



Tikrit University

College of Medicine

Depart. of Microbiology

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جامعة تكريت

كلية الطب

فرع الأحياء المجهرية

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الصف الثالث

### Objectives of lecture:

1. Identify the Enterobacteriaceae & their characteristics with antigenic structures.
2. Recognize the microscopical & macroscopical characteristic features of Enterobacteriaceae.
3. Define the major genes of Enterobacteriaceae (*E.coli* & *Klebsiella*)
4. Explain the main pathogenic of *E.coli* & *Klebsiella*.
5. Outline the microscopical & cultural features of *E.coli* & *Klebsiella*
6. Explain the most important biochemical tests for diagnosis of *E.coli* & *Klebsiella*.
7. Outline the diseases of *E.coli* & *Klebsiella* .

### The main references:

1. Medical microbiology (Jawetz, Melnick & Adelberg`s).
2. Medical Microbiology an introduction to infectious diseases (Sherris).
3. Diagnostic microbiology (Bailey & Scott`s).
4. Pictures from the net.

### Enterobacteriaceae

- Family Enterobacteriaceae often is called as enterics or coliform because found in colon (large intestine) or normal flora.
- The major characteristic features of Enterobacteriaceae:
  1. All genes ferment glucose.
  2. All reduce nitrates to nitrites.
  3. All are oxidase test negative.
  4. All are motile except *Klebsiella*, *Shigella* and *Yersinia*.

- **Microscopical examination:**

1. Gram negative, bacilli or coccobacilli.
2. Non spore forming.
3. Motile with flagella or non motile according to species.

- **Colony morphology (Cultural features):**

1. Colony morphology on blood agar media are non value except Klebsiella.
2. They can grow on selective media as MacConkey's agar, Eosine methylene blue & XLD agar.



- **Virulence & antigenic factors of Enterobacteriaceae:**

- a. Ability to colonize, adherence, produce various toxins & invade tissues.
- b. Some species possess plasmid that induce resistance to some antibiotics
- c. Many enteric possess Ags that can be used to identify groups.

1. O-Ag → Somatic, heat stable Ag located in the cell wall.
2. H-Ag → Flagella, heat labile Ag.
3. K-Ag → Capsular, heat labile Ag.

- **Clinical significance of Enterobacteriaceae:**

1. Most are present in the intestinal tract of human animals as commensal flora except for few. Therefore, they are sometimes called fecal coliforms.
2. Some live in the water, soil & sewage.
3. Based on clinical infections, the enterics are divided into 2 groups:
  1. Opportunistic pathogens which are normally part of the usual intestinal tract.
  2. Primary intestinal pathogens such as Salmonella, Shigella & Yersinia spp.

1. ***Escherichia coli (E.coli):***

- **Cultural features:**

- On MacConkey's agar the colonies will present as circular, smooth, dry colonies with pink rose spot appearance (due to lactose fermentation which found in this media).

- *E.coli* ferment **glucose**, **lactose** & **xylose**.
- *E.coli* don't produce **H<sub>2</sub>S** or phenylalanine deaminase.
- *E.coli* have simmon citrate **negative**.
- *E.coli* ususally motile.
- Voges-Proskauer test **negative**.
- Indole test positive.
- MR (Methyl Red) test is also **positive**.



Indole test



MR test

- **Microscopical features:**

Under the light microscope, *E.coli* will appear as Gr -ve, small, rod bacilli, arranged in single or pairs.

- **Diseases or infections of *E.coli*:**

- **Gastrointestinal infections**

1. Enteropathogenic *E.coli* (EPEC): produce diarrhea in infant & children, outbreaks in hospital & day care centers. The stool has mucous but not blood.
2. Enterotoxogenic *E.coli* (ETEC): produce **traveler's** diarrhea characterized by watery diarrhea without blood, self-limiting.
3. Enteroinvasive *E.coli* (EIEC): produce dysentery with bowel penetration, invasive & destruction of intestinal mucosa characterized by watery diarrhea with blood (**don't ferment lactose & identified by DNA probes**).

4. Enterohemorrhagic *E.coli* (EHEC): associated with hemorrhagic diarrhea & hemolytic uremic syndrome (HUS), which induce low platelet count, hemolytic anemia & kidney failure.
  5. Enteroaggregative *E.col* (EAEC): cause diarrhea by adhering to the mucosal surface of the intestine, which characterized by watery diarrhea, symptoms may persist for over 2 weeks in chronic diarrhea.
- **UTI:**

*E.coli* is the most common cause of UTI about 90% of UTI caused by *E.coli* especially in female at school age group? Why?

- **Septecimia & meningitis:**

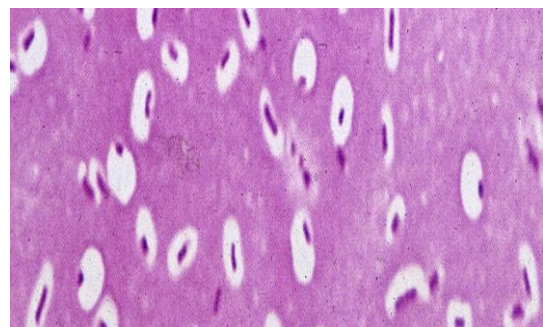
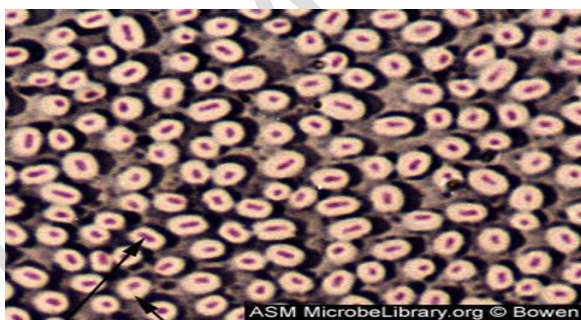
It increases among neonate since acquired in the birth canal before or during delivery.

## 2. Klebsiella:

- It usually found in the intestinal tract as a normal flora & converted into pathogenic opportunistic bacteria in immunocompromised patients.
- *Klebsiella* spp. Causes many infections like pneumonia, wound infection, gastroenteritis & UTI.
- *Klebsiella* consist of 4 major species (*K.peumoniae*, *K.ozanae*, *K.rhinosclromatis* & *K.oxytoca*).
- *K.pneumoniae* is the most common isolated.

- **Microscopical features:**

- Gr –ve, large, rod bacilli, have thick polysaccharide capsule (which makes mucoid, protect against phagocytosis & more resistant to antibiotics), non motile in some species.

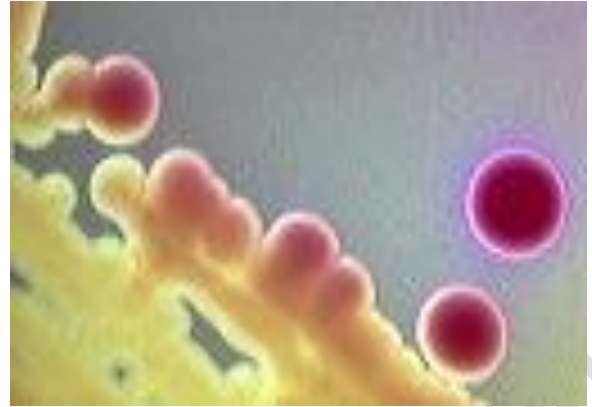


Quelling test

- **Cultural features:**

The colonies appear as large, circular colonies with irregular edges, mucoid, lactose fermentation is positive, facultative anaerobic grow at 37°C / 18-24 hr. & have yeasty odor.





- **Biochemical tests:**

- Lactose +ve.
- Urase +ve.
- Simmon citrate +ve.
- H<sub>2</sub>S -ve.
- MR -ve.
- VP +ve.
- Indole -ve.



Simmon citrate

- **Diseases of Klebsiella:**

- *K.pneumoniae* → pneumonia, necrotic destruction of alveolar spaces & bloody sputum.
- Wound infection
- UTI
- *K.rhinoscleromatis* → Sklerom
- *K.ozanae* → Atrophic disease of nasal epithelium.

