

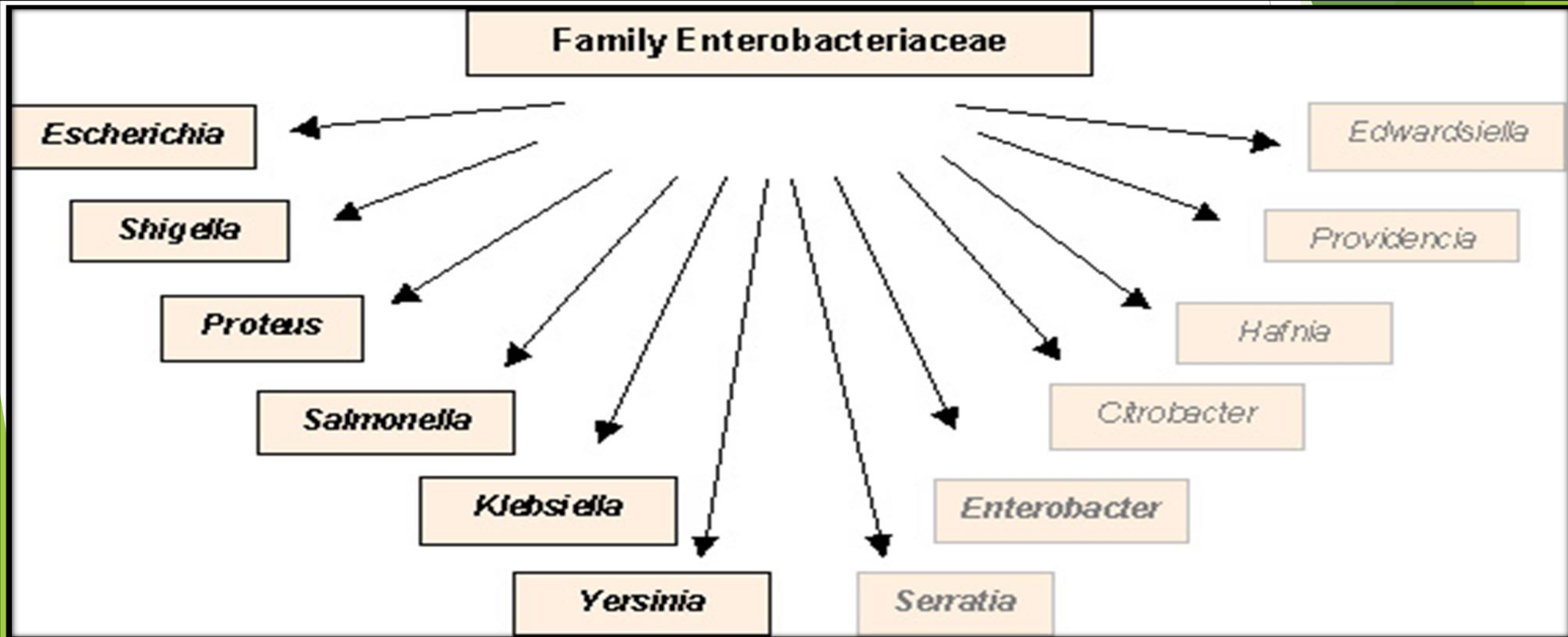
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THE Enterobacteriaceae

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THE Enterobacteriaceae



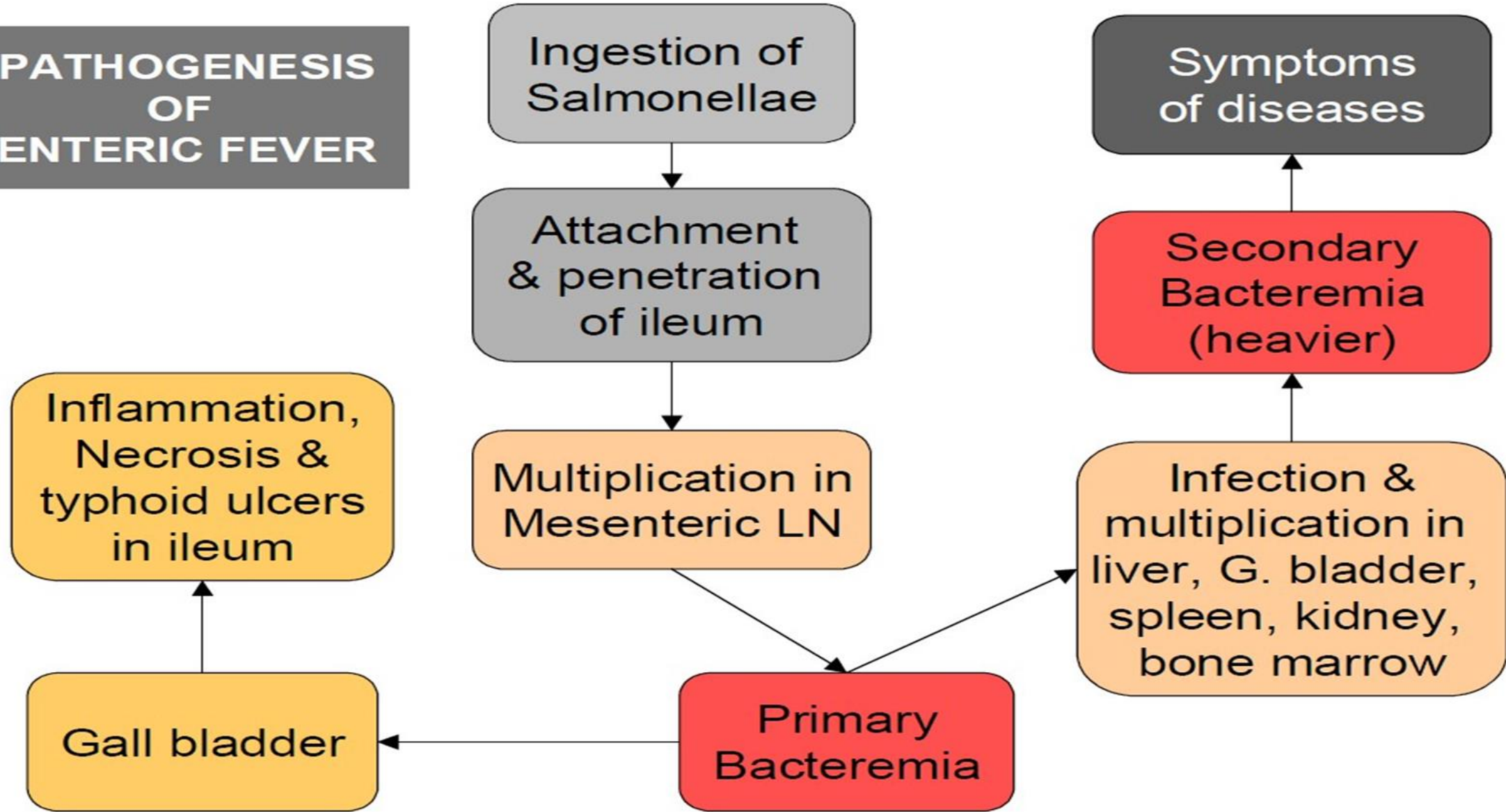
Salmonella

- ▶ *S. typhi* (The typhoid bacilli)
- ▶ *S. paratyphi* (Produce paratyphoid fever)
- ▶ *S. typhimurium* (Food poisoning)
- ▶ *S. enteritidis* (Food infection)
- ▶ *S. choleraesuis* (Hog cholera bacillus)
- ▶ *S. pullorum* (White diarrhea in children)
- ▶ *S. gallinarum* (Fowl typhoid bacillus)

Salmonella typhi

- ▶ is the causative agent of typhoid fever in humans. The organism is typically transmitted by fecally contaminated food or water.
- ▶ *S. typhi* initially attacks epithelial cells of the small intestine, is ushered into the underlying connective tissue and regional lymph nodes, and begins to multiply.
- ▶ It then enters the bloodstream where it produces acute bacteremia and subsequently infects the liver, spleen, bone marrow, and eventually the kidneys and gallbladder. This phase, accompanied by high fever and sometimes diarrhea, is long lasting and continuous (up to 8 weeks in untreated cases).

PATHOGENESIS OF ENTERIC FEVER



HABITAT AND TRANSMISSION:

- ▶ Most Salmonella species are found in the intestine of animals especially pigs, cows, goats, sheep, rodents, hens, ducks and other poultry.
- ▶ *S. typhi* and *S. paratyphi*, however, are usually found only in human., both of which are excreted in the feces and urine of infected patients.
- ▶ Infection occurs via ingesting contaminated food or drinks.

Typhoid fever

- ▶ An acute infectious disease characterized by continuous fever, skin eruptions, bowel disturbances and profound toxemia.
- ▶ • Following entrance of the typhoid bacilli into the human body through the mouth there is always an incubation period of 7 to 14 days, before symptoms appear.
- ▶ • During this time, the organism penetrates the wall of the upper intestine and causes an inflammation.
- ▶ • Then reaches the blood via the lymphatic system where they circulate and may be localized in many internal organs especially in spleen, bone marrow, and gallbladder.
- ▶ • Serious complication of typhoid fever may be produced as a result of multiplication of the bacilli in organs other than the intestine.
- ▶ • The organism begins to disappear from the blood during the first week of the illness, and especially after the second week.
- ▶ • The disappearance of the organism from the blood is clearly associated with the development of specific antibodies.

LABORATORY DIAGNOSIS:

- ▶ SPECIMEN: include, blood, feces and urine for culture may be used depending on the course of illness.
- ▶ A. Blood: Organisms can usually be detected in 75-90% of patients during the first 10 days of infection and in about 30% of patients during the 3rd. week.
- ▶ B. Feces: Organisms can usually be isolated from 40-50% of patients during the third week.
- ▶ C. Urine: Organism, can usually be detected from about 25% of patients after the second week of infection.
- ▶ D. Serum: Is used for the detection of serum antibodies (Widal test).

1-1 *S. typhi* is a straight, motile, encapsulated, facultatively anaerobic, nonsporing, Gram-negative rod .



Shigella

Shigella species

- ▶ *S. dysenteriae*,
- ▶ *S. flexneri*
- ▶ *S. boydii*,
- ▶ *S. sonnei*),
- ▶ all of which are responsible for bacillary dysentery (shigellosis) in humans and a few other primates. *S. dysenteriae* is endemic in Africa, Asia, and Latin America; The majority of cases occur in children under 10 years of age. Transmission is by direct person-to-person contact or ingestion of food or water contaminated by human feces.
- ▶ Although all species of *Shigella* cause the disease, *S. dysenteriae* alone produces the cell-killing Shiga exotoxin and is, therefore, responsible for the most severe symptoms.

1-2 GRAM STAIN OF A SHIGELLA DYSENTERIAE STOCK CULTURE The cells are straight rods ranging in size from 0.7-1.0 μm wide by 1.0-3.0 μm long. *S. dysenteriae* is a straight, nonmotile, facultatively anaerobic, Gram- negative rod.



Shigellosis

- ▶ Low infectious dose (10^2 - 10^4 CFU)
- ▶ Humans are only reservoir
- ▶ Transmission by fecal-oral route
- ▶ Incubation period = 1-3 days
- ▶ Watery diarrhea with fever; changing to dysentery
- ▶ Major cause of bacillary dysentery (severe 2nd stage) in pediatric age group (1-10 yrs) via fecal-oral route
- ▶ Outbreaks in daycare centers, nurseries, institutions
- ▶ Estimated 15% of pediatric diarrhea in U.S.
- ▶ Leading cause of infant diarrhea and mortality (death) in developing countries

Shigellosis

- ▶ Two-stage disease:
- ▶ **Early stage:**
- ▶ Watery diarrhea attributed to the enterotoxic activity of Shiga toxin following ingestion and noninvasive colonization, multiplication, and production of enterotoxin in the small intestine
- ▶ Fever attributed to neurotoxic activity of toxin
- ▶ **Second stage:**
- ▶ Adherence to and tissue invasion of large intestine with typical symptoms of dysentery
- ▶ Cytotoxic activity of Shiga toxin increases severity

Invasiveness in Shigella-Associated Dysentery

- ▶ 1-Invasiveness :Attachment (adherence)
- ▶ 2- Exotoxin (Shiga toxin)
- ▶ 3- Intracellular survival & multiplication
- ▶ 4-Penetrates through mucosal surface of colon (colonic mucosa) and invades and multiplies in the colonic epithelium

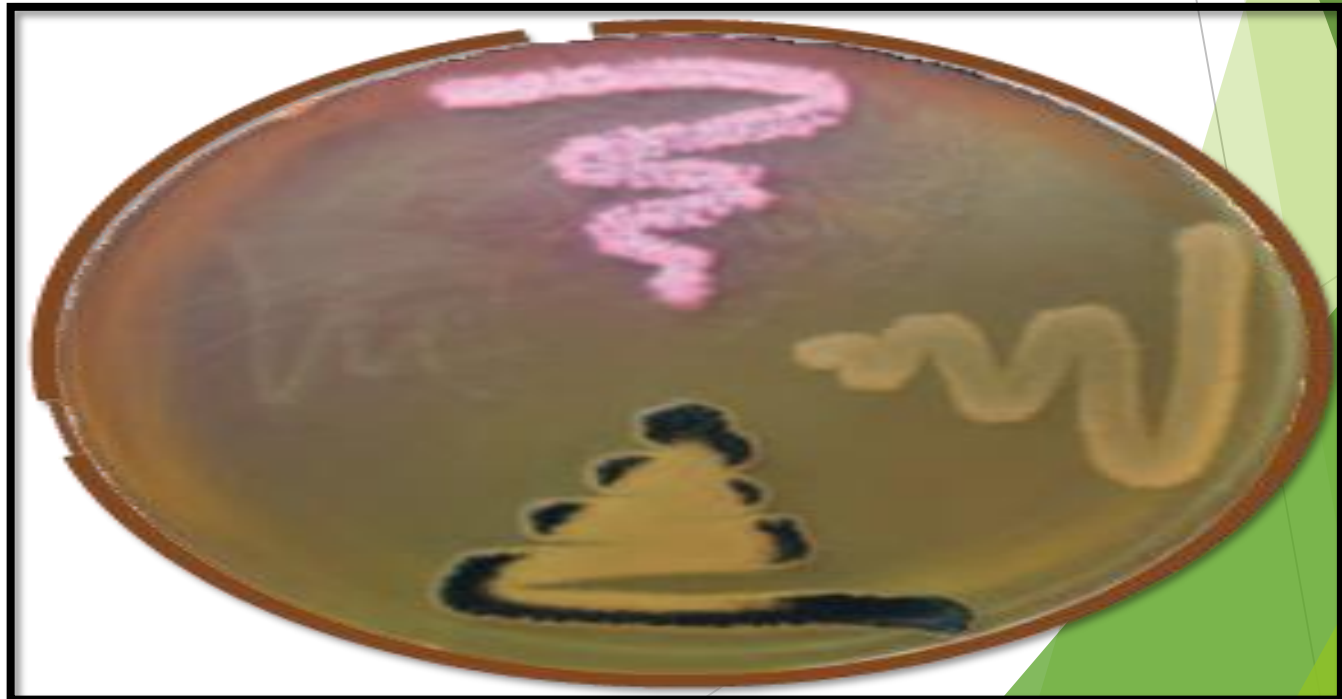
- ▶ 5-Preferentially attach to and invade into M cells in Peyer's patches (lymphoid tissue, i.e., lymphatic system) of small intestine
- ▶ 6-M cells typically transport foreign antigens from the intestine to underlying macrophages, but Shigella can lyse the phagocytic vacuole (phagosome) and replicate in the cytoplasm.
- ▶ Actin filaments propel the bacteria through the cytoplasm and into adjacent epithelial cells with cell-to-cell passage, thereby effectively avoiding antibody-mediated humoral immunity .

Salmonella-Shigella Agar

- ▶ Salmonella-Shigella (SS) Agar is a selective medium originally used for the isolation of Salmonella and many Shigella species .
- ▶ Salmonella-Shigella Agar is an undefined, differential, and selective medium with bile salts and brilliant green dye acting as the selective agents against Gram-positives and many Gram-negatives.
- ▶ Lactose is included as a fermentable carbohydrate .
- ▶ Lactose fermenters will produce reddish colonies as neutral red changes from colorless to red in the low pH.
- ▶ Salmonella and Shigella species will be their natural color due to their inability to ferment lactose.
- ▶ Salmonella and Proteus species typically reduce sulfur, which is indicated by colonies with black centers.

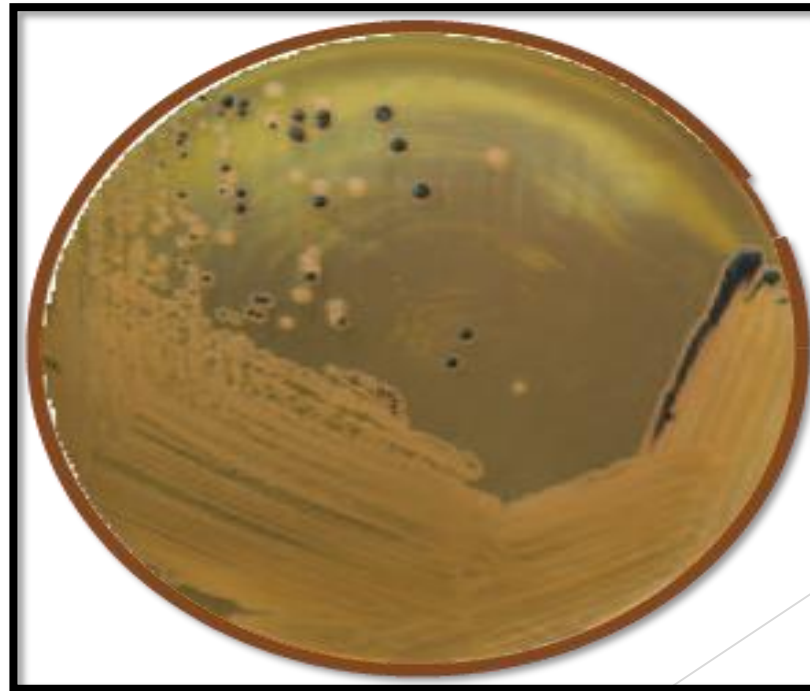
1-3 SALMONELLA-SHIGELLA AGAR SS Agar

- ▶ inoculated with (clockwise from top) *Escherichia coli*, *Shigella dysenteriae*, *Salmonella typhi*, and *Enterococcus faecalis*.
- ▶ Note the pink color of *E. coli* due to acid production during lactose fermentation.
- ▶ Note also the black precipitate in the *Salmonella* growth due to the sulfur reduction.



1-4 SALMONELLA-SHIGELLA AGAR

- ▶ STREAKED FOR ISOLATION SS Agar inoculated
- ▶ with *Salmonella typhi* and *Shigella dysenteriae*. Note the colonies with black centers and clear edges characteristic of Salmonella on this medium.





Thank you for your listening