

Lec (11-12)

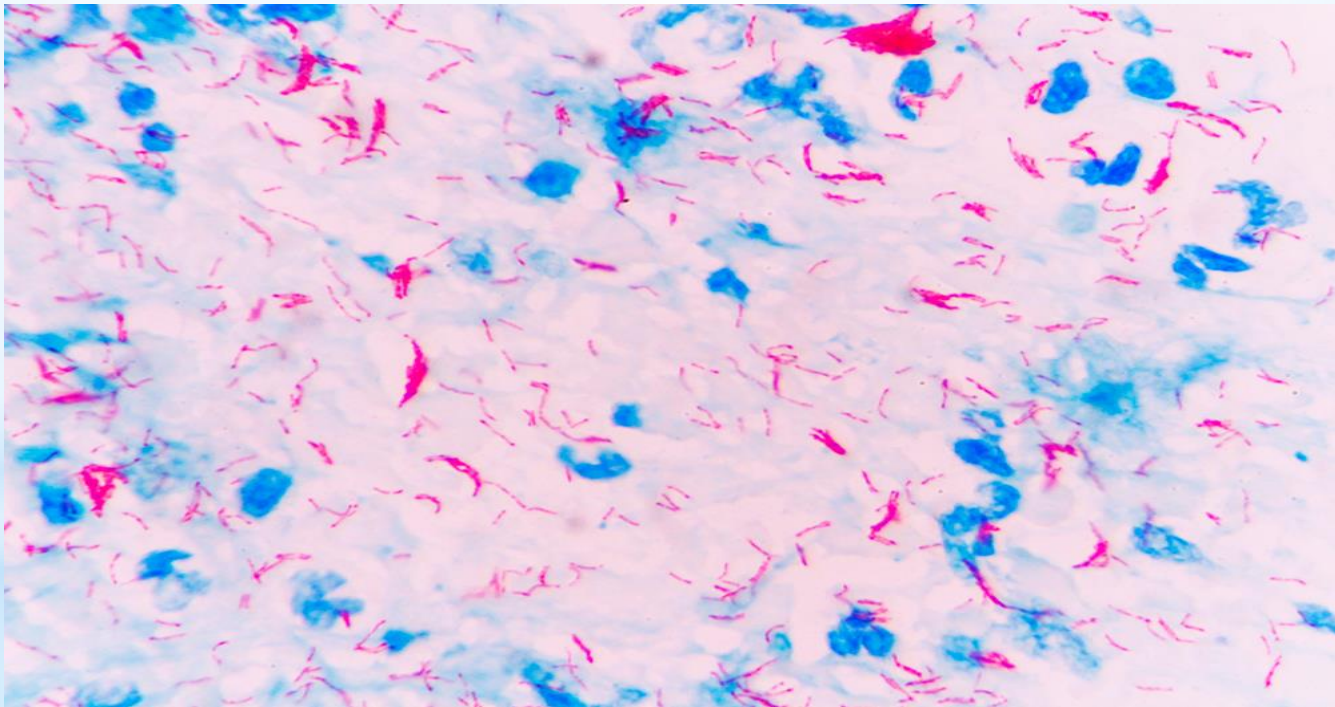
Genus *Mycobacterium*

(Mycobacterium tuberculosis).. TB disease

M. tuberculosis is a slender, straight or slightly curved rod with rounded ends. The bacilli are non-motile, non-spore forming, non-capsulated and acid-fast. TB bacilli are gram positive, but difficult to stain by gram method, since they give variable results (G+ve & G-ve), therefore Ziehl-Neelsen method is used to stain this bacterium.



With this stain, the *Tubercle bacilli* stain bright red, while the tissue cells and other organisms are stained blue



Acid fastness has been ascribed to the presence in the bacillus of **mycolic acid**. It is related to the integrity of the cell and appears to be a property of the lipid-rich waxy cell wall. Staining may be uniform or granular. In *M. tuberculosis* beaded or barred forms are frequently seen.

Cultural Characteristics

M. tuberculosis is an **obligate aerobe**. The optimal growth temperature of tubercle bacilli is 35 to 37°C but they fail to grow at 25°C or 41°C. Optimum pH is 6.4 to 7.0. The bacilli grow slowly, the generation time *in vitro* being 14 to 15 hours. Colonies appear in about 2 to 8 weeks.

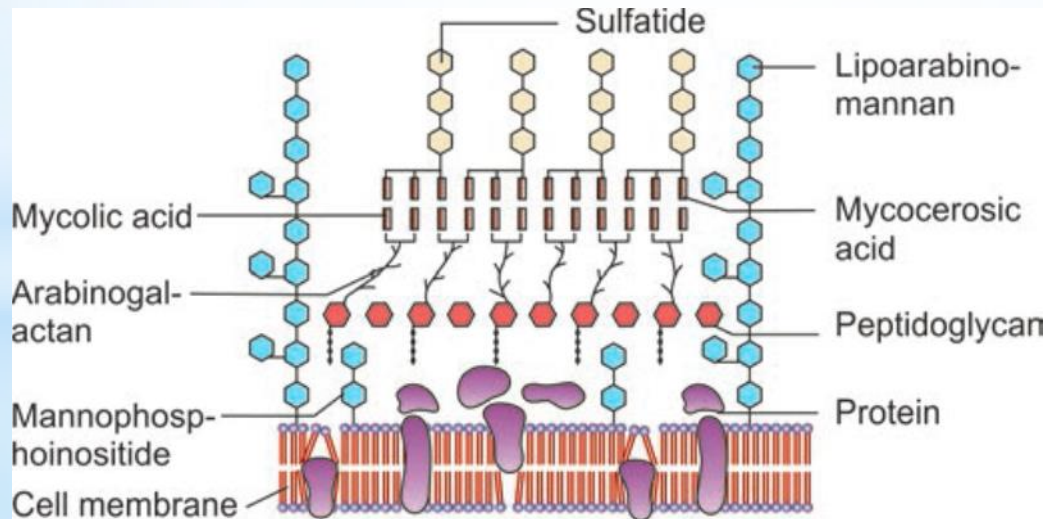
The solid medium most widely employed for routine culture is **Lowenstein-Jensen (LJ) medium without starch**.

Human tubercle bacilli produce visible growth on LJ medium in about 2 weeks. On solid media, *M. tuberculosis* forms **dry, rough, raised, irregular colonies with a wrinkled surface**. They are **creamy white, becoming yellowish or buff colored on further incubation**.



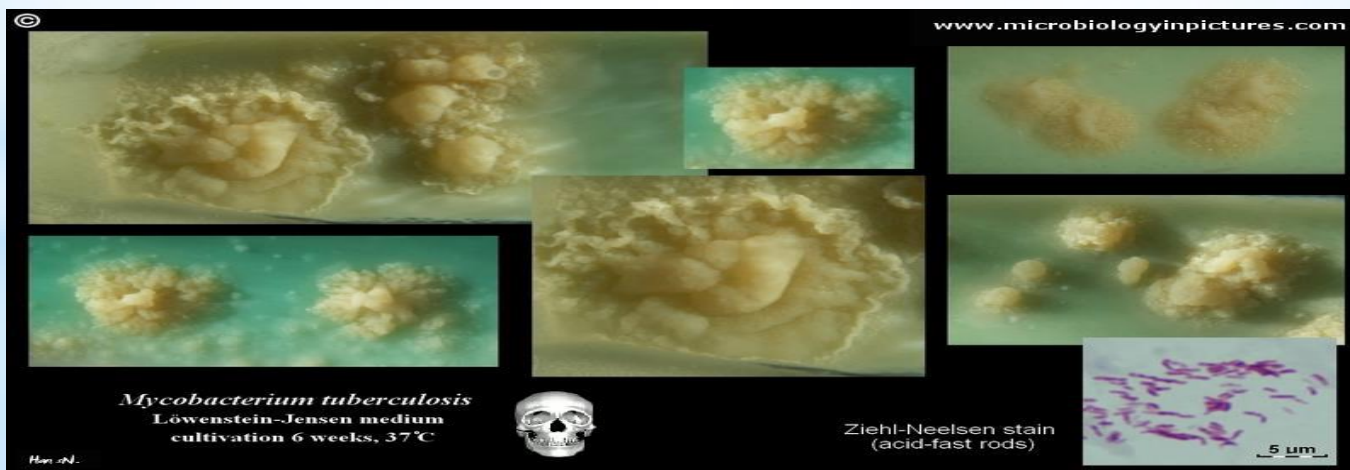
The basic structure of the **cell wall** is typical of gram-positive bacteria: an inner cytoplasmic membrane overlaid with a thick peptidoglycan layer and no outer membrane. The cell wall consists of; 1) lipids, 2) proteins and 3) polysaccharides. These lipids constitute 60% of the cell wall weight and contributes to several biological properties. Lipids of the cell wall particularly mycolic acid fraction are responsible for acid-fastness of bacteria and the cellular reaction of the body. The cell wall is made up of four distinct layers as the following:

- 1- Peptidoglycan layer (murein)
- 2- Arabinogalactan layer
- 3- Mycolic acid layer
- 4- lipoarabinomannan (LAM).



Treatment

- Isoniazid.
 - Rifampin (Rifadin, Rimactane)
 - Ethambutol (Myambutol)
 - Pyrazinamide
- *The selective medium most widely employed for routine culture is **Lowenstein-Jensen (LJ) medium without starch.**



Virulence Factor:

- **Cord factor- Trehalose 6-6 dimycolate**, is a glycolipid molecule found in the cell wall of *Mycobacterium tuberculosis* and similar species. It is the primary lipid found on the exterior of *M. tuberculosis* cells.
 - **Serpentine growth** (filaments, cords) grows in close parallel arrangement.
 - Toxic to leukocytes
 - Role in development of granulomatous lesions
- **Sulfolipids-** Sulfated glycolipid (sulfatide) prevent phagosome- lysosome fusion which is important for intracellular survival.



Mycobacterium leprae

Mycobacterium leprae is a bacterium that causes **leprosy**, also known as "Hansen's disease", which is a chronic infectious disease that damages the peripheral nerves and targets the skin, eyes, nose, and muscles.

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. It damages peripheral nerves and can affect the skin, eyes, nose and muscles. Nerve injury in leprosy can cause severe disabling deformities.

People who develop leprosy usually incubate the infection for 3–5 years before manifesting illness, and they exhibit a broad spectrum of clinical and histopathological responses to the infection determined by their immunological response to *Mycobacterium leprae*.



The cell wall is composed of two layers: the outer layer contains lipopolysaccharide and the inner layer peptidoglycan. Under the cell wall, there is a membrane composed of lipids and proteins. The cytoplasm contains storage granules, DNA and ribosomes. *M. leprae* is an obligate intra-cellular parasite in man, multiplying mainly in histiocytes and Schwann cells. The entry of the bacilli into the Schwann cells causes peripheral neuropathy.

Treatment of *M. leprae*

Current treatment of leprosy involves use of 3 drugs: rifampicin (rifampin); clofazimine; and **dapsone**. Multidrug therapy aims to effectively eliminate *M. leprae* in the shortest possible time to prevent resistance from occurring. The duration of therapy was recently reduced from 24 to 12 months.

