Al-Mustaqbal University College
Dept. Medical Lab. Techniques
Diagnostic Microbiology 20/2021
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Lecture-15: Family of *Enterobacteriaceae*. Genus of *Salmonella*:

General characteristics:

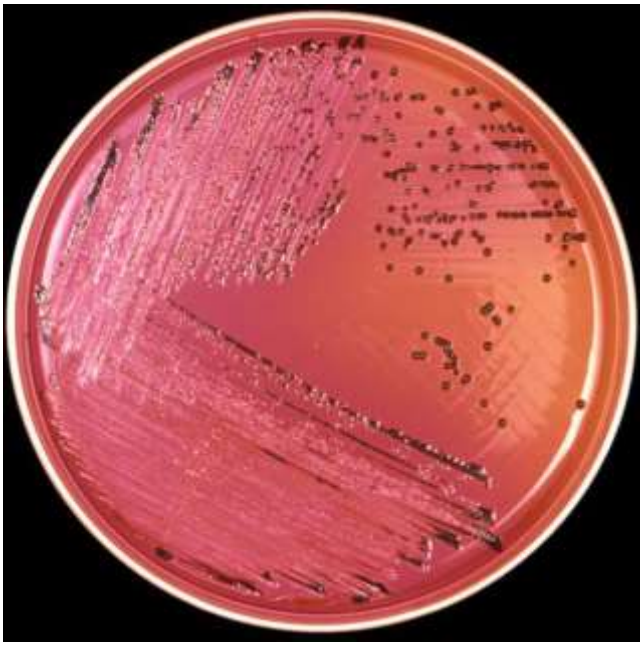
- Gram-negative, aerobic/facultative anaerobe.
- Salmonellae live in the intestinal tracts of human and animals.
- In humans, it causes two diseases called **salmonellosis**: **a- enteric fever** (**typhoid**), resulting from bacterial invasion of the bloodstream, and **b- acute gastroenteritis**, resulting from a food poisoning.

Antigenic structure: The genus *Salmonella* has three kinds of major antigens:
1- Somatic-O antigen **(Cell Wall Antigens):** Heat stable
2- Surface antigen **(Envelope) Antigens** or Vi antigen. The Vi antigen occurs in only three *Salmonella* serovars: Typhi, Paratyphi C, and Dublin.
3- Flagellar-H antigen (are heat-labile proteins).

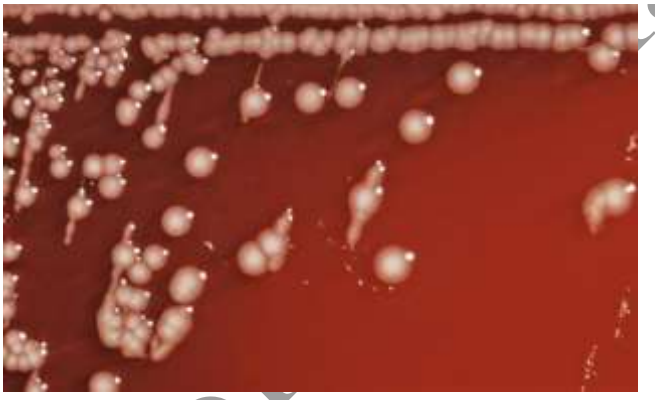
Flagellar stain of *Salmonella* Typhi. *Salmonella* are motile by means of peritrichous flagell.

Diagnosis of *Salmonella*
The most commonly used media selective for *Salmonella* are:
1- S-S agar.
2- Bismuth sulfite agar.
3- Hektoen enteric (HE) medium.
4- Brilliant green agar.
5- Xylose-lysine-deoxycholate (XLD) agar.
6- **Tetrathionate-enrichment broth contains bile salts, thereby inhibiting the growth of Gram-positive organisms, while the Gram-negative *Salmonella* sp.,**

being an organism that possess the enzyme tetrathionate reductase, is able to break down tetrathionate, and grow uninhibited.
All these media contain both selective and differential ingredients and they are commercially available.



***Salmonella* sp. after 24 hours' growth on XLD agar. It is Xylose Lysine (XL) supplemented with sodium thiosulfate, ferric ammonium citrate, and sodium deoxycholate, it is then termed XLD agar. It is the selective medium for Salmonella. The presence of any black colored area indicates the deposition of hydrogen sulfide, (H_2S) under alkaline conditions.**



Colonies of *Salmonella* grown on a blood agar plate. It is a zoonotic bacterium that can infect humans, and animals.

Characteristics of Salmonella:
- **Gram-negative bacteria.**
- **Indole test negative** (-ve)
- **Methyl red test positive (+ve)**
- **Voges-Proskauer test negative** (-ve
- **Citrate positive (growth on Simmon's citrate agar)** (+ve)
- **Urease negative** (-ve)
- **H_2S produced from thiosulfate** (+ve)

Pathogenesis of *Salmomella* Infections in Humans:
Most serovars are highly pathogenic for humans.
An oral dose of at least **10^5** *Salmonella Typhi* cells are needed to cause **typhoid** in 50% of human volunteers, whereas at least **10^9** *S. Typhimurium* cells (oral dose) are needed to cause symptoms of a **toxic** infection.

Pathogenesis of typhoid.
-The bacteria enter the human digestive tract with contaminated foods or water.
- penetrate the intestinal mucosa and are stopped in the mesenteric lymph nodes.
- It multiply and part of the bacterial population lyses.
- From the mesenteric lymph nodes, viable bacteria and LPS (endotoxin) may be released into the bloodstream resulting in **septicemia**.
- Release of endotoxin is responsible for cardiovascular collapsus and typhoid.

Virulence factors:

1- **Toxins:** *Salmonella* produces both endotoxins and exotoxins. The endotoxin (lipid A) of the lipopolysaccharide (LPS) of *Salmonella*. The exotoxins can be subdivided in two types: the cytotoxins and the enterotoxins. Cytotoxins (verotoxins; referring to a cytotoxic assay in Vero cells, able to kill mammalian cells. A third type of exotoxin termed salmolysin (hemolysin) has been proposed.
2- **Fimbriae:** Fimbriae (also called pili) are filamentous surface structures involve in the colonization of target cells.
3- **Flagella:** The majority of *Salmonellae* possess randomly positioned (peritrichous) flagella that confer motility to the bacterium. Flagella play an important role in adhesion in and invasion into eukaryotic cells and in the pathogenesis of *Salmonella* spp.

Vaccination Against Typhoid Fever: Three types of typhoid vaccines are currently available: (1) the oral live-attenuated vaccine. (2) the heat-phenol-inactivated vaccine. (3) the capsular polysaccharide vaccine. (4) the acetone-inactivated parenteral vaccine, is currently available only to the armed forces.

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