Al-Mustaqbal University College
Dept. Medical Lab. Techniques
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Lecture-13: Family of *Enterobacteriaceae*

General characters of *Enterobacteriaceae*

All members of *Enterobacteriaceae* are:

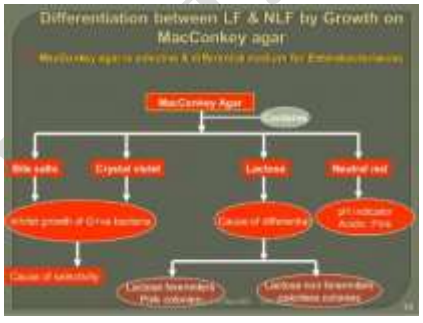
- ✓ All are gram-negative rods, non-spore forming
- ✓ Reduce nitrates to nitrites
- ✓ Oxidase negative (-ve)
- ✓ Catalase positive ($^{+}$ve)
- ✓ Facultative anaerobic
- ✓ Motile except ***Shigella*** and ***Klebsiella***
- ✓ Non-capsulated except ***Klebsiella***
- ✓ Wide diversity / Antigenic heterogeneity.
- ✓ **grow on bile containing media (MacConkey agar)**

Classification of on the bases of Lactose fermenting, on MacConkey agar *Enterobacteriaceae* can be differentiated as Lactose fermenters (LF) such as ***E. coli*** and ***Klebsiella*** & **non-Lactose fermenters (NLF) such as *Salmonella*, *Shigella***.

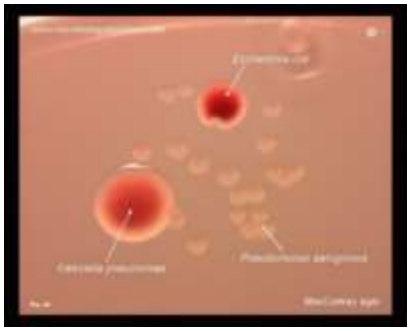
Identification of *Enterobacteriaceae* on MacConkey agar:

MacConkey agar is inoculated with tested organism using streak plate technique. Incubate the plate in incubator at 37 C for 24 hrs., then read the results as the following:

- LF organism appears as **pink colonies** (e.g. ***E. coli*** and ***Klebsiella***)
- NLF organism appears as **colorless colonies** (***Salmonella*** *and* ***Shigella***).



MacConkey agar



Bacteria on MacConkey

E. coli on EMB-agar

Taxonomy of *Enterobacteriaceae*: there are **four tribes**:

Tribe I Escherichia: includes five genera:

1- **Escherichia**. **2**. **Salmonella**. **3**. **Shigella**. **4**. **Citrobacter. 5. Edwardsiella**

Tribe II; Klebsiella: includes four genera:

1. **Klebsiella**. **2**. **Enterobacter. 3. Hafnia. 4 Serratia**

Tribe III; **Proteeae**: includes three genera:

1. Proteus. 2. Morganella. 3. Providencia

Tribe IV; Erwinieae: includes only one genus: 1. Erwinia

The highly Pathogenic genera among Enterobacteriaceae are:

Salmonella and Shigella

Escherichia coli, (E. coli)

- ✓ Identified and named by **Escherichia**
- ✓ Wide group of bacteria on basis of **Bio-typing and Sero-typing**
- ✓ Produce infections in **Humans and Animals**
- ✓ **Detection of *E. coli* in water indicates for pollution and contamination of water by fecal products.**
- ✓ Gram (-ve) Straight rods,
- ✓ Appear in singles or in pairs,
- ✓ **Motile by peritrichous flagella.**
- ✓ **Not spore forming, Non-acid fast.**

Cultural characters

- ✓ Aerobic and facultative anaerobic
- ✓ Grows between 10 – 40 C°, optimal at **37** C°
- ✓ Grown in simple medium
- ✓ Produce large grayish, Thick white, moist smooth opaque colonies
- ✓ May contain capsule.
- ✓ **On MacConkey agar Produces Bright pink colonies (Lactose fermenters).**
- ✓ On Blood Agar: Many pathogenic strains are haemolytic on blood agar.

Biochemical Characters of ***E. coli***: It ferments **Glucose**, **Lactose**, **Mannitol**, **Maltose** with acid (A)/(G)

- ✓ Indole positive (+ve)
- ✓ Methyl Red positive (+ve)
- ✓ VogesProskauer negative (–ve)
- ✓ Citrate negative (–ve)
- ✓ Urease production, (-ve).

Antigenic Structure of *E. coli*

- ▶ **Somatic-O** 170 antigen, lipopolysaccharide has endotoxic activity
- ▶ **Capsular-K** 100 antigen, **protects against the phagocytosis.**
- ▶ **Flagella-H** 75 antigen

Virulence factors:

Two main types of virulence factors in *E. coli*;

1- **Surface antigens**; **a- capsule (K)** antigen, protects against the phagocytosis. **b-Fimbriae** which promote virulence (important in UTI), causing **mannose sensitive Haem-agglutination, colonisation factor antigens is enterotoxigenic *E. coli***

2-Toxins (endotoxins). The somatic **lipopolysaccharide** surface O-antigen has **endotoxic** activity and protects from phagocytosis.

3-In addition, *E. coli* produces two kinds of Exotoxins; hemolysins and enterotoxins.

Toxins: - Heat labile HL Heat stable HS.

- Vero toxins VT Like Shigella toxins (shiga like toxin)

Infections caused by *E. coli*

- **Neonatal meningitis** is the leading cause of neonatal meningitis and septicemia with a high mortality rate, usually caused by strains with the **K1 capsular antigen.**
- **Gastroenteritis, there are several distinct types of *E. coli* that are involved in different types of gastroenteritis:**

1. **enterotoxigenic*E. coli* (ETEC).**
2. **enteroinvasive*E. coli* (EIEC).**
3. **enteropathogenic*E. coli* (EPEC).**
4. **enteroaggregative*E. coli* (EAEC).**
5. **enterohemorrhagic*E. coli* (EHEC).**

Other infections caused by *E. coli*

- Intra-abdominal infections
- Peritonitis. Abscess.
- Septicemias

Clinical significance of *E. coli*: It is the leading cause of urinary tract infections (UTI) which can lead to acute **cystitis** (bladder infection), **pyelonephritis** (kidney infection), **Prostitis and asymptomatic Bacteriuria in pregnant women** and.

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