



FACULTAD DE  
CIENCIAS QUÍMICAS

UNIVERSIDAD AUTÓNOMA DE SAN LUIS POTOSÍ

FACULTAD DE CIENCIAS QUÍMICAS

LABORATORIO DE MICROBIOLOGÍA GENERAL



*Salmonella typhi*

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**Group: 8:00-9:00**

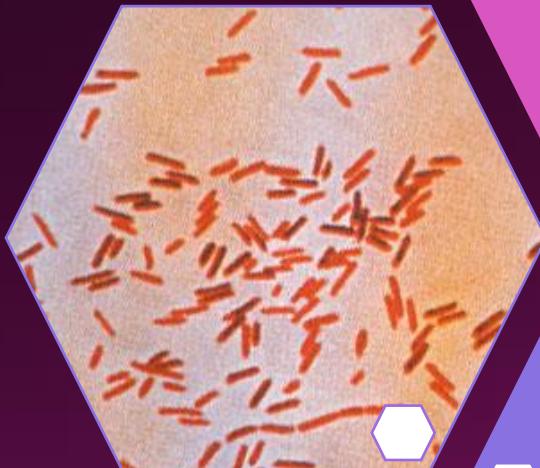


*Salmonella typhi*

# Introduction

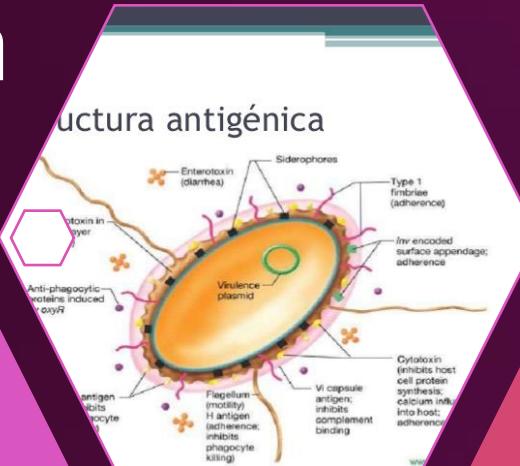
- The study of the mechanisms by which bacteria such as *Salmonella typhi* can cause typhoid fever in humans involves understanding how this pathogen invades cells, multiplies and evades the immune response in the host and, in turn, how the human It responds to this infection. All that there is no basic information on the fundamental biological processes at the molecular and cellular level, but can provide tools for the design of better methods of diagnosis and prevention of this and other diseases of bacterial origin

# The genus Salmonella

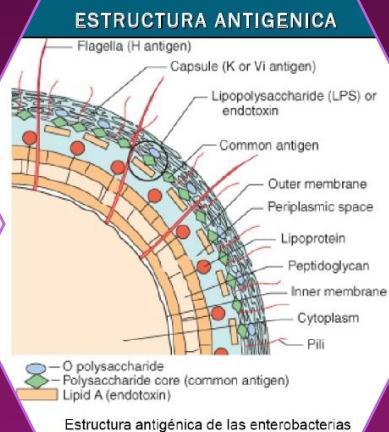


Salmonellas are gram-negative bacteria

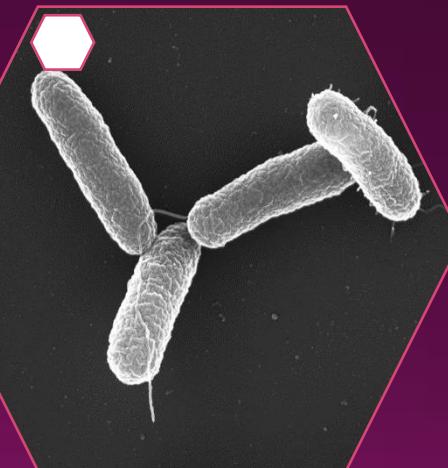
These bacteria are enveloped by several layers: the outer membrane, the cell wall (which is ten times thinner than in gram-positive bacteria), and the inner membrane. The outer and inner membrane delimit the periplasm.



This is because the dye stains the cell wall, which in these cases is covered by an outer membrane.



The appearance of bacteria in the microscope is bacilli, or cylinders with rounded tips.



The genus *Salmonella* was described at the beginning of the 20th century by the American bacteriologist Theobald Smith, named after its chief David Salmon. *Salmonellas* are enteric bacteria, meaning that they are lodged in the intestine and their taxonomy is complex. Currently, the genus *Salmonella* consists of a single species, which has been called *Salmonella enterica*. This one, once, is formed by seven subspecies, depending on its capacity to realize different biochemical reactions.



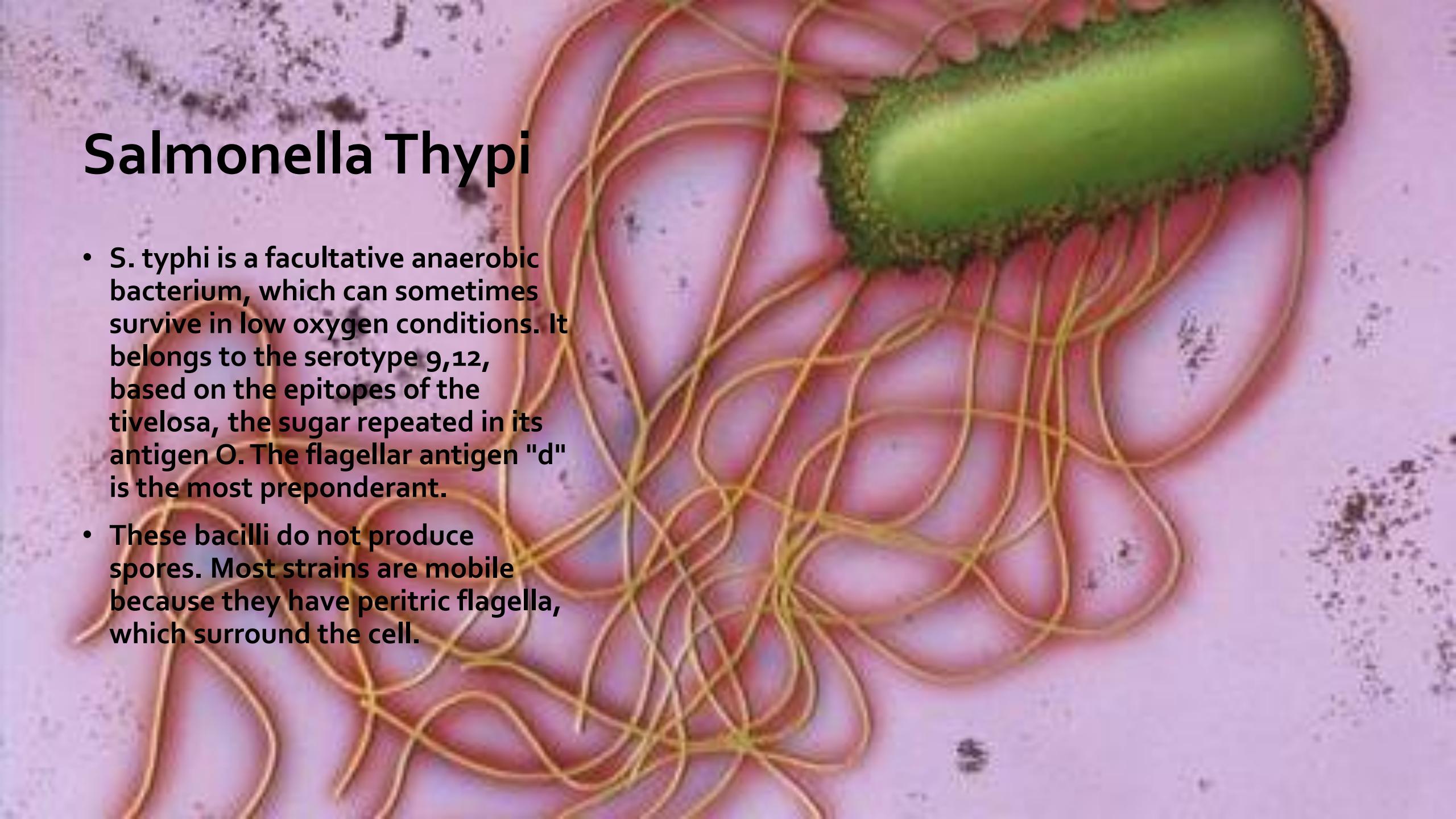


# Salmonellosis

- Human salmonellosis can be divided into two syndromes.
- 1) Enteric fever, including typhoid fever caused by *S. typhi*, and paratyphoid fever, which is pathologically and clinically similar to typhoid but with less severe symptoms, caused by *S. paratyphi A*, *B*, or *C*. Fever Enteric involves a systemic infection, due to the invasiveness of the bacteria.
- 2) Gastroenteritis or food poisoning, which is the most common of the infections, caused by many serotypes. This type of infection is not accompanied by a systemic infection. The most common serotypes in non-typhoid salmonellosis are *S. typhimurium* and *S. enteritidis*

# **Salmonella Thypi**

- **S. typhi** is a facultative anaerobic bacterium, which can sometimes survive in low oxygen conditions. It belongs to the serotype 9,12, based on the epitopes of the tivelosa, the sugar repeated in its antigen O. The flagellar antigen "d" is the most preponderant.
- These bacilli do not produce spores. Most strains are mobile because they have peritric flagella, which surround the cell.

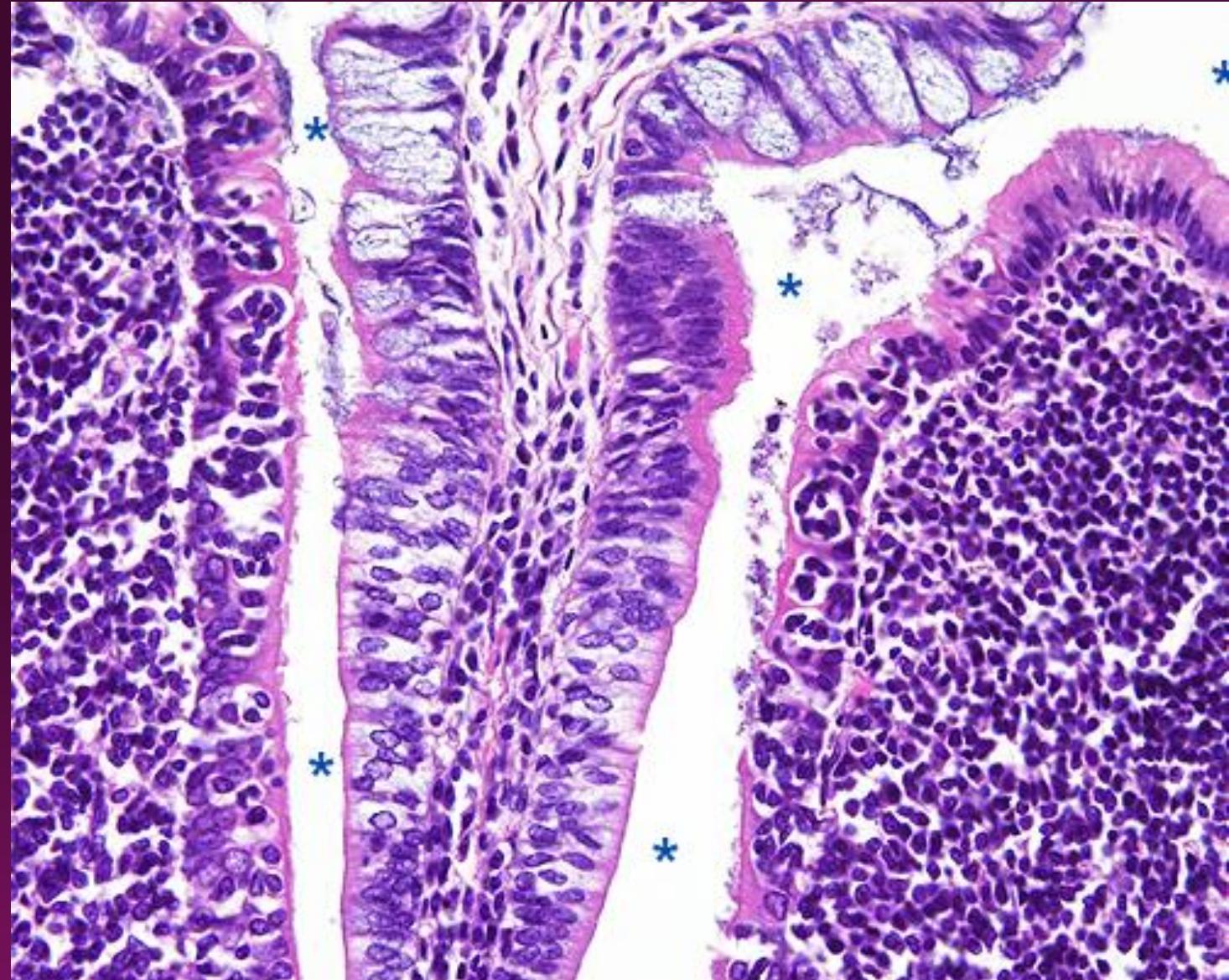


- *S. typhi* produces acid from glucose, maltose and sorbitol, without the production of gas; But does not ferment lactose, sucrose, rhamnose and other sugars. It produces nitrite from nitrate and also produces hydrogen sulfide. Its optimal temperature of growth is of 37°C



# Clinical manifestations

- The incubation period for *S. typhi* ranges from one week to one month, mainly being two weeks, from the ingestion of bacteria from food or contaminated water. It is presumed that *S. typhi* invades through the M cells of the intestine, which are part of the lymphoid or immunological tissue



- Diarrhea does not always occur, but there is usually ulceration. This septicemia or generalized invasion can be confirmed by the culture of the bacterium of the blood, which reflects a bacteremia. This stage of infection, which can last 2 to 3 weeks, is characterized by a dry cough, high fever, and severe headache. Fever may be cyclic, meaning the temperature may increase in the afternoon, accompanied by chills, convulsions, and delirium. The name of the disease comes from the Greek typhus, or "fog or smoke," which was probably used to describe febrile illnesses that cause mental disorders.



# Diagnosis, treatment and prevention

- The diagnosis of a *S. typhi* infection is made through the isolation of the bacteria from blood, feces, urine, bone marrow aspirate and bile. These tests take two to three days to provide the results because the sample is diluted in a culture medium and, since it is estimated that a patient with typhoid has, for example, 20 bacteria or less per ml of blood, it is required Wait for it to multiply sufficiently to be observed by turbidity of the medium. Blood culture is the most frequently used method for accurate diagnosis, although its sensitivity is not more than 90%, even when taking three consecutive samples. The culture of aspirate of bone marrow is more sensible, but the procedure of extraction of the aspirate is delicate and painful.





- Typhoid fever is treated with antibiotics. Typical regimens include amoxicillin, cotrimoxazole, and chloramphenicol. Despite these resistant strains, chloramphenicol remains the antibiotic of choice, because of its ability to infiltrate tissues. Third-generation cephalosporins and quinolones are interesting alternatives.

# Clinical case

- An 18-year-old male patient, Caucasian, with a previous health history; 20 days before admission he started with marked asthenia and generalized myalgias. One week later, fever of  $38^{\circ}\text{C}$  appeared mainly nocturnal, not accompanied by chills or sweating, although coughing. He went to his health area where he was diagnosed with acute bronchitis of viral origin. He was referred to the Higher Institute of Military Medicine "Dr. Luis Diaz Soto" because the fever became continuous, rebellious to the antipyretics, in plateau "and with gradual descent, weakened the weakness and appeared anorexia.



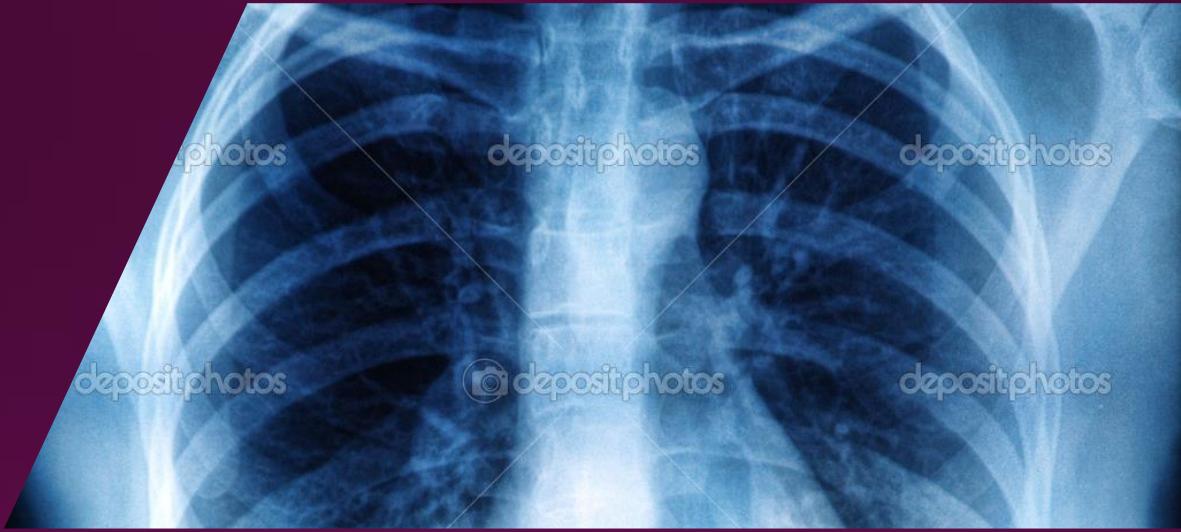


- The patient appeared severely ill, so he was admitted to the Intermediate Care Room. Personal, family and epidemiological records did not reveal any interesting data. During the first 2 weeks, numerous investigations were carried out including: blood glucose 5.2 mmol / L, urea 6.2 mmol / L, creatinine 80 mmol / L, leukocyte with leukocytes  $6.2 \times 10^9$  g / L Po65 L 033 E Hemoglobin 10.5 g / L, hematocrit 035, normal cituria and 3 negative blood cultures. Therapy was started with crystalline penicillin 2 g every 6 h and gentamicin 80 mg intramuscularly every 8 h, no improvement was observed.

- The following 3 weeks were characterized by maintaining a febrile syndrome of 39 to 40 °C, marked asthenia, headache and absence of symptoms and gastrointestinal signs, so that blood cultures, urine culture and serial co-culture were taken and even medulogram with meduloculture. All co-cultures were negative, the medulogram was reactive to bacterial sepsis and blood cultures repeatedly reported *Salmonella typhi*. At the beginning of the sixth week, therapy with chloramphenicol 4 g daily was begun for 21 days, and thereafter a considerable improvement.



- In search of other sites of the causal agent, chest X-rays, lumbar puncture, culture of bronchial secretions, bilicultivos and medulocultivo, were reported as negative. Investigating possible immunosuppression was made study of plasma proteins, lymphocyte count and rocas, plus HIV serology, with negative results. In order to complete the study, epidemiology support was requested, which investigated the possible contacts as many labor as domiciliary but found no patients or carriers. Although the source of home infection was suspected, it was not confirmed. The patient was withdrawn at 60 days, asymptomatic, without complications, with all cultures negative and final diagnosis of atypical typhoid fever in an immunocompetent patient.



# Mechanism of action of chloramphenicol

- Inhibits protein synthesis at the 50S subunit of the bacterial ribosome. It competes with other antibiotics that bind to the same subunit (macrolides and clindamycin) and therefore should not be associated. Chloramphenicol inhibits the formation of peptide bridges in the elongation chain. It may also inhibit the protein synthesis of eukaryotic cells, which would explain their toxicity.



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