



Salmonella spp

Introduction: The organisms are named after the American veterinary pathologist **Daniel Elmer Salmon** in 1885. Currently, there are three recognized species: *S. enterica*, *S. bongori* and *S. subterranean*. Salmonella is found worldwide in cold- and warm-blooded animals (including humans), and in the environment. They cause illnesses such as **typhoid fever**, **paratyphoid fever**, and foodborne illness.

Classification:

– The members of the genus Salmonella were originally classified on the basis of **epidemiology; host range; biochemical reactions; and structures** of the O, H, and Vi (**when present**) antigens

- Over 2500 serotypes are distinguished, most of which belong to the species *S. enterica*. However, many of these have been given binomial names (e.g. *Salmonella typhimurium* and *Salmonella enteritidis*), although they are not separate species. In clinical practice, laboratories identify microorganisms according to their binomial name.

Important Properties: Salmonellae are motile rods that characteristically ferment glucose and mannose without producing gas but do not ferment lactose or sucrose. Most salmonellae produce H₂S. They are often pathogenic for humans or animals when ingested.

Virulence Factors:

1. Type III secretion systems: which facilitate secretion of virulence factors of Salmonella into host cells.
2. Endotoxin: Endotoxin is responsible for many of the systemic manifestations of the disease caused by Salmonella spp.
3. Fimbriae: The species-specific fimbriae mediate binding of Salmonella to M (microfold) cells present in Peyer patches of the terminal part of the small



intestine. These M cells typically transport foreign antigens, such as bacteria to the underlying macrophages for clearance.

4. Acid tolerance response gene: The acid tolerance response (ATR) gene protects *Salmonella* spp. from stomach acids and the acidic pH of the phagosome, thereby facilitating survival of bacteria in phagosomes

5. Enzymes: Catalase and superoxide dismutase are the enzymes that protect the bacteria from intracellular killing in macrophages.

Pathogenesis of Salmonella: The three types of *Salmonella* infections (enterocolitis, enteric fevers, and septicemia) have different pathogenic features.

- (1) Enterocolitis: is characterized by an invasion of the epithelial and sub-epithelial tissue of the small and large intestines.
- (2) In typhoid and other enteric fevers, infection begins in the small intestine, but few gastrointestinal symptoms occur.
- (3) Septicemia accounts for only about 5–10% of *Salmonella* infections and occurs in one of two settings: a patient with an underlying chronic disease, such as sickle cell anemia or cancer, or a child with enterocolitis.

Laboratory Diagnosis:

In enterocolitis: the organism is most easily isolated from a stool sample in selective media e.g. XLD (Xylose lysine deoxycholate agar), DCA (deoxycholate citrate agar), salmonella-Shigella (SS) agar, and enrichment media, e.g. selenite broth; identification of *Salmonella* spp. by biochemical agglutination tests. Phage typing can be used for typing individual strain.



Salmonella *Shigella* (SS) Agar: salmonella **colorless, transparent**, with a **black center** if **H₂S** is produced

XLD- Agar: *Salmonella* Typhi **red Colonies, black centers**.

TSI-Agar: Salmonella **Alkaline** slant/**acidic** butt (K/A); + H₂S and Gas +.

In the enteric fevers: a **blood culture** is the procedure most likely to reveal the organism during the first weeks of illness. **Stool cultures** may also be positive, especially in **chronic carriers** in whom the organism is secreted in the bile into the intestinal tract. **Urine culture** results may be positive after the second week.

Serologic Methods:

I. Agglutination test

II. Tube dilution agglutination test (Widal test): Serum agglutinins rise sharply during the **second** and **third** weeks of *S* serotype Typhi infection.