The salmonella- group

- Gram negative, have lipopolysaccharide [O antigen], Vi [capsular antigen], motile [H antigen]
- They never ferment lactose
- They usually produce **H2S** [to differentiate from Shigella]
- They are resistance to certain chemicals [brilliant green] and that can be useful in lab isolation
- They can colonize **all animals** and **humans**
- [exception] those causing typhoid fever → can colonize humans **only**
- They are named by 1- genus (Salmonella) 2- species (enterica) 3- subspecies (typhi or enteritidis)
- They can cause:

1- typhoid fever [S. enterica subsp. Typhi + S. enterica subsp. Paratyphi A+B+C]

2- gastroenteritis/ enterocolitis → *most common clinical form* [S. enterica subsp. Enteritidis + S. enterica subsp. Typhimurium]

3- bacteremia with focal lesions [S. enterica subsp. Choleraesuis]

The "Enteric Fevers" (Typhoid Fever) most severe

- Can be caused by S. typhi + S. Paratyphi [A+B+C]
- The reservoir: **human only** / especially subclinical patients
- The location of Salmonella colonization inside people is the biliary tract – gall bladder
- Systemic disease + still a major cause of morbidity and mortality
- Vertical transmission

Pathogenesis:

- Salmonella is **sensitive** to stomach acidity -> the disease require high dosage to occur [in comparison to shigella]
- Attach to mucosa of small intestine -> invade peyer's patches [Microfold cells] [they are facultative intracellular bacteria] -> transported to blood and lymphatics -> causing inflamed mucosa and lymphatics

Clinical manifestations:

- Incubation: 7-14 days post ingestion of contaminated food and drink
- S & S:

1st week: **fever, headache**, abdominal pain, diarrhea is fluctuating with constipation

2nd week: high fever, abdominal symptoms are sever, **rose spots** on the abdomen and chest

3rd week: If no complications, symptoms & signs gradually resolve. / In the pre-antibiotic era, the chief complications of enteric fever were **intestinal hemorrhage and perforation**, and the mortality rate was 10–15%

Enterocolitis most common

- S. typhimurium and S. enteritidis are prominent
- Reservoir: animals, eggs, dietary products
- **8 to 48 hours** after ingestion of salmonellae, there is nausea, vomiting and non-bloody diarrhea
- Bacteremia is rare except in immunodeficient persons [cancer patients]
- Blood culture results are usually **negative**, but stool culture results are **positive** for salmonellae and may remain positive for several weeks after clinical recovery
- The symptoms resist for less than a week before spontaneous resolution

Bacteremia with Focal Lesions

- This is associated **commonly** with S cholerasuis but <u>may be caused by any salmonella serotype</u>
- Blood culture results are positive
- There are local suppurative infections [focal lesions] seeding in one of the organs, usually bone → osteomyelitis, joints → arthritis in more than 10% of patients
- The bacteremia depends on the serotype of salmonella and the patient health status
- other diseases such as sickle cell anemia increase the probability of developing bacteremia from salmonella

⇒notes:

Diagnostic laboratory tests:

A. Specimens: culture positive in blood, stool.. a positive culture of duodenal drainage establishes the presence of salmonellae in the biliary tract in carriers

B. Bacteriologic culturing for Isolation of Salmonellae: 1- enrichment cultures → inhibit normal intestinal bacteria and permit multiplication of salmonellae 2- **Differential medium** → non-lactose fermenters, example EMB, MacConkey. **Selective medium**→ salmonella- shigella agar, Hektoen enteric agar 3- final identification → by biochemical properties [the ability to produce H2S], serology

C. Serologic methods: 1) slide agglutination test: **known sera + unknown culture**/ if agglutination occur, it is a +ve test

2) Tube dilution agglutination test [Widal test]: to detect antibodies for salmonella in patient's serum. **unknown sera+ known antigens from the lab**. The interpretive criteria varies, but a titer against the O antigen of greater than 1:320 and against the H antigen of greater than 1:640 is considered positive. **Results of serologic tests for Salmonella infection cannot be relied upon**

Immunity:

- Infections with S Typhi or Salmonella Paratyphi usually confer a certain degree of immunity
- relapses may occur despite the presence of antibodies to salmonella antigens
- Secretory **IgA** antibodies may prevent attachment of salmonellae to intestinal epithelium

Treatment:

- Gastroenteritis -> fluid and electrolytes replacement
- Typhoid fever + Bacteremia -> ciprofloxacin, cephalosporin
- Some chronic carriers have been cured by -> ampicillin alone, but in most cases cholecystectomy must be combined with drug treatment

Prevention and control:

- Food must be thoroughly cooked
- Carriers should be treated + must not be allowed to work as food handlers and should observe strict hygienic precautions
- Two typhoid vaccines are currently available : an oral live, attenuated vaccine and a Vi capsular polysaccharide vaccine for intramuscular use / efficacy of 50–80% / are not long- lasting

Yersinia:

- Gram negative, bacilli [cocco-bacilli], retain the stain at both ends [**bipolar stained cocco-bacilli**]
- Reservoir: from animals / pathogenic to humans
- **They grow best at 25°C and are motile at 25°C but nonmotile at 37°C**
- Y pestis [black death], Y enterocolitica, Y pseudotuberculosis

- Most clinical infections are associated with serogroups O:3, O:9, and O:5,27
- By blood transfusion [because it can multiply at refrigeration temperature when we store donated blood from an infected person]

Pathogenesis:

- All yersiniae possess **lipopolysaccharides.** They have **type III secretion systems.** The pathogenic yersiniae have a **pathogenicity island (PAI)**
- Contaminated food -> intestine -> peyer's patches [Microfold cells]

Clinical manifestations:

- Y. enterocolitica + Y. pseudotuberculosis → mesenteric lymphadenitis which is characterized by abdominal pain and fever / that often leads to laparotomy for presumed **appendicitis**
- Y. gastroenteritis → usually in children / fever, **diarrhea**, abdominal pain
- Post-infective phenomena of **reactive arthritis** might be developing within 2–4 weeks of a preceding infection

Laboratory diagnosis:

- Specimens may be stool, blood or material obtained at surgical exploration cultured in enrichment medium
- Culture: Yersinia selective agar such as cefsulodin-Irgasan-novobiocin (**CIN**) agar → bull's eye appearance with a red center
- Serology: cross-reactions between yersiniae and other organisms (vibrios, salmonellae, and brucellae) may confuse the results

Treatment:

- Y. enterocolitica gastroenteritis -> self- limiting / resistant to penicillin and cephalosporins
- Y pseudotuberculosis -> susceptible to ampicillin, cephalosporins, aminoglycosides

Prevention and control:

- Safe handling and processing of food + Consumption of food made from raw meat should be discouraged