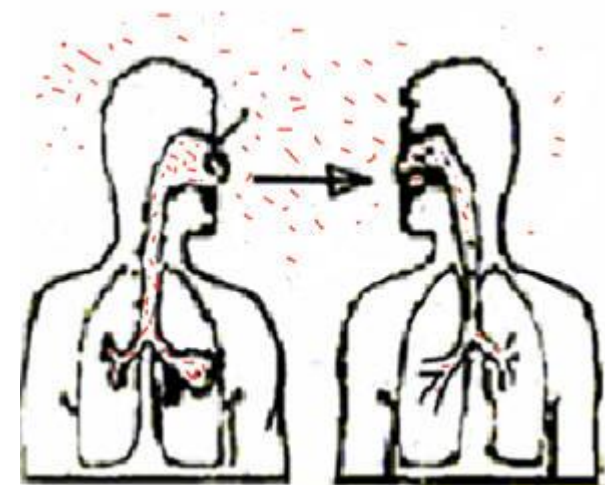
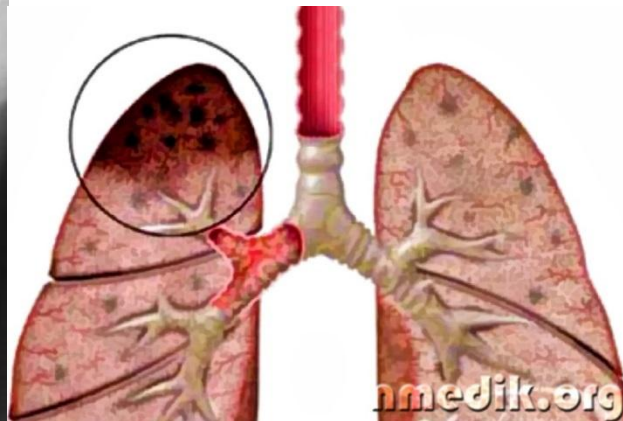


Microbiological characteristics of the causative agent of tuberculosis

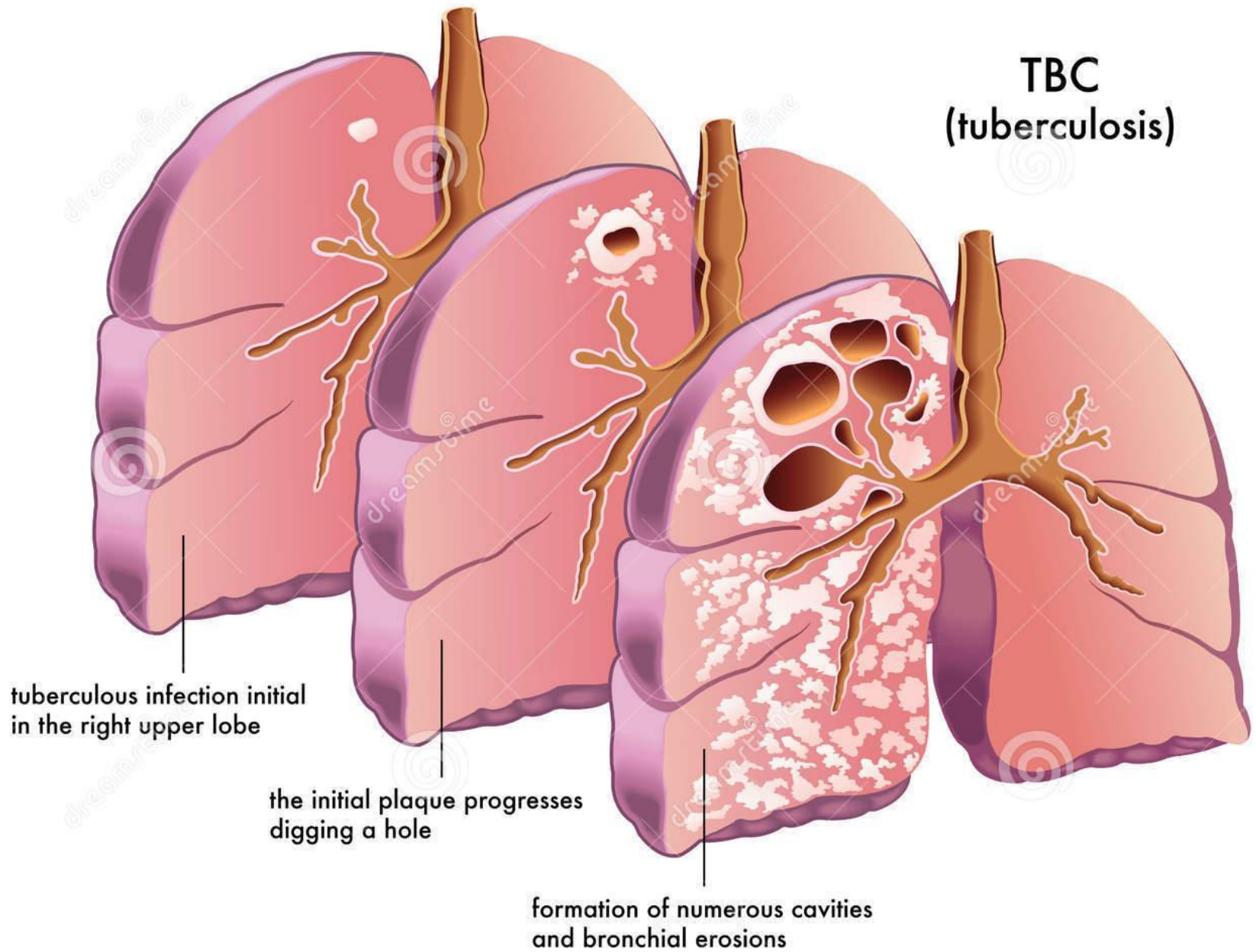
Lecture 3

Tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis* (MTB).

Tuberculosis generally affects the lungs, but can also affect other parts of the body. Most infections do not have symptoms, in which case it is known as latent tuberculosis. About 10% of latent infections progress to active disease which, if left untreated, kills about half of those infected. The classic symptoms of active TB are a chronic cough with blood-containing sputum, fever, night sweats, and weight loss.



TBC (tuberculosis)

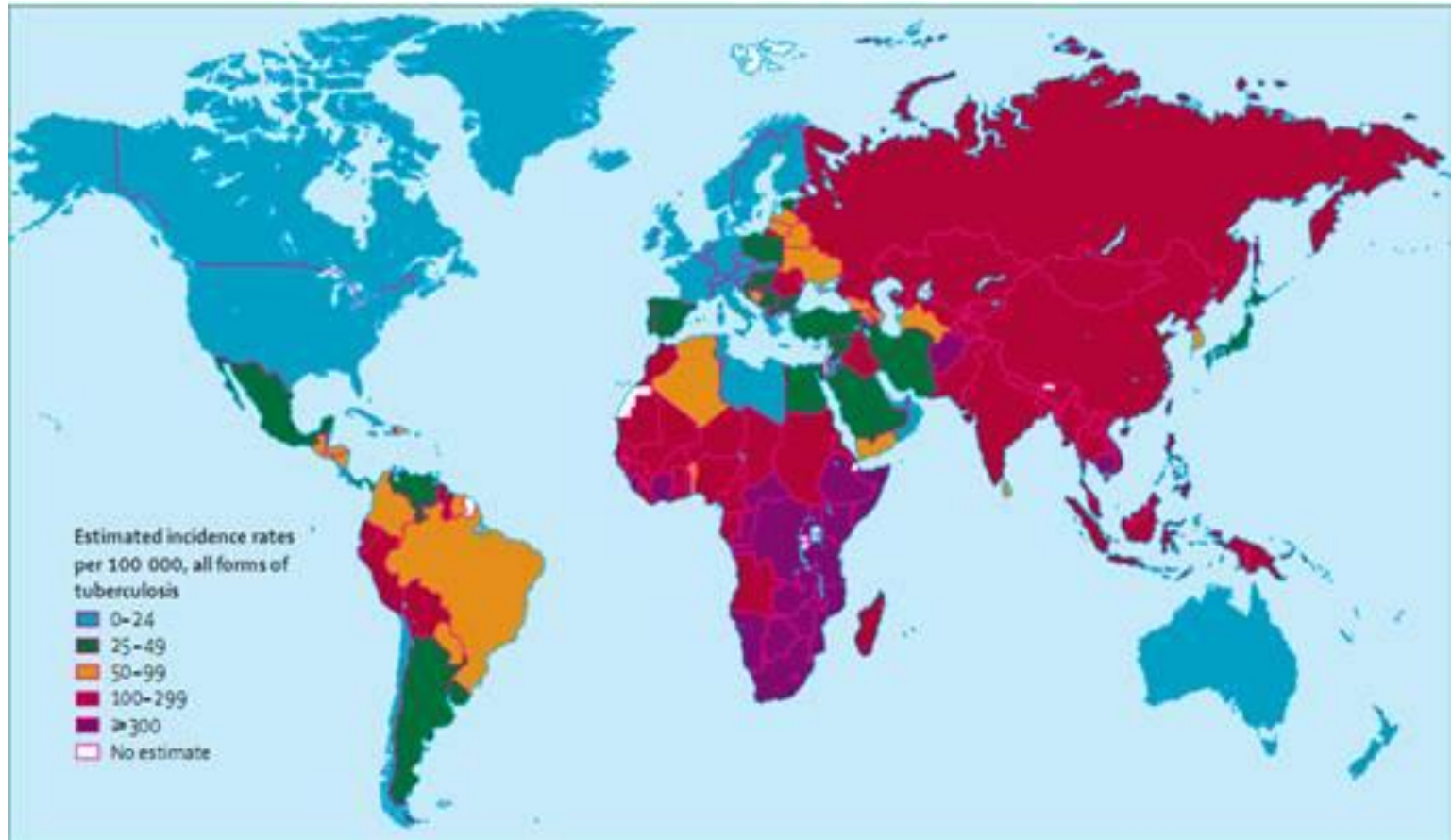


Symtoms

Tuberculosis may infect any part of the body, but most commonly occurs in the lungs (known as pulmonary tuberculosis). Extrapulmonary TB occurs when tuberculosis develops outside of the lungs, although extrapulmonary TB may coexist with pulmonary TB. During Active TB symptoms of TB are present, which can include:

- coughing
- weight loss
 - loss of appetite
- night sweats
- fever – chest pain

Epidemiology





Mycobacterium tuberculosis

In 1882, the microbiologist Robert Koch discovered the tubercle bacillus, at a time when one of every seven deaths in Europe was caused by TB.

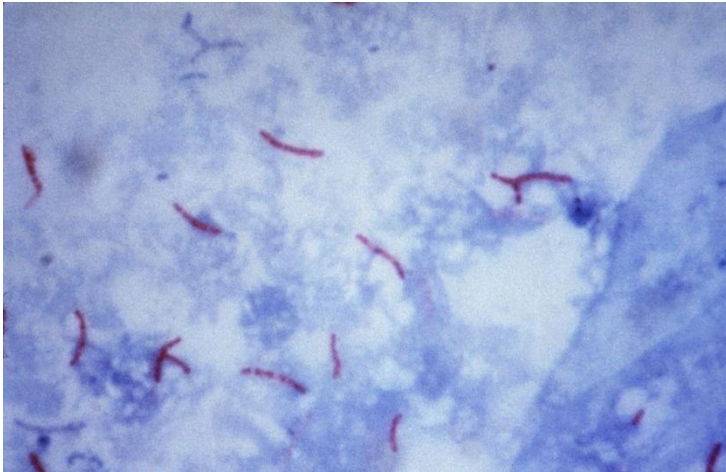
Robert Koch (Heinrich Hermann Robert Koch) was born on December 11, 1843 in Clausthal, Germany and died on May 27, 1910.

A physician, he isolated *Bacillus anthracis*, the tuberculosis bacillus AND the cholera vibrio.

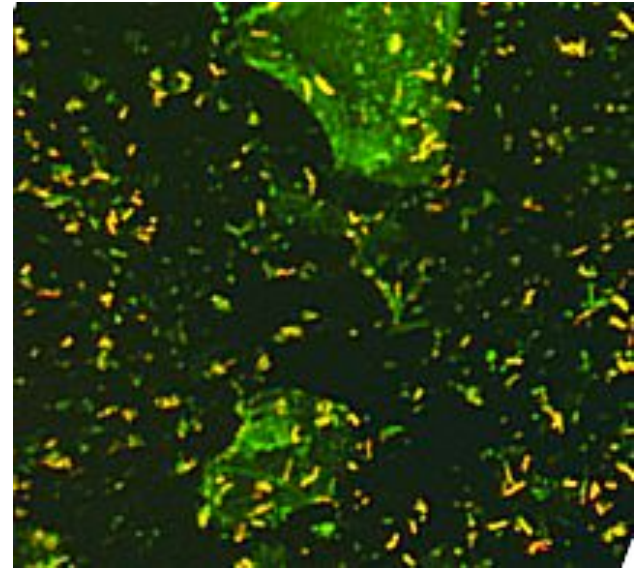
Nobel Prize for Physiology and Medicine in 1905.



Microscopy of Mycobacterium tuberculosis



Mycobacterium tuberculosis visualization using the Ziehl–Neelsen stain.

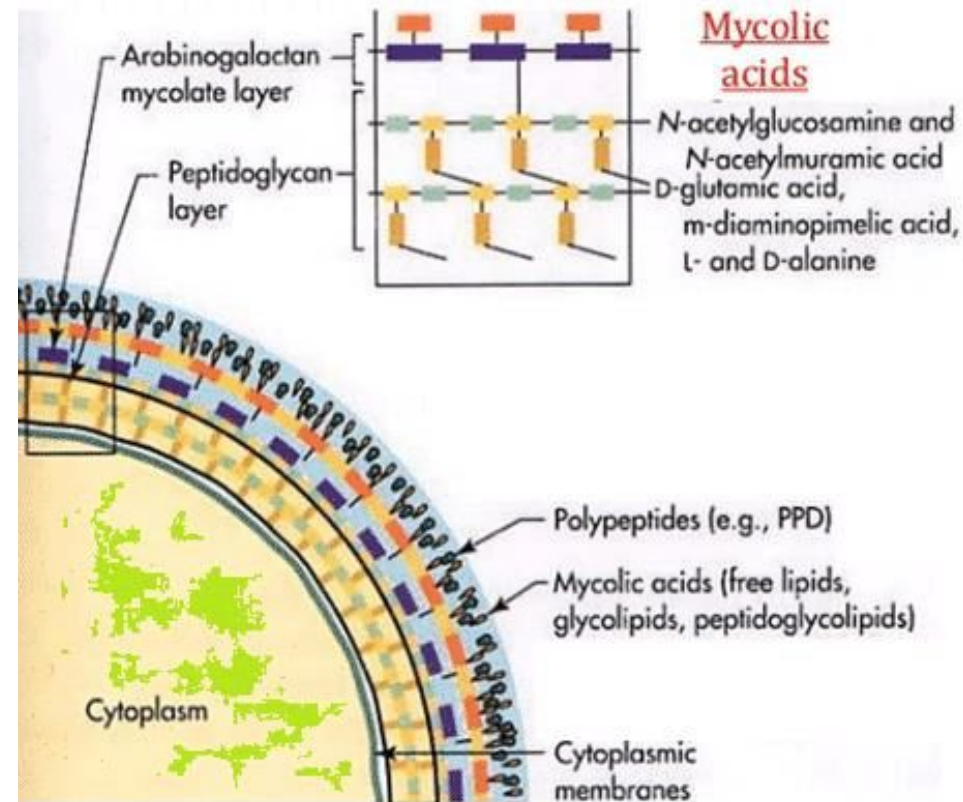


Fluorescent microscopy of *Mycobacterium tuberculosis*

Structure of *M. tuberculosis*

- cell wall - consisting of 3-4 bound layers with thickness up to 200-250 nm, contains specific waxes (mycosides) of polysaccharides, protects mycobacterium from the external environment, has antigenic properties and shows serological activity; limits the mycobacterium from the outside, ensures the stability of cell size and shape, mechanical, osmotic and chemical protection, includes virulence factors - lipopolysaccharides, whose phosphatide fraction is associated with the virulence of mycobacteria;
- bacterial cytoplasm; can contain granules;
- cytoplasmic membrane - includes lipoprotein complexes, enzyme systems, forms an intracytoplasmic membrane system (mesosome);
- The nuclear substance consists of one ring DNA.
- Proteins (tuberculo proteins) are the main carriers of the antigenic properties of MBT and exhibit certainty in delayed-type hypersensitivity reactions. These proteins include tuberculin. Polysaccharides are associated with the detection of antibodies in the serum of patients with tuberculosis. Lipid fractions contribute to the resistance of mycobacteria to acids and alkalis.

Lipid-Rich Cell Wall of Mycobacterium

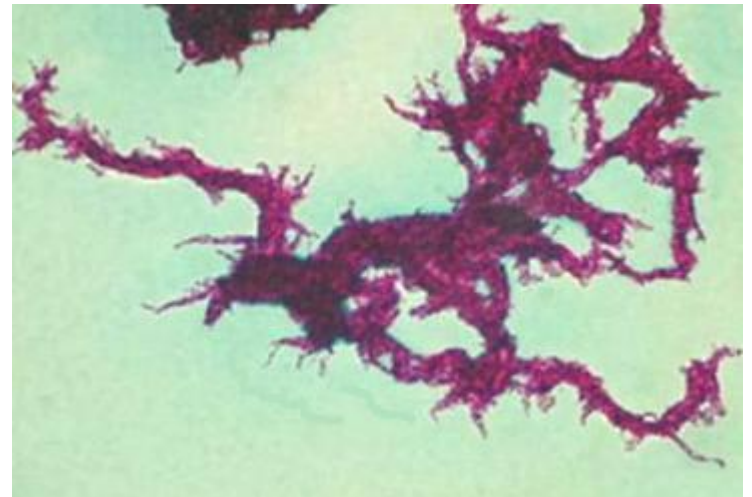


Cultural properties

M. tuberculosis can be grown in the laboratory. Compared to other commonly studied bacteria, *M. tuberculosis* has a remarkably slow growth rate, doubling roughly once per day.



This is a close-up of a Mycobacterium tuberculosis culture revealing this organism's colonial morphology



The manifestation of the cord-factor (the growth of the colony of the MBT, resembling the mycelium of the mycelium)



The Levenshtein-Jensen agar

Life-sustaining

The MBT is very stable in the environment. So, at a temperature of 23 ° C in a wet and dark place, it lasts up to 7 years. In a dark and dry place (with the patient's sputum drying out or in the dust), the MBT persists for up to 10-12 months, in street dust (that is, in a dry and bright place), Koch's stick persists for up to 2 months, on the pages of books - up to 3 months, in water - up to 5 months. In the soil, MBT persists for up to 6 months, in raw milk - up to 2 weeks, in butter and cheese - up to a year.

To date, it is believed that mycobacterium tuberculosis, which are in sputum, remain viable when the latter is boiled within 5 minutes. Mycobacteria are sensitive to agents containing chlorine (bleach, chloramine, etc.) and tertiary amines, as well as to hydrogen peroxide.

BCG vaccine

- is a vaccine primarily used against tuberculosis. In countries where tuberculosis is common, one dose is recommended in healthy babies as close to the time of birth as possible. The vaccine was originally developed from *Mycobacterium bovis* which is commonly found in cows. While it has been weakened, it is still live.
- The vaccine is given by injection into the skin.
- Often there is redness, swelling, and mild pain at the site of injection. A small ulcer may also form with some scarring after healing.

