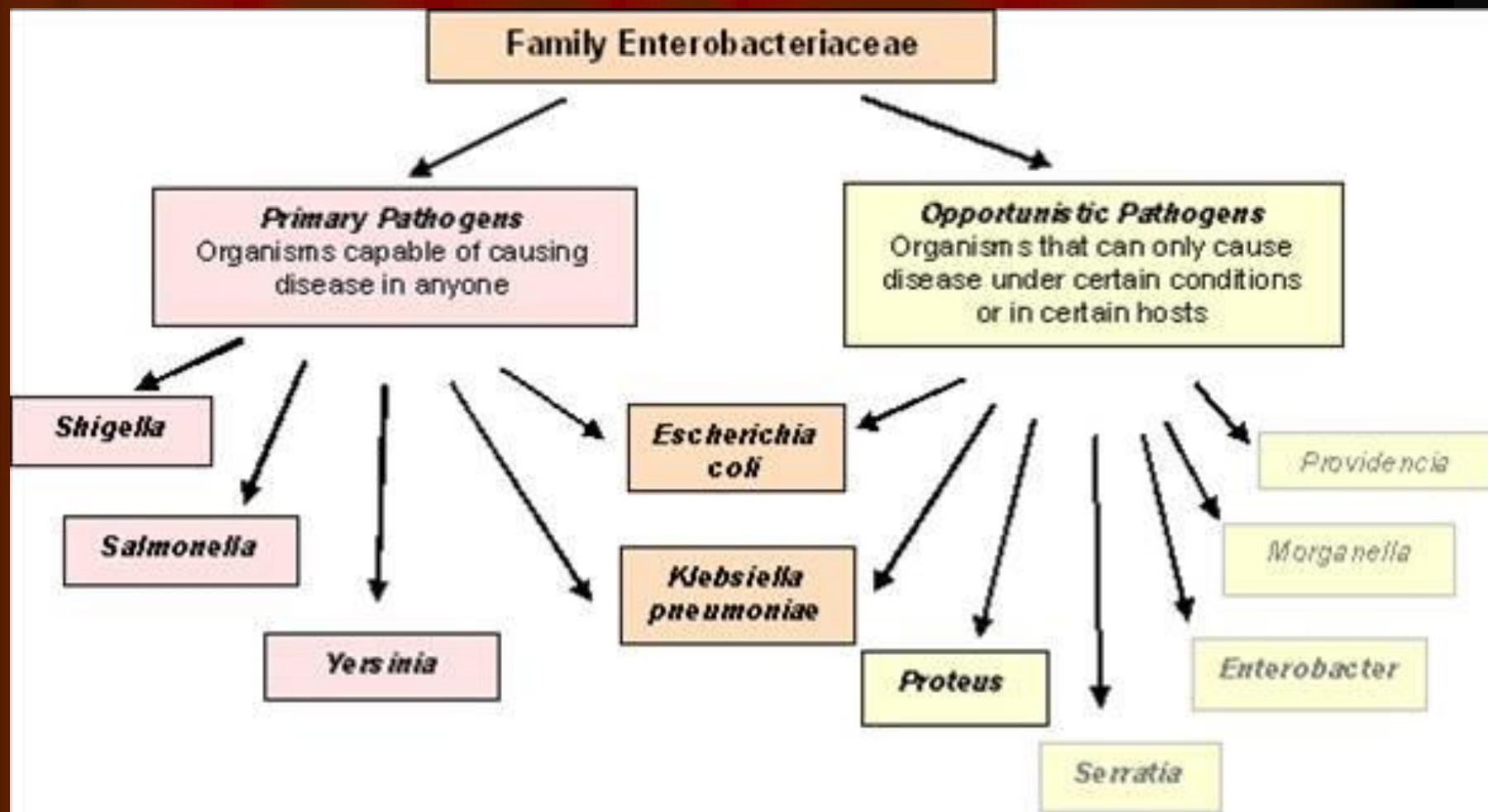
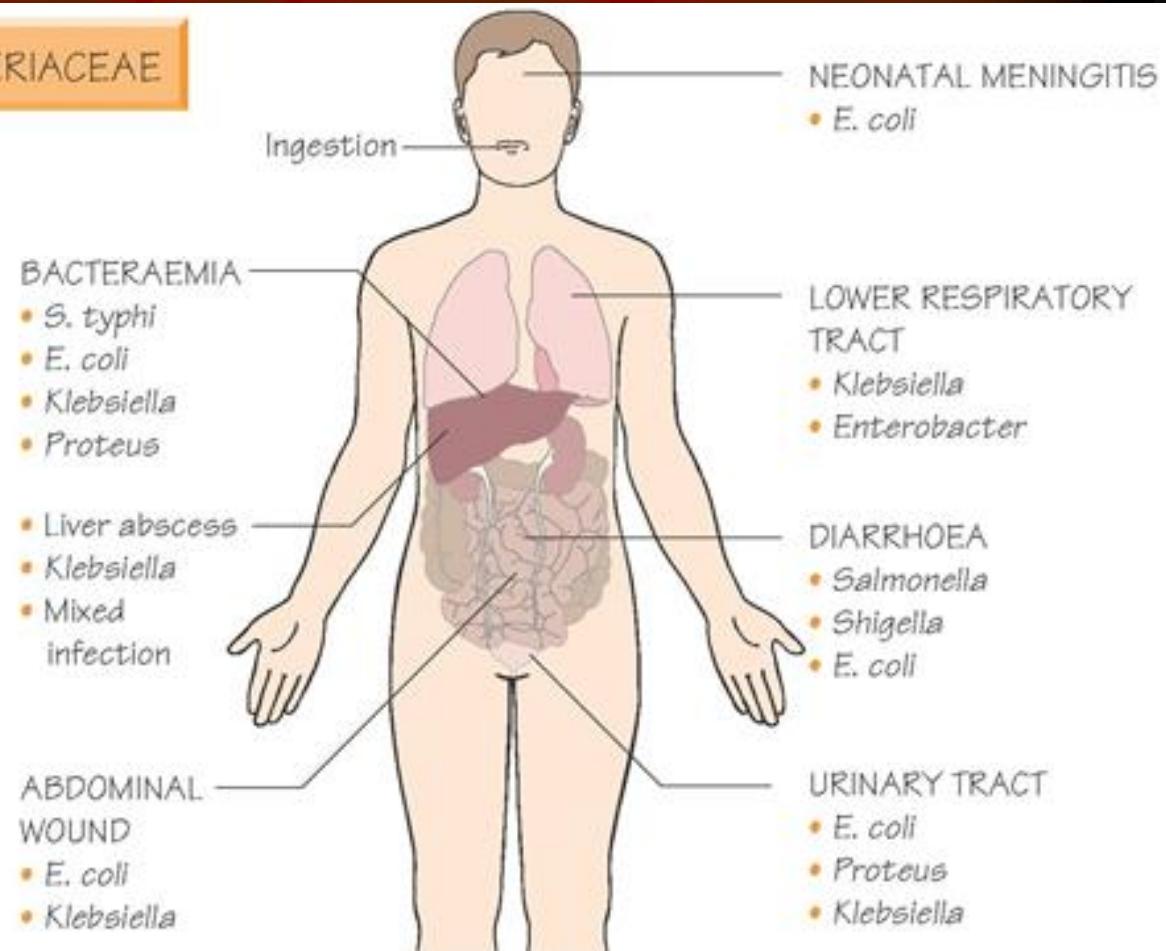


# Family Enterobacteriaceae

# 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.



## 4. Enrichment media

Enhance the growth of certain bacterial species while 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

Shigella

Klebsiella

## Motile

Proteus

Salmonella

*E. coli*

# Ix

1.Gram staining

2.Culture

Immediately after collection

On BA / MA / selective media

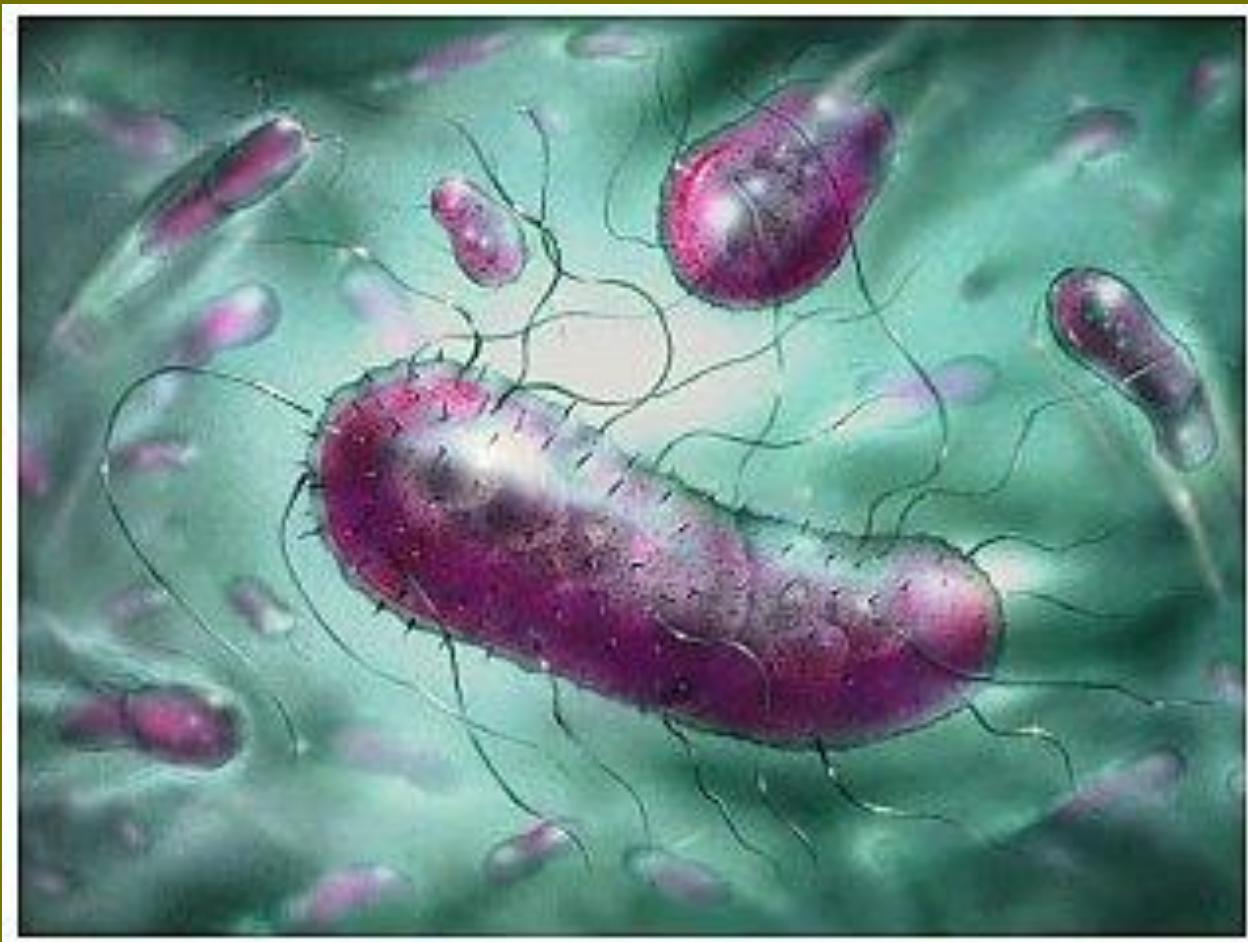
Overnight incubation at 37°C

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

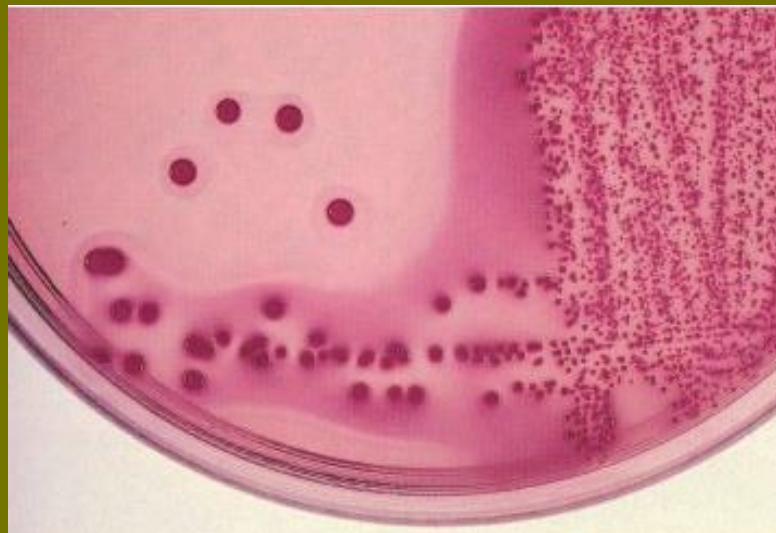


- Some strains show  $\beta$  haemolysis on blood agar



# Cultural characteristics

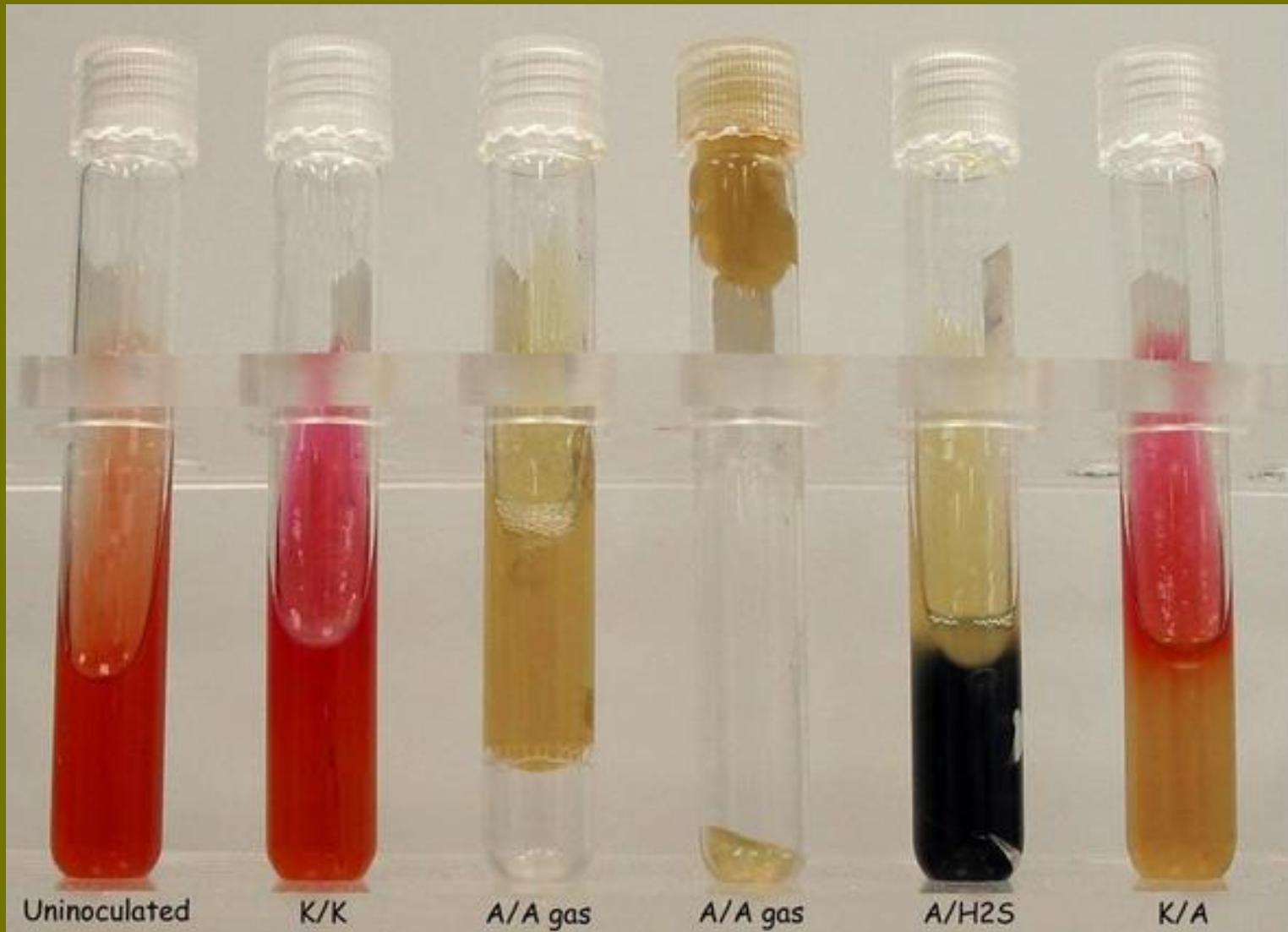
- Bile tolerant
  - Grow on MacConkey agar
  - Form smooth, glossy, pink colour colonies
  - Ferment **lactose** & produce acid & gas



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

- Optimal temperature for growth 36-37°C

# Ferment lactose, glucose & produce acid & gas



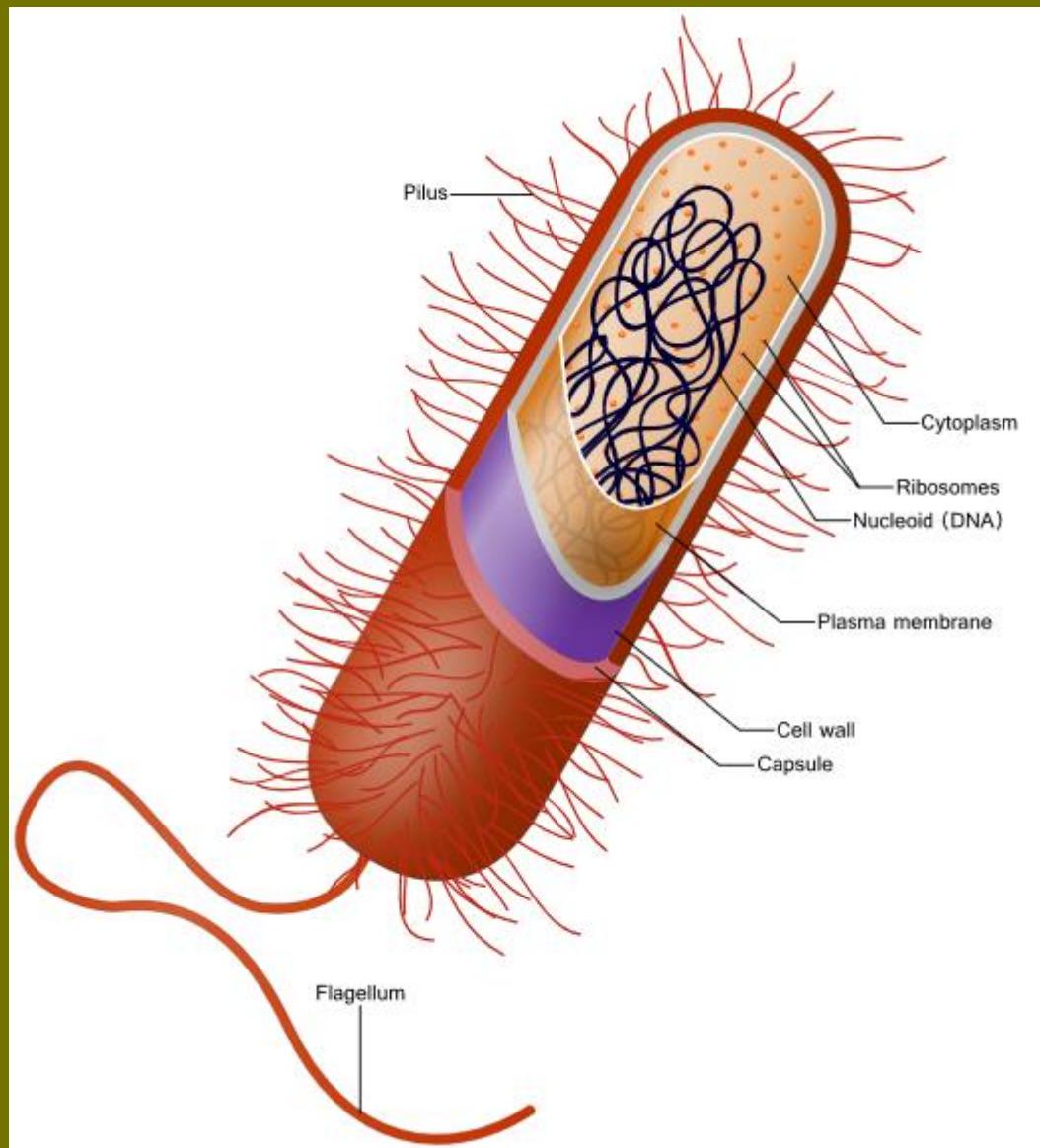
# Antigenic structure

- Serotyping based on 3 types of antigens.

1. **O** antigen (Cell wall lipopolysaccharide)

2. **H** antigen (Flagella protein)

3. **K** antigen (Capsular polysaccharide /envelop)



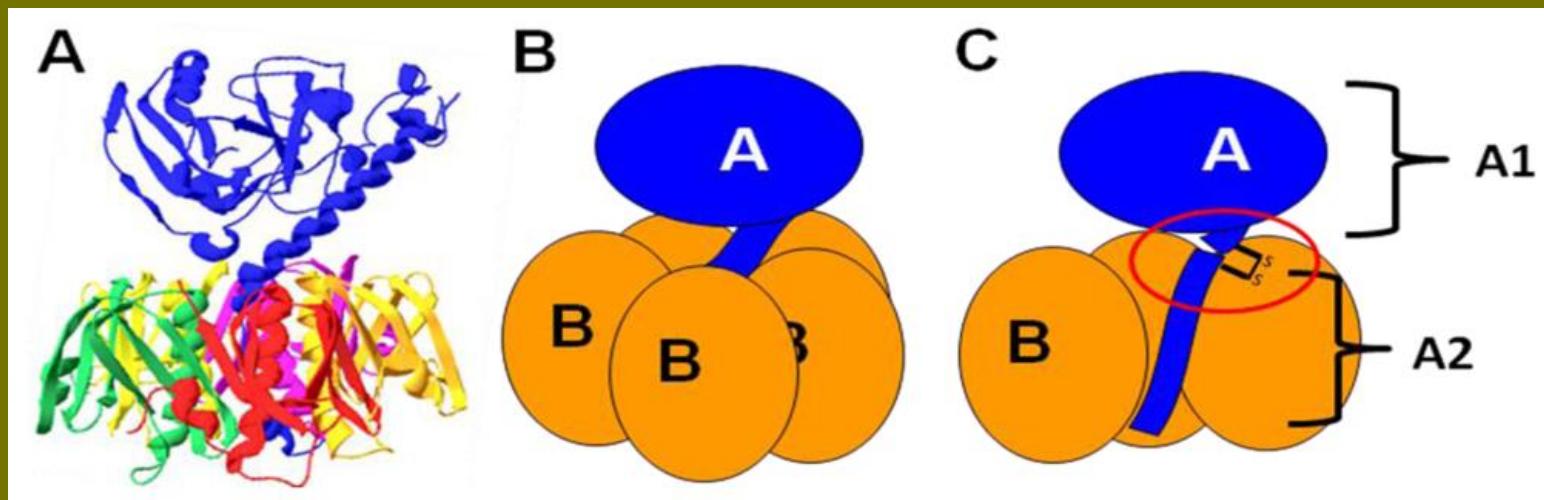
# ● Virulence factors

## 1. Toxins

Eg: Enterotoxin

Haemolysin

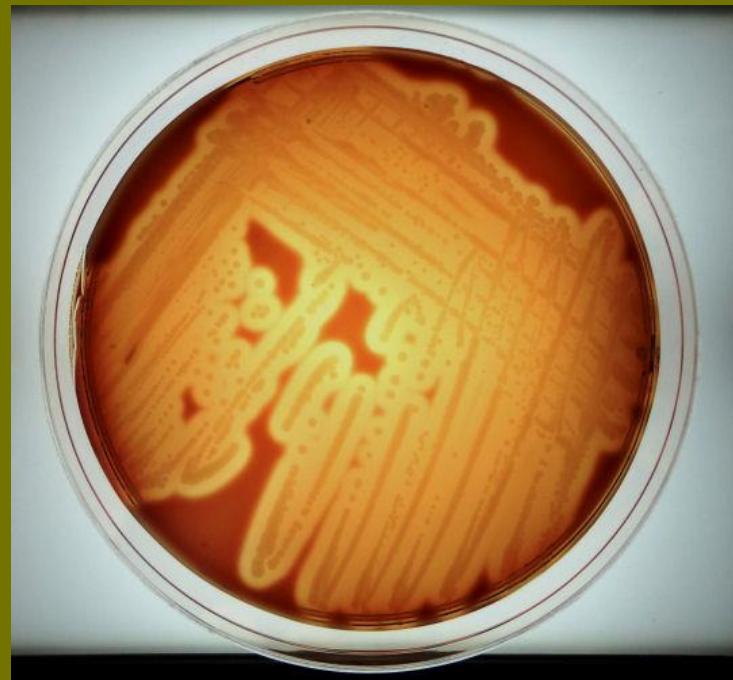
Verotoxin



Enterotoxin

# Haemolysin

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



2. Adhesins

3. Capsule

# Diarrhoeal 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. Enteropathogenic *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

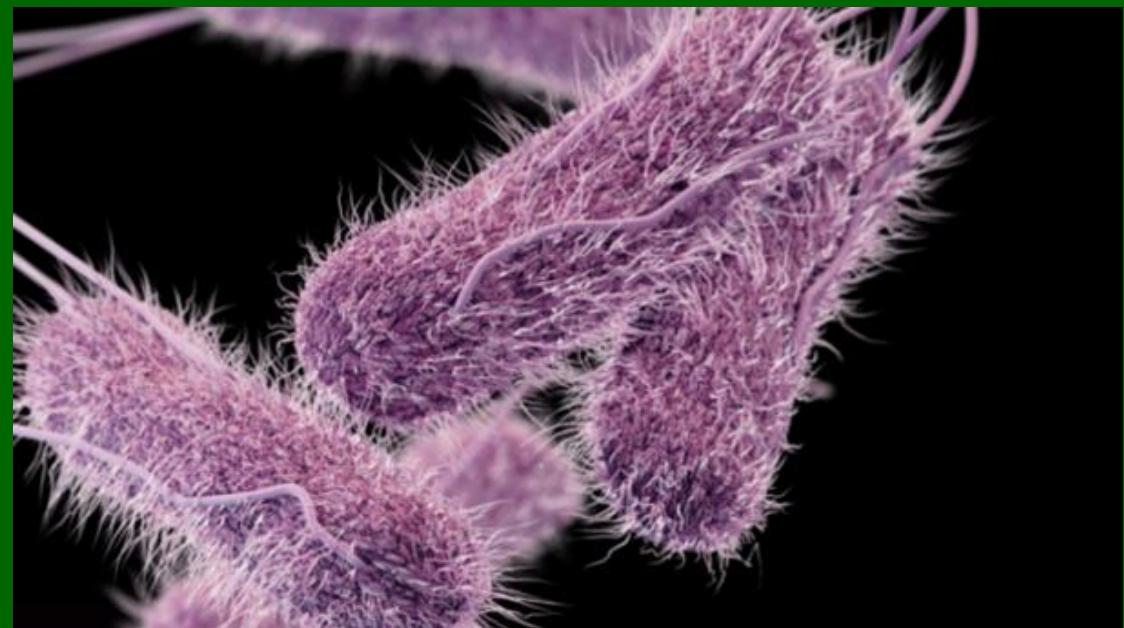
## Sanitary measures

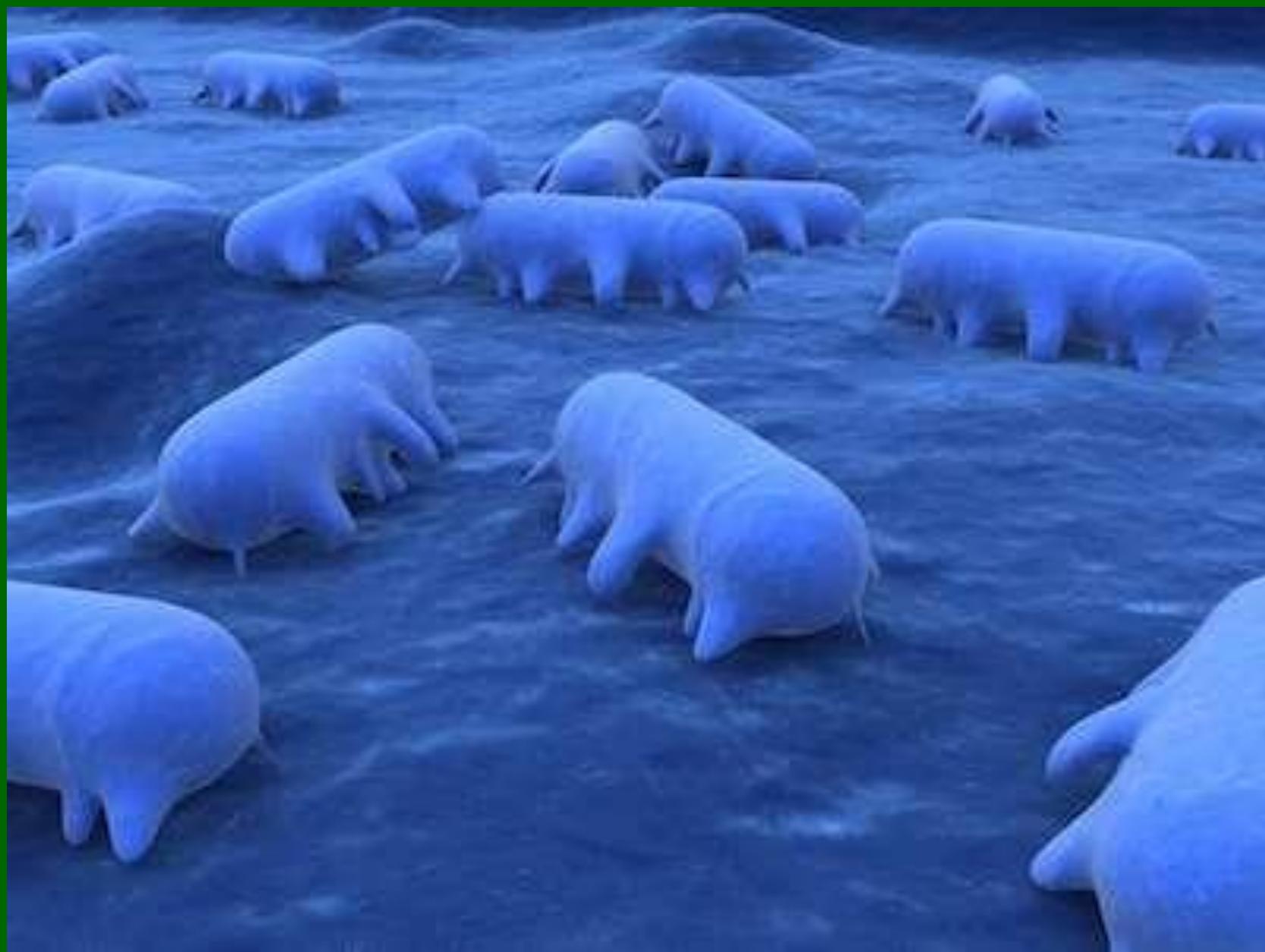
Prevent fecal oral transmission

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

# Salmonella

# Salmonella





# Clinical importance

## 1. Diarrhoeal diseases

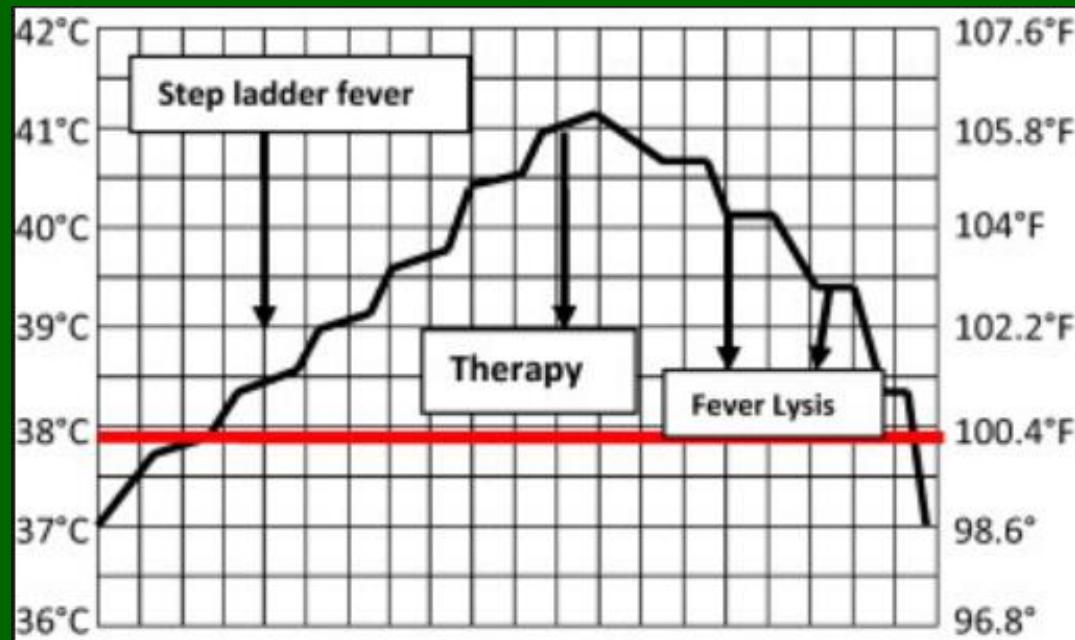
**Gastroenteritis (food poisoning) (Vast majority)**

## 2. Enteric fevers

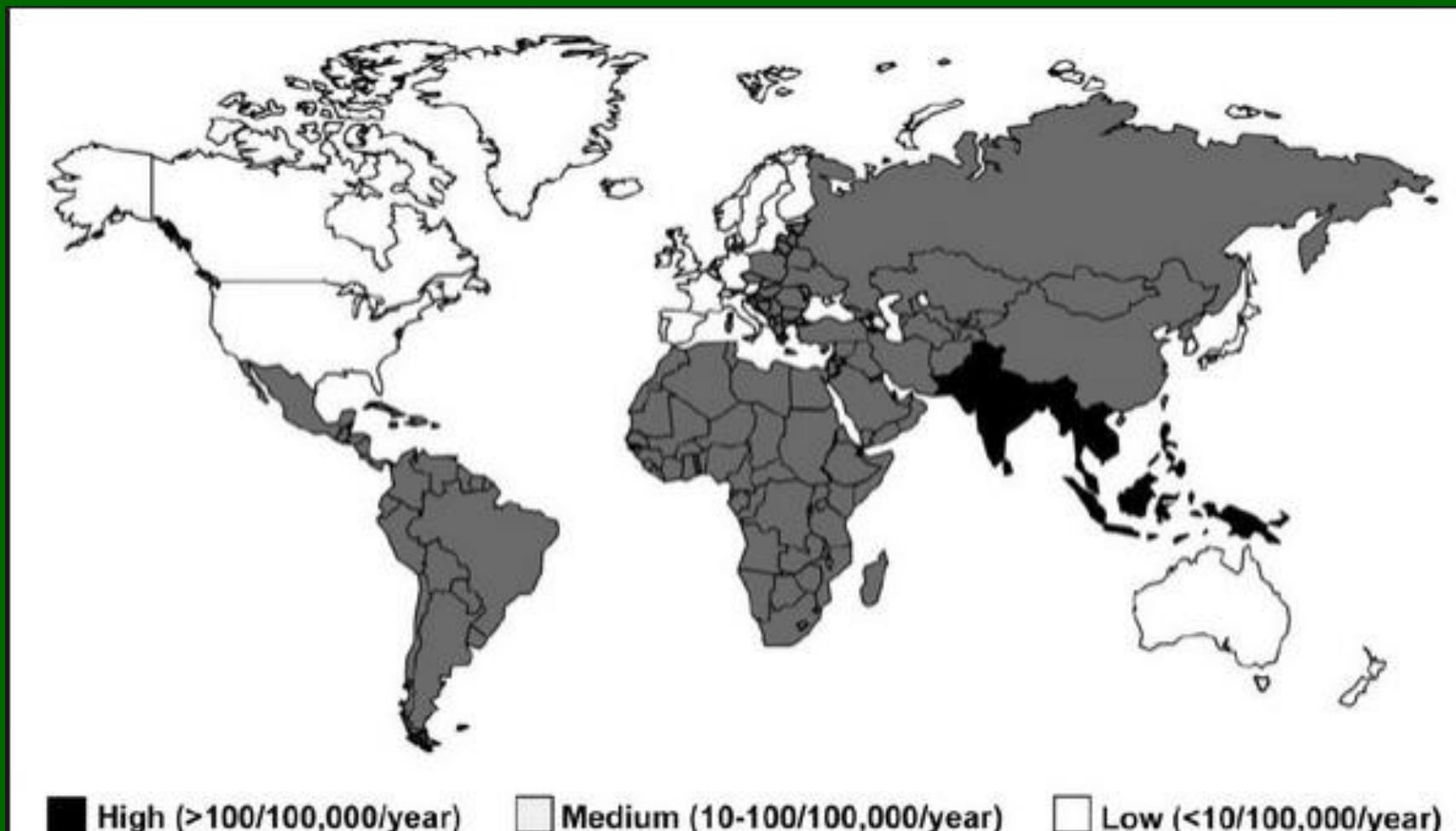
**Typhoid fever**

**Paratyphoid fever**

# Typhoid fever

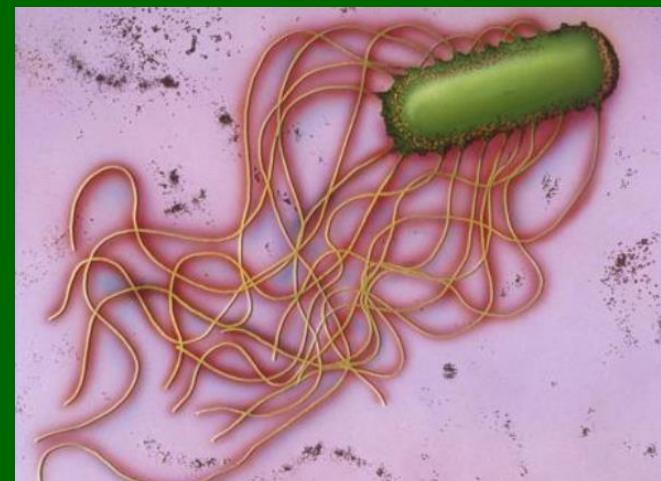
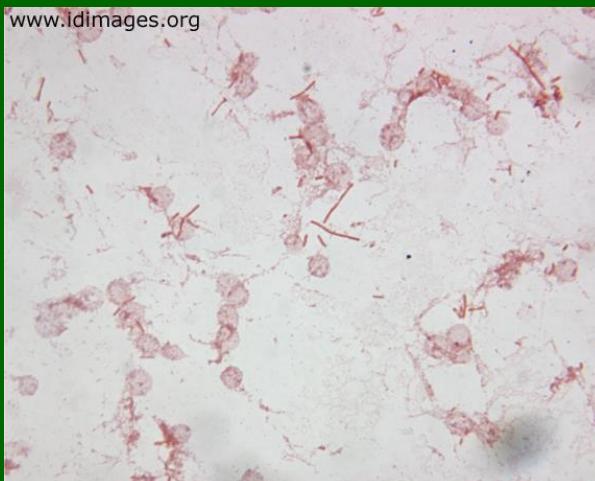


# Epidemiology of typhoid fever



# 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<sup>0</sup>C  
(optimal at 37<sup>0</sup>C)

# Antigenic structure

Posses 3 major antigens.

## 1. Somatic antigen (O)

Occur on the surface of the outer membrane

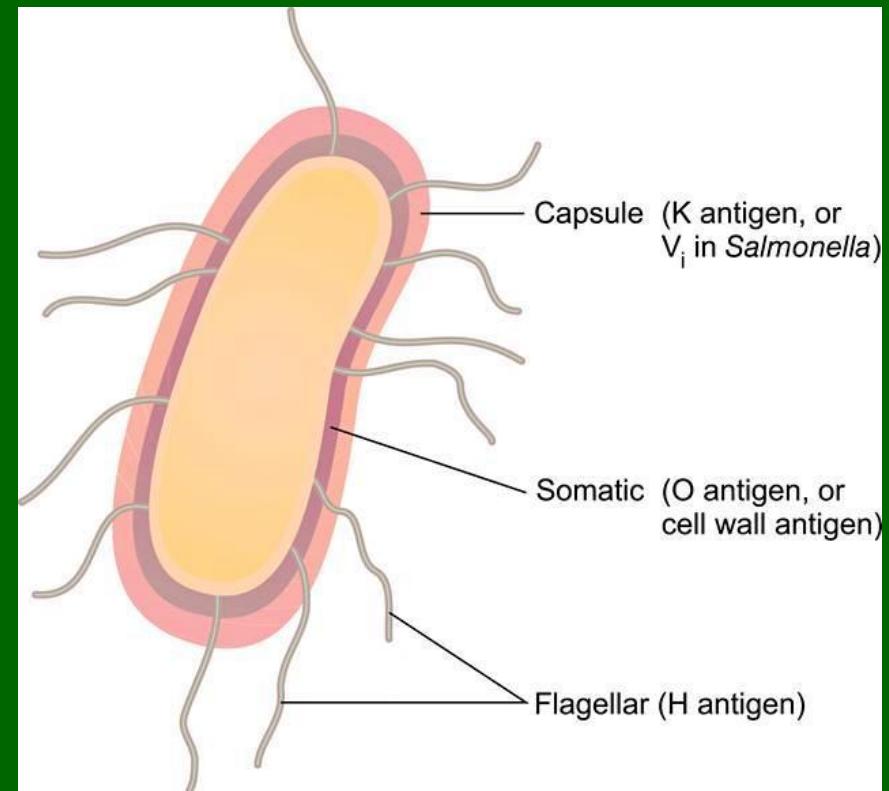
## 2. Flagellar antigen (H)

## 3. Capsular antigen (Vi)

Superficial antigen overlying the O antigen

Present only in few serotypes

Eg: *S. typhi*



## 1. Culture

Appropriate specimen differ according to the stage of the illness

### A. Blood culture

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

## **2.Feaces/ urine culture**

- Chance of isolation is high during  
2<sup>nd</sup> – 3<sup>rd</sup> / 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(O) 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

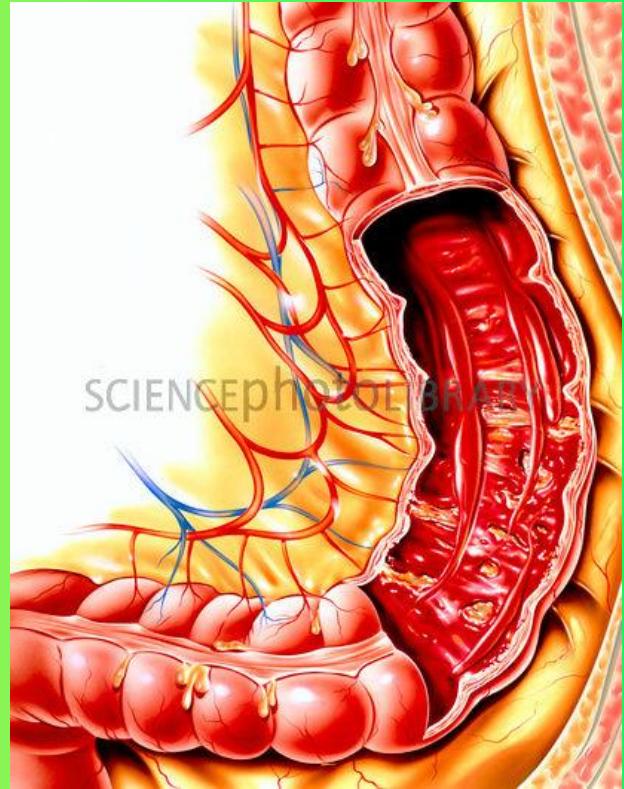
Produce by *S.dysenteriae* type 1

# Virulence factors

## Toxins

### 2. Endotoxins

Cause diarrhoea & subsequent intestinal ulcerations.



Gross of Intestinal pathologic changes caused 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.