

Enterotoxigenic E.coli (ETEC)

Site of action:

small intestine

Diseases:

Traveler's diarrhea ; infant diarrhea (watery diarrhea, vomiting, cramp, nausea, low grade fever)

Pathogenesis: Plasmid mediated

1-Heat labile enterotoxin (LT) ; activates adenylyl cyclase

2-Heat stable enterotoxin (ST) ; activates guanylyl cyclase

Stimulates hipersecretion of fluids and electrolytes

Lumen

Diarrhea

E coli
with CFA pili

Enterotoxin

Cl^- Na^+ H_2O K^+ HCO_3^-

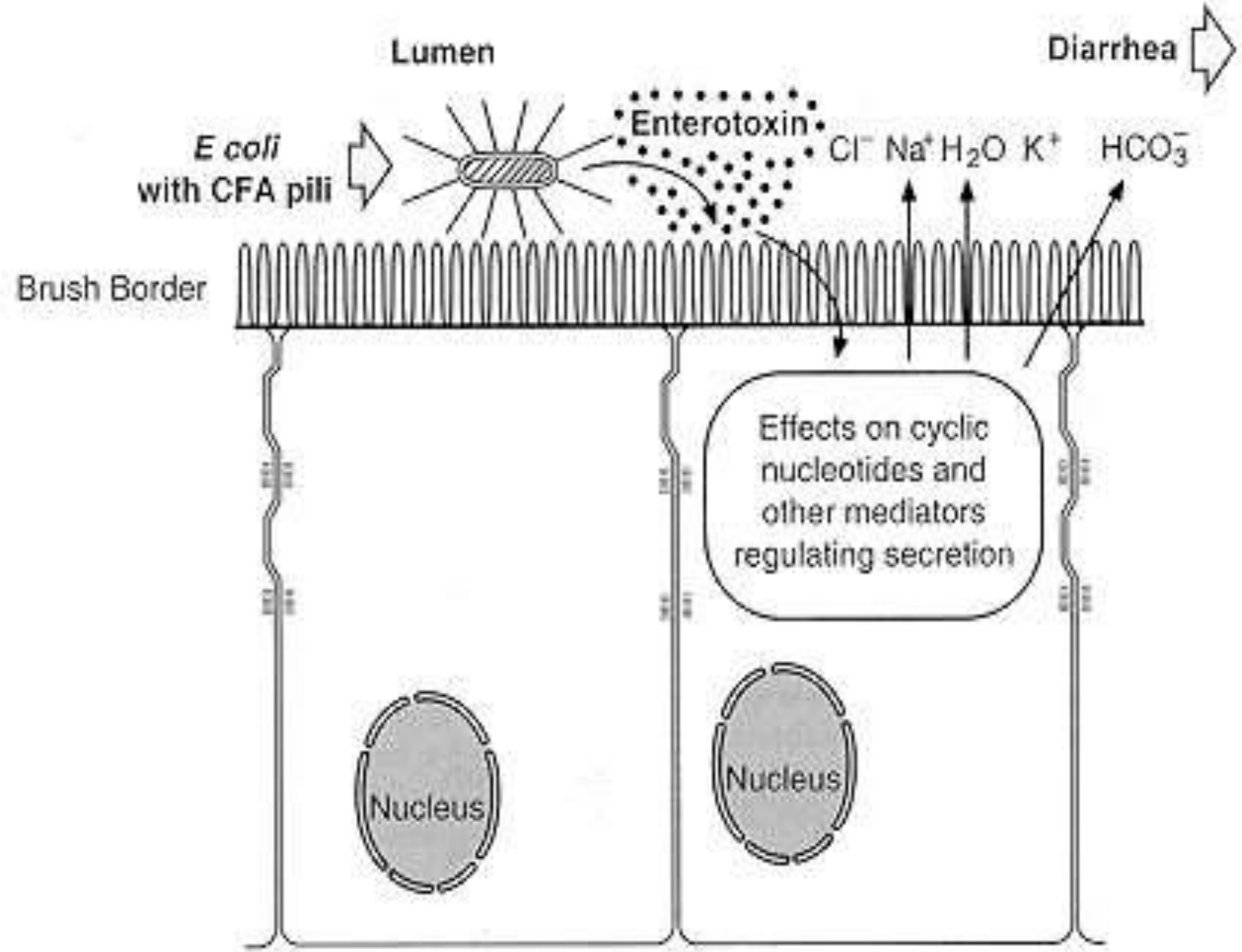
Brush Border

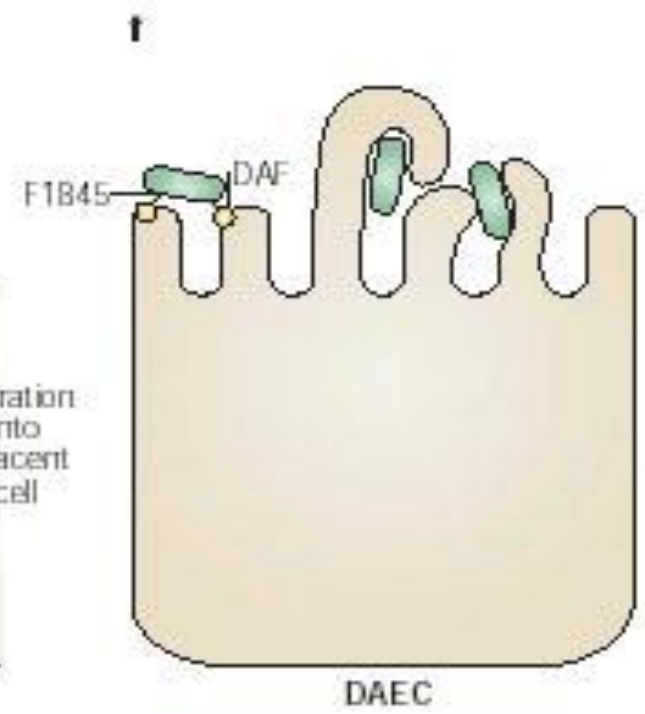
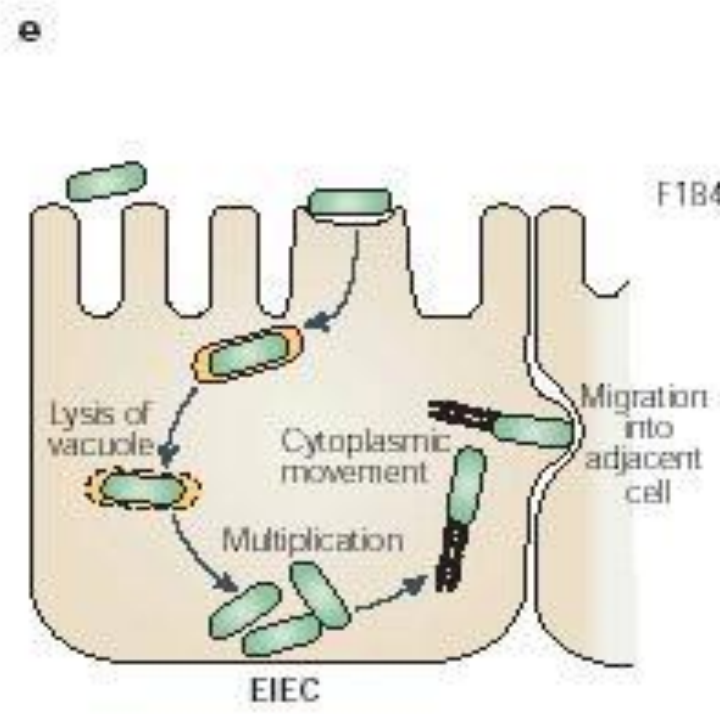
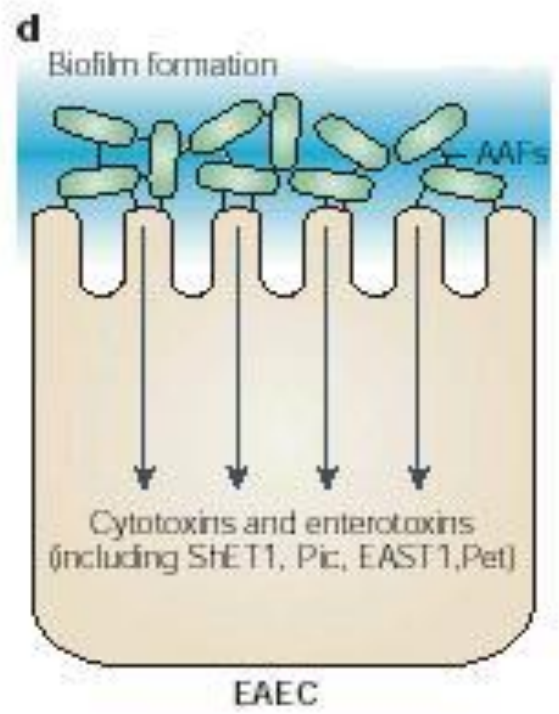
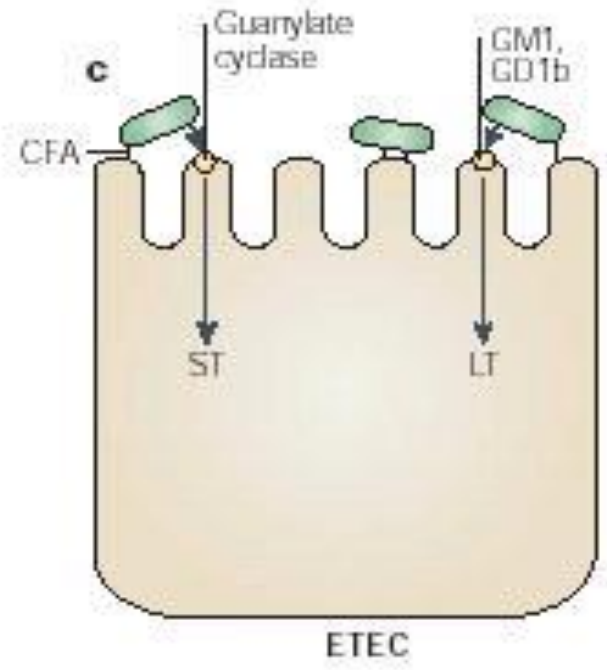
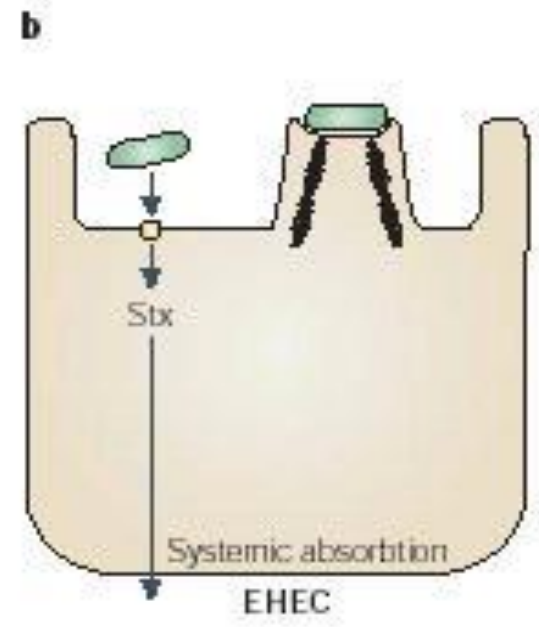
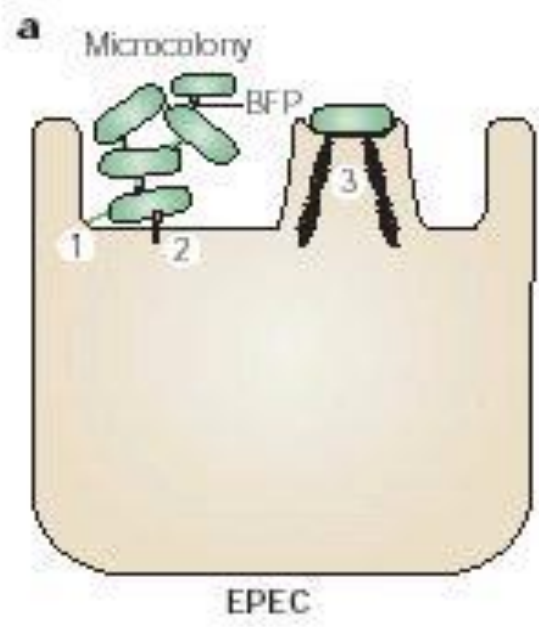
Effects on cyclic
nucleotides and
other mediators
regulating secretion

Nucleus

Nucleus

Lamina propria





Enterohemorrhagic E.coli(EHEC)

Site of action:

Large intestine

Most common type :

O157:H7

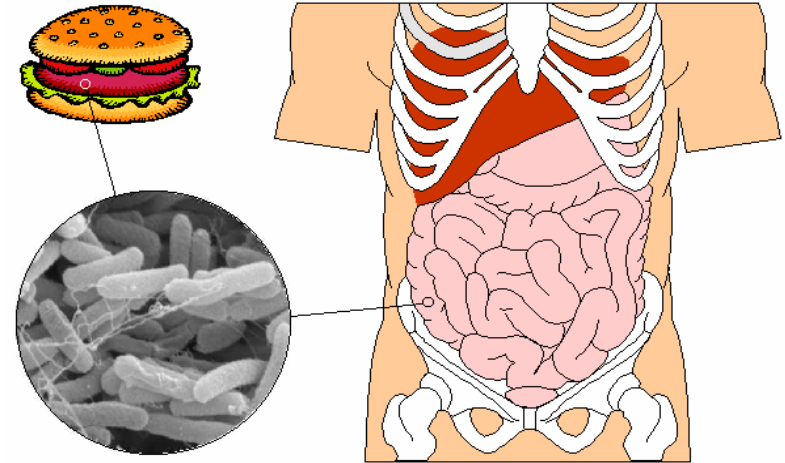
Diseases:

Hemorrhagic colitis (initial watery diarrhea followed by bloody diarrhea, severe abdominal cramps, no fever) ;

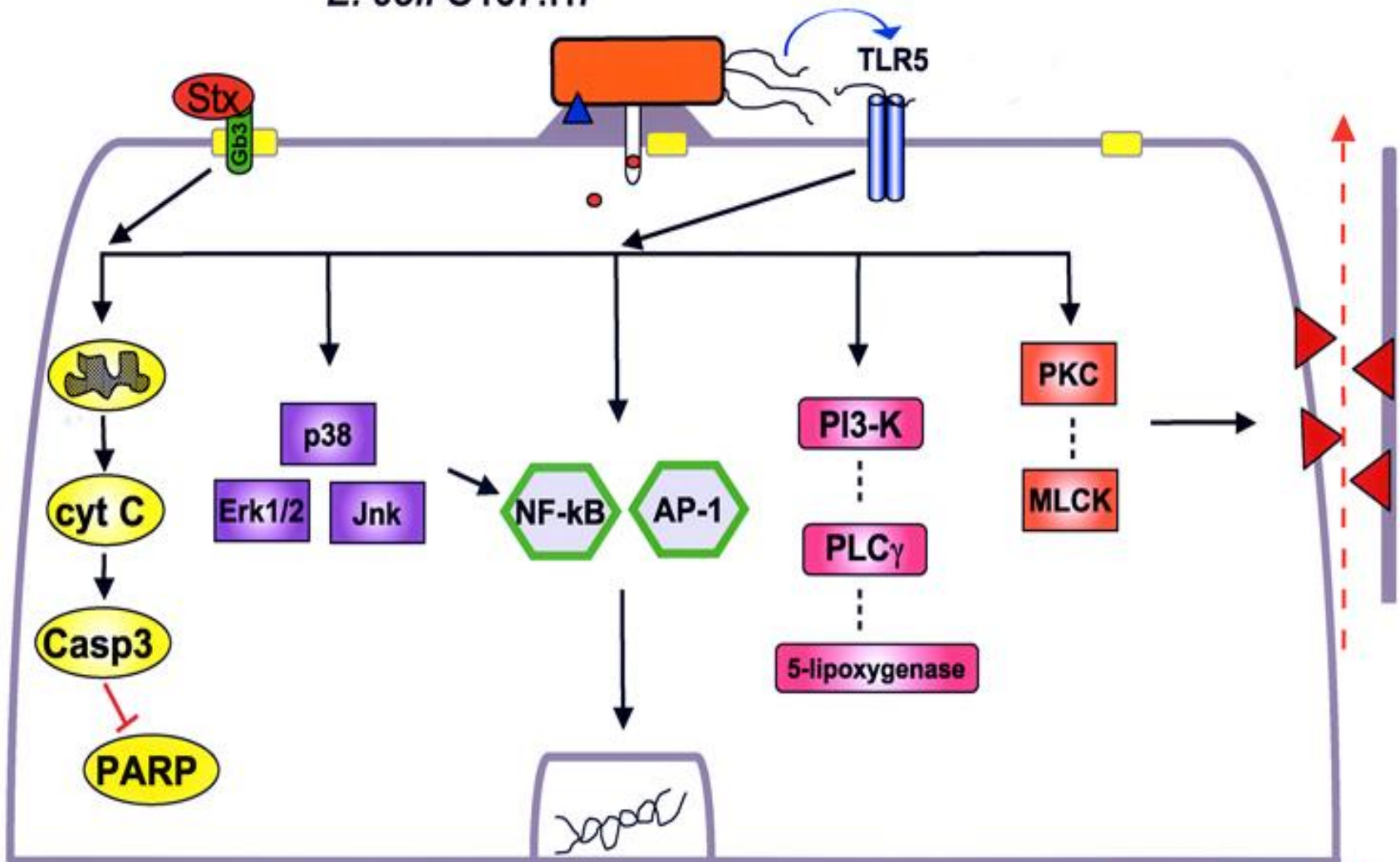
hemolytic – uremic syndrome (HUS)

Pathogenesis:

Mediation by cytotoxic shiga toxins (Stx-1 ,Stx-2) which disrupt protein synthesis; A/E lesions with disruption of microvillus structure resulting in decreased absorption and diarrhea



E. coli O157:H7



Apoptosis

MAP
kinases

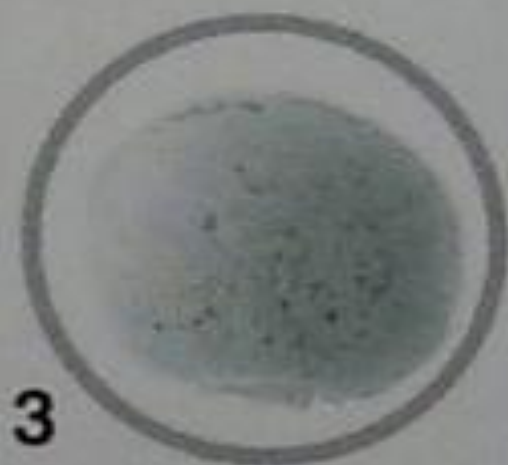
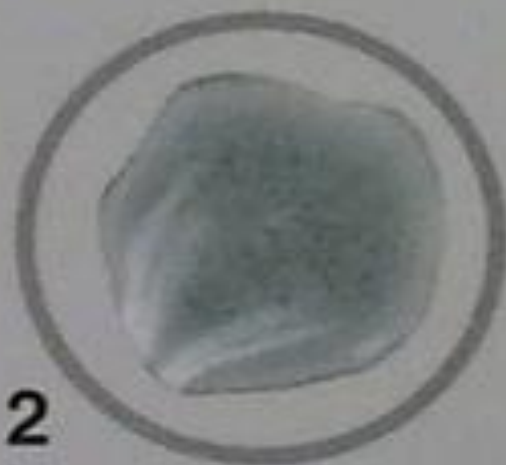
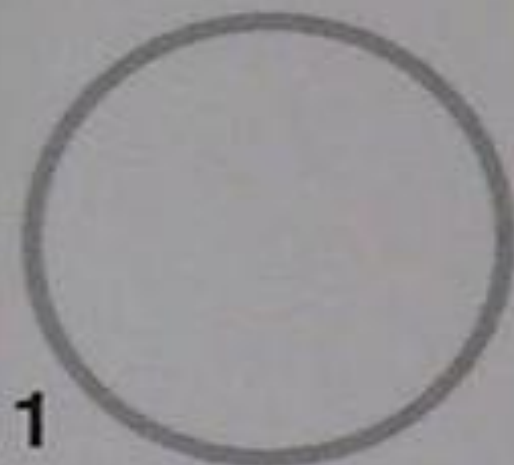
IL-8

Attaching-effacing
lesion

↑ Paracellular
permeability

O157 antigen

H7 antigen



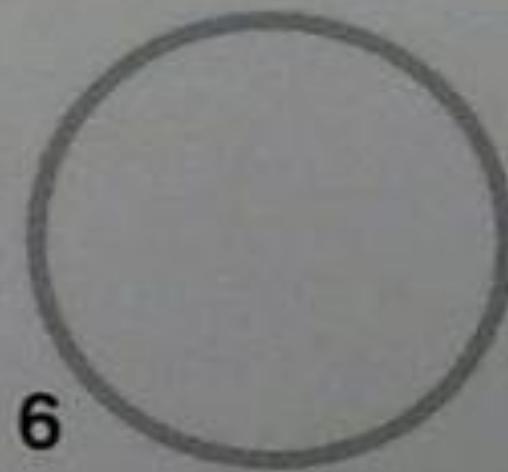
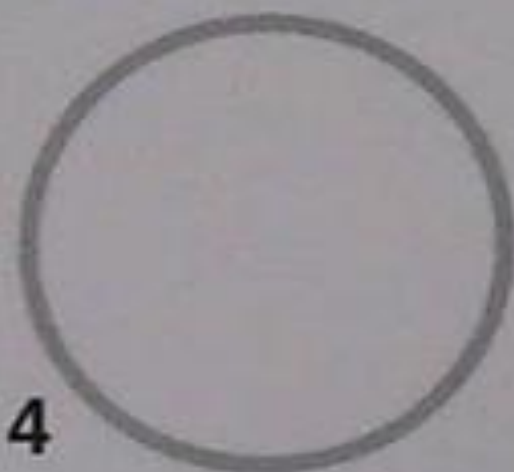
1

2

3

E. coli O157

H7



4

5

6



Control latex

Enteroinvasive E.coli(EIEC)

Site of action:

Large intestine

Diseases:

Disease in underdeveloped countries (watery diarrhea may progress to dysentery diarrhea, cramps, fever)

Pathogenesis:

Plasmid mediated by invasion and destruction of epithelial cells lining colon

Enteraggregative E.coli(EAEC)

Site of action:

small intestine

Diseases:

Infant diarrhea; persistent watery diarrhea with vomiting, low grade fever and dehydration

Pathogenesis:

plasmid mediated aggregative adherence of bacilli (stacked bricks) with shortening of microvilli, mononuclear infiltration and hemorrhage; decreased fluids absorption

Diffuse aggregative E.coli(DAEC)

Site of action:

small intestine

Diseases:

Infant diarrhea (watery diarrhea in 1-5 years of age)

Pathogenesis:

Stimulate elongation of microvilli

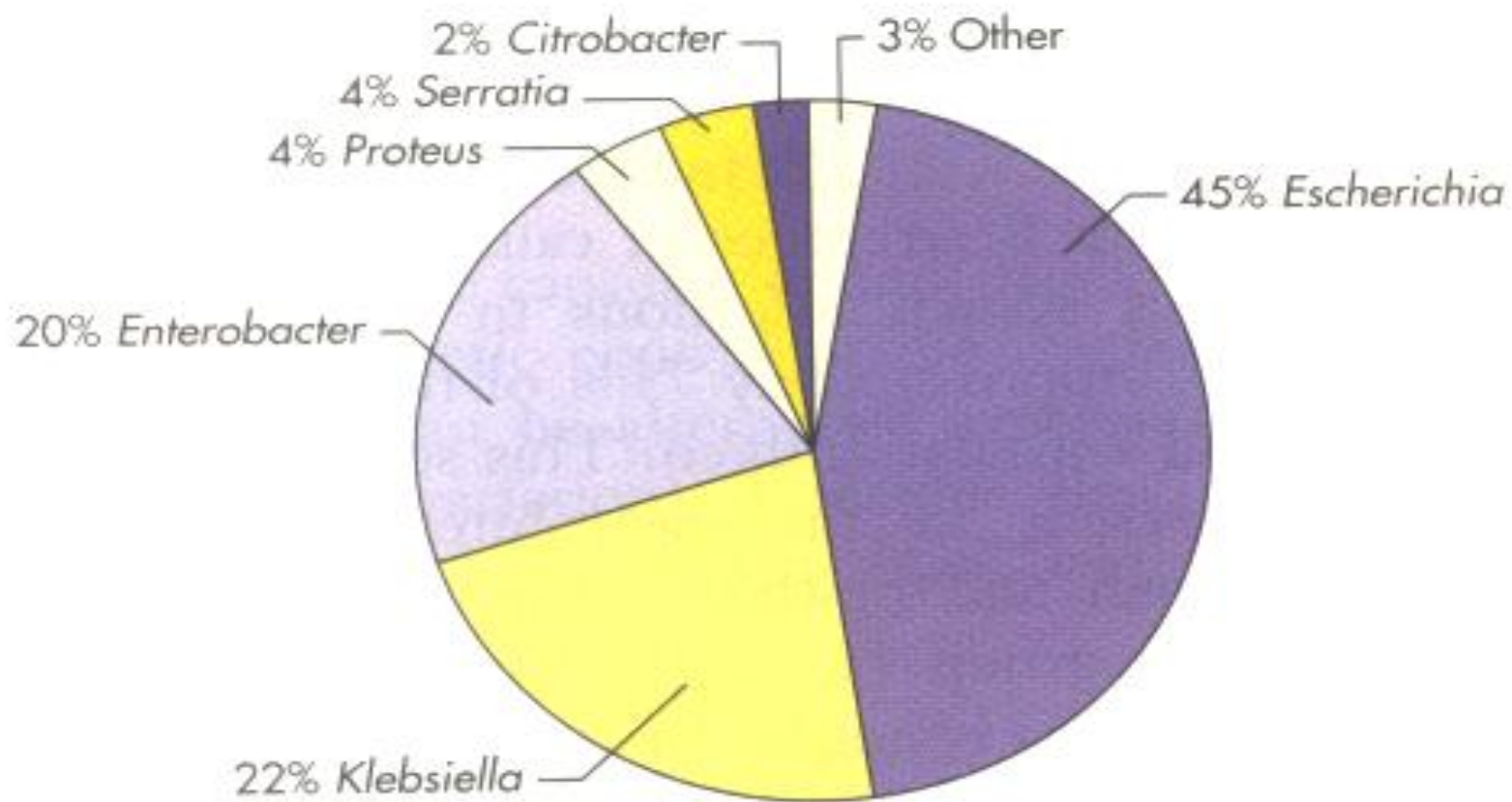


FIGURE 29–4. Incidence of Enterobacteriaceae associated with bacteremia. (Data courtesy Barnes-Jewish Hospital, St. Louis.)

Summary : Diseases caused by E. coli

■ Urinary tract infection

Most common cause of UTI in young women (90%)

• E.coli – associated diarrheal diseases

➤ Enteropathogenic E.coli (EPEC)

Main cause of diarrhea in infants

➤ Enteroenterogenic E.coli (EETEC)

Main cause of Traveler's diarrhea. Toxins are:

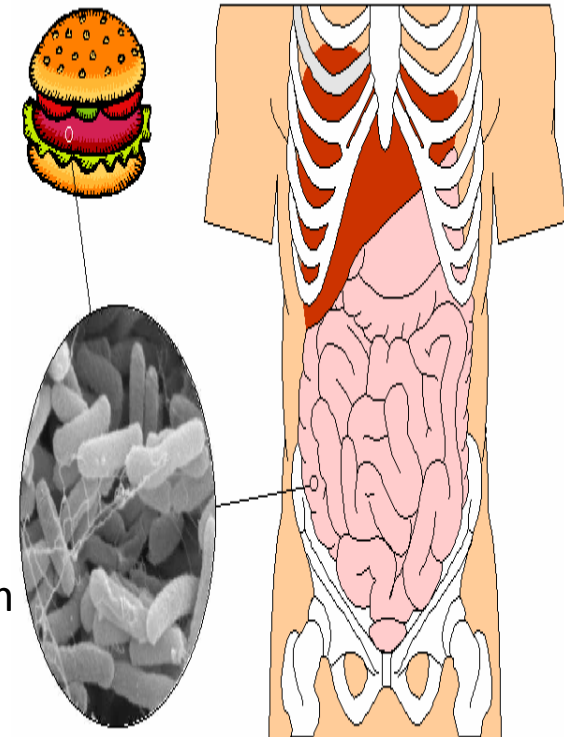
Heat labile enterotoxin (LT) ; activates adenylyl cyclase

Heat stable enterotoxin (ST) ; activates guanylyl cyclase

➤ Enterohemorrhagic E.coli (EHEC)

Produces verotoxin , most common type is O157:H7

cause of hemorrhagic colitis and hemolytic uremic syndrom



Summary : Diseases caused by E. coli

➤ Enteroinvasive E.coli (EIEC)

like shigellosis ,is late lactose fermenter and non- motile

➤ Enteroaggregative E.coli (EAEC)

cause acute and chronic diarrhea and food-borne illness

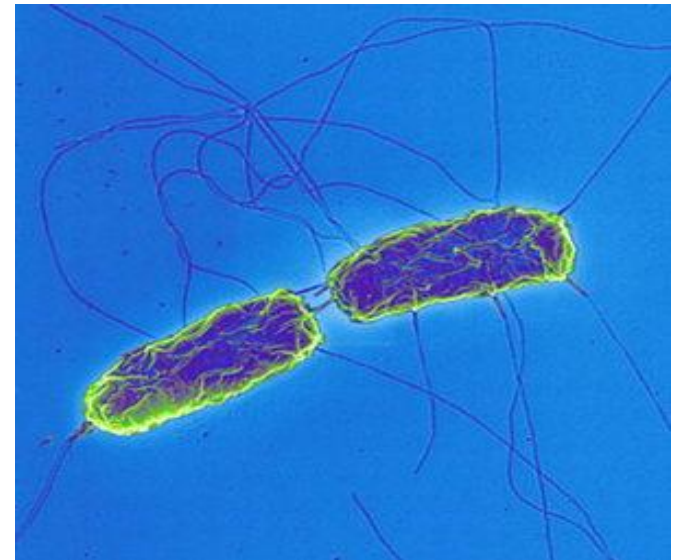
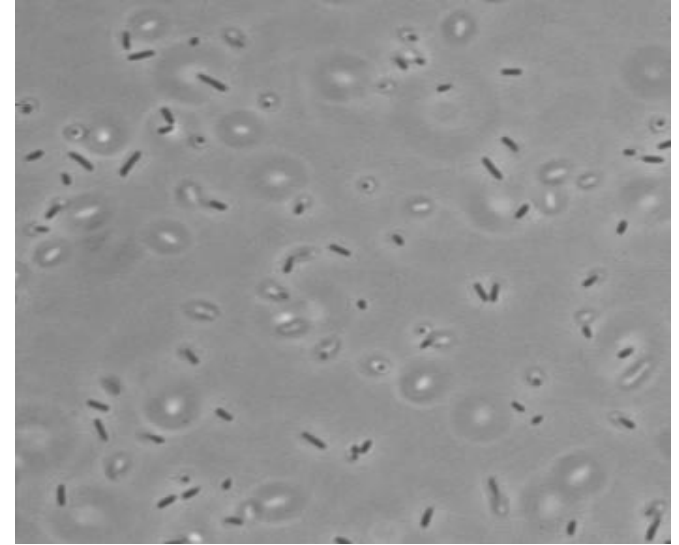
- Sepsis

- Meningitis

cause of meningitis in infants.(K₁ antigen)

Salmonella

- Lactose and sucrose(-)
- most isolates are motile
- Ferments glucose and mannose without gas production
- most produce H₂S
- O, H (phase variation) and vi antigens
- survive in freezing water for long periods , resistant to brilliant green and sodium tetrathionate .



Salmonellae

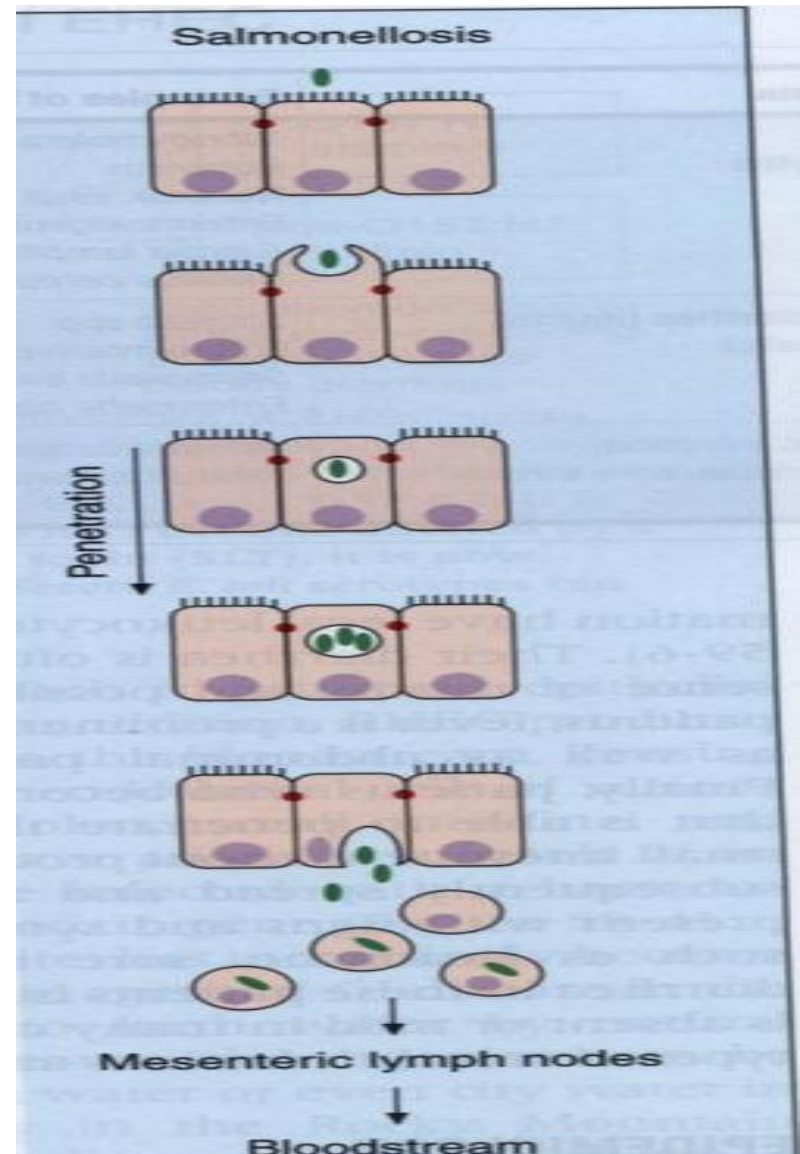
- The taxonomic classification of the genus salmonella is problematic.
 - kuffman-white system
 - Edwards-Ewing system
 - DNA hybridizing model
- More than 2500 serotype for *S.enterica*
- *Salmonella enterica* serovar. Typhi
- **Formulation**

O group	serotype	Ag formula
D	S.typhi	9,12 (vi) :d:--
A	S.paratyphi A	1,2,12 :a—
C ₁	S.cholerssuis	6,7 :c:1,5
B	S.typhimurium	1,4,5,12 :i:1.2
D	S.enteridis	1,9,12 :g,m:--



Pathogenesis of salmonella

- After ingestion, attach to the mucosa of the small intestine and invade into the M cells in peyer patches and erythrocytes.
- Remain in endocytic vacuole, and replicate.
- Transport across the cytoplasm and released into the blood or lymphatic circulation.



Salmonella

- **Virulence**: can survive in macrophage and spread from intestinal to other sites of body (S.typhi); endotoxin ;tolerance to acids in phagocytic vesicles.
- **Epidemiology**: direct fecal-oral spread; Eating contaminated food products; passing person to person (S.typhi) with asymptomatic long-term colonization;

Diseases of salmonella

- Gastroenteritis
- *S. typhimurium* and *S. enteritidis* ,.....
- Most common form of salmonellosis
- Incubation period:6-48 hours
- Symptoms: fever ,vomiting ,bloody or non-bloody diarrhea, abdominal cramps and nausea
- Symptoms persist from 2 days -1 week



Diseases of salmonella

- Septicemia
- *S.typhi*, *S paratyphi*, *S.cholerasuis*,....
- Bacteremia is higher in pediatric and geriatric patients , immunocompromised patients (sickle- cell anemia, HIV, congenital deficiencies)
- Symptoms is like other G(-) bacteremia
- Localizes suppurative infections (osteomyelitis, endocarditis, arthritis) occur in 10% of patients



Diseases of salmonella

- Enteric fever, typhoid fever:

S.Typhi

- Paratyphoid fever: *S.paratyphi A*, *S.schuttmuelleri*, *S.hirschfeldii*,
- Bacteria pass through the cells lining the intestines and engulfed by macrophages.
- Transported to the liver, spleen, bone marrow and replicate
- Incubation period: 10-14 days
- Symptoms: gradually increasing fever (to 40C) with headache, myalgias, malaise, rose spots, anorexia (symptoms persist for a week or longer) , followed by colonization of the gallbladder , then reinfection of the intestine



- **A.Clinical presentation in first week of Typhoid fever**
- Slowly progressive fever as high as 104 degree Fahrenheit.(stepladder fever pattern)
- Headache
- Profuse sweating
- Decrease appetite
- Constipation or diarrhea
- Fatigue and weakness
- Sore throat
- Abdominal pain
- Insomnia
- Confusion
- Psychosis
- Jaundice
- Sharp right lower quadrant pain
- Joint pain , muscle pain
- Rose spots
- Urinary retention
- Hematuria(blood in urine)
- **B.Clinical presentation in second week**
- Continuous high fever
- Weight loss
- Distention of abdomen
- Malaise , confusion and delirium
- Dicrotic Pulse (a pulse characterized by two peaks, the second peak occurring in diastole)
- Diarrhea (pea soup like)
- **C.Clinical presentation in third week**
- Delirious
- Motionless and exhausted eyes
- Life-threatening complication may developed.
- **D.Clinical presentation in forth week**
- This is the recovery phase
- Decreased fever
- Improvement of other signs and symptoms



- **complications of Typhoid fever?**
- Intestinal bleeding
- Intestinal perforation (most common complication may developed in the third week of illness)
- Myocarditis
- Pancreatitis
- Pneumonia
- Osteomyelitis
- Meningitis
- Cholecystitis

Diseases of salmonella

- Asymptomatic colonization
- Typhoid fever strains are maintained by human colonization.
- Chronic colonization for more than 1 year after disease develops in 1%-5%
- The gallbladder is reservoir

Diagnosis of salmonella

- Enterocolitis
- stool culture :(+)
- Latex agglutination by antiserums

- The enteric fevers (typhoid fever)
 - at first week ,blood culture (+),stool culture (-)
 - at second and third week , urine and stool culture (+)
- Latex agglutination by antiserums
 - widal test : >1/80 (+)
 - Vaccination reduce can the risk for travelers to endemic areas

- Bacteremia with local lesions
 - ❖ blood culture (+)

- Asymptomatic colonization
 - ❖ Vi antigen detection

Summary: Diseases caused by salmonellae

➤ **Enterocolitis** (fever ,vomiting ,bloody or non-bloody diarrhea, abdominal cramps and nausea)

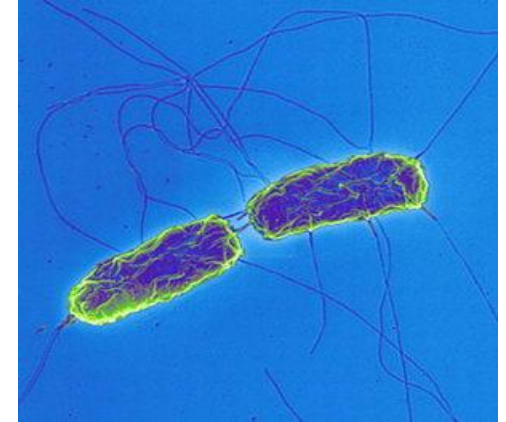
❖ *S. typhimurium* and *S. enteritidis* ,.....

- stool culture :(+)

➤ **The enteric fevers (typhoid fever)**

❖ *S. typhi* , *S. paratyphi A* ,.....

- at first week ,blood culture (+),stool culture (-)
- at second and third week , urine and stool culture (+)
- widal test : $\geq 1/160$ (+)
- Vaccination reduce can the risk for travelers to endemic areas



➤ **Bacteremia with focal lesions**

❖ *S.cholerssuis*, *S.typhi*, *S.paratyphi*,.....

blood culture (+)

➤ **Asymptomatic colonization**

❖ *S.typhi*, *S.paratyphi*

