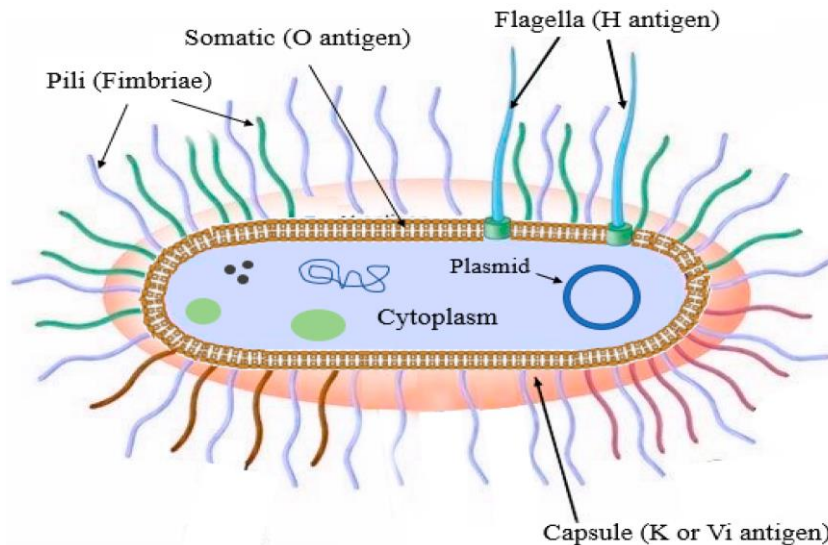


## Widal test

### Salmonella

*Salmonella* sp are Gram-negative bacilli, non-spore-forming, non-capsulated, motile (bacteria have flagella projecting in all directions, i.e. peritrichous), facultative anaerobic and characterized by **antigenic structure**, the genus *Salmonella* has three kinds of major antigens:

1. **Somatic (O) or Cell Wall Antigens:** Somatic antigens are heat stable and alcohol resistant.
2. **Surface (Envelope) Antigens:** One specific surface antigen is well known: The Vi (virulence) antigen.
3. **Flagellar (H) Antigens:** Flagellar antigens are heat-labile proteins.



There are clinical cases caused by *salmonella*:

1. **Typhoid fever (Enteric fever)** which is caused by either *S. typhi* or *S. paratyphi*.
2. **Food poisoning** which is caused by either *S. enteritidis* or *S. typhimurium*.

### Typhoid fever

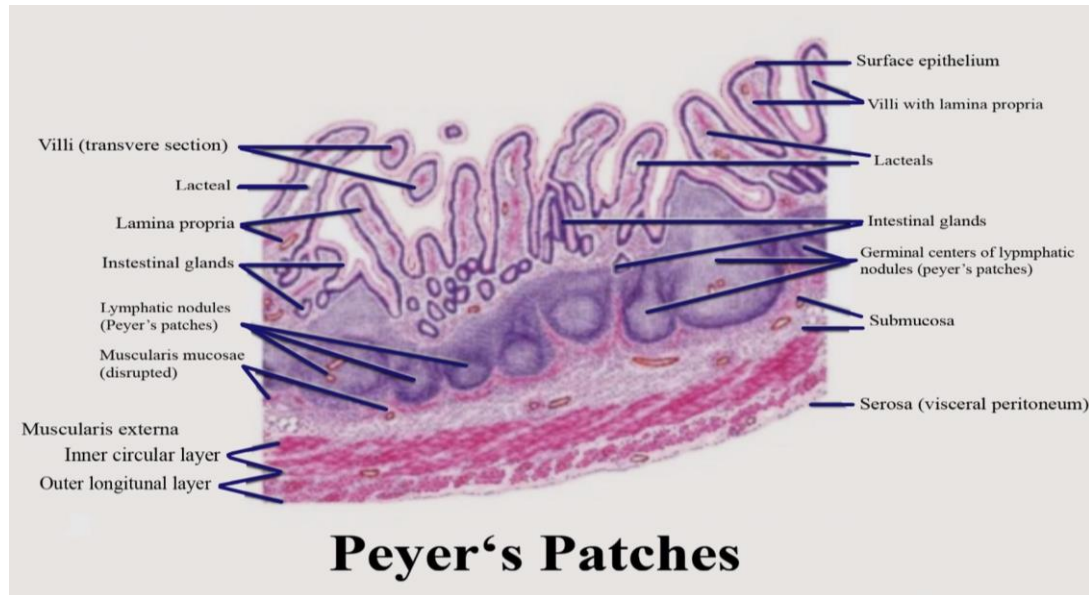
An infectious feverish disease caused by the bacterium *Salmonella typhi* (*Salmonella enterica* Serovar Typhi) and less commonly by *Salmonella paratyphi*. It includes acute infection of the reticuloendothelial system, intestinal lymphoid tissue, and the gall bladder.

The infection always comes from another human, either an ill person or a healthy carrier of the bacterium. The bacterium is passed on with water and foods and can withstand both drying and refrigeration.

### Pathogenesis:

*Salmonella* ingested in food survive passage through the gastric acid barrier and invade the mucosa of the small intestine. Invasion of epithelial cells stimulates the release of cytokines which induce an inflammatory reaction. The acute inflammatory response causes diarrhea and may lead to **ulcers** and **necrosis** of the mucosa.

*S. typhi* infects the body via the **peyer's patches** of the small intestine. The bacteria migrate to mesenteric lymph nodes and arrive via the blood in the **liver** and **spleen** during the first exposure. After multiple replications in the above locations, the bacteria re-enter the small intestine for secondary exposure, and consequently, the clinical symptoms are seen.



## Symptoms

Some of the symptoms of typhoid fever may include **Headache, Fever (have a sustained fever as high as 39 to 40 °C), Lethargy, Poor appetite, Diarrhea, vomiting, Constipation, and slow heartbeat. Chest congestion, Stomach pain, Muscle pains, and Blood in the stool.**

No symptoms - if only a mild exposure; some people become "carriers" of typhoid.

## Time frame

Occurs gradually over a few weeks after exposure to the bacteria. Sometimes children suddenly become sick.

**First week:** The disease classically presents with a rise in temperature (39 to 40 °C) over 4 to 5 days, accompanied by headache, unclear abdominal pain, diarrhea, and constipation.

**Second week:** Between the 7th and 10th days of illness, mild hepatosplenomegaly occurs in the majority of patients and rose spots may be seen.

**Third week:** The patient will appear in the "typhoid state" which is a state of prolonged apathy, toxemia, delirium, and/or coma. Diarrhea will then become apparent. If left untreated, there is a high risk of intestinal hemorrhage. At this point fatal complications may emerge.

## Diagnosis:

Early rapid detection and identification of *S. typhi* and (*paratyphi*), is essential in diagnosis and for treatment to reduce morbidity and mortality.

**The direct diagnosis** of *S. typhi* and (*paratyphi*) include cultures of blood, urine and feces. The definitive diagnosis of the disease requires the isolation of *S. typhi* and (*paratyphi*), from the blood, feces, or urine. Blood culture is generally recognized as the best procedure for a definitive diagnosis of early typhoid fever. The procedure is costly and time-consuming requiring almost 3 days.

**The indirect diagnosis** of *S. typhi* and (*paratyphi*) includes a Slide or Tube agglutination test (Widal test). The Widal test is a routine serological test for detecting antibodies against *S. typhi* and *paratyphi*. Antibodies against salmonella may be detected after 7- 10 days and reach to peak in 2-3 weeks of infection. A test involving agglutination of salmonella antigen when they are mixed with serum-containing antibodies.

**Principle of Widal-test:**

Stained febrile antigens are suitable for both the rapid slide and tube agglutination tests against human sera for the detection of specific antibodies. Antibody in the serum produced in the response to *Salmonella* organism, the kit contains antigen suspensions which are killed bacteria and they were stained to enhance the reading of agglutination tests. The blue-stained antigens are specific to the somatic antigens (O-Ag), while the red-stained antigens are specific to the flagellar antigens (H-Ag).

**Procedures of Widal-test:**

• **Rapid Slide (screen) Test:**

- 1- Place 1 drop of the serum patient into each of circle slide.
- 2- Add 1 drop of well shake Ag. O, H, A (O), B (O), C (O), A (H), B (H) & C(H) respectively into each circle.
- 3- Mix & rotate the slide for 1 minute & observe for agglutination.

• **Rapid Slide Titration:**

- 1- Place 80 µl, 40 µl, 20 µl, 10 µl & 5 µl of undiluted serum onto circles.
- 2- Shake the reagent bottle well and add one drop of Ag to each serum circle.
- 3- Mix well using a stirring stick and rotate the slide
- 4- Read after 1 minute.

**Results:**

(80 µl =1:20), (40 µl =1:40), (20 µl = 1:80), (10 µl =1:160), (5 µl =1:320).

**Interpretation:**

- 1- Agglutination 1:160 normal.
- 2- Agglutination in 1:240 & above is typical of enteric fever.
- 3- Vaccination moderate rise Ab titer.
- 4- Treated case may show poor agglutination response.