



## Department of biology



## Department of biology

### ((MICROBIOLOGY II))

#### Stage 2

#### Lecture 8

## **Mycobacteria**

By

**Dr. Asseel Hashim Radhi**



# Department of biology



## Mycobacteria

### 1. Introduction

- Definition: A genus of Actinobacteria, known for acid-fast stain due to mycolic acid in the cell wall.
- Important species:
  - *Mycobacterium tuberculosis* (causes TB)
  - *Mycobacterium leprae* (causes leprosy)
  - Nontuberculous mycobacteria (NTM), e.g., *M. avium*, *M. kansasii*

### 2. Taxonomy

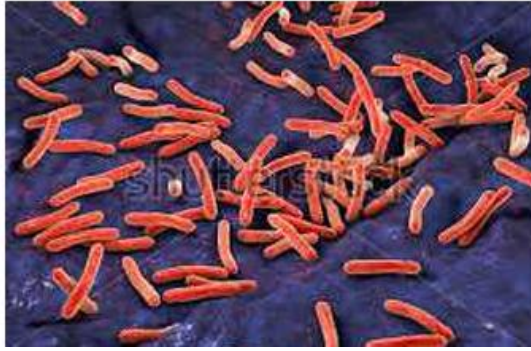
- Domain: Bacteria
- Phylum: Actinobacteria
- Order: Mycobacteriales
- Family: Mycobacteriaceae
- Genus: Mycobacterium

### 3. Morphology and Staining

- Rod-shaped, non-motile, non-spore-forming
- **Acid-fast bacilli (AFB):**
  - Ziehl-Neelsen stain (red rods on blue background)
  - Auramine-rhodamine stain (fluorescent)
- High lipid content in cell wall (60% mycolic acids)
- Cell Wall: Thick, waxy, rich in mycolic acid.
- Acid-fast: Positive (resist decolorization by acid alcohol).
- Gram Stain: Poorly stained; not classified as Gram-positive or Gram-negative.
- Growth Rate: Slow-growing (some species take weeks to culture).
- Oxygen requirement: Aerobic.



## Department of biology



### 4. Cell Wall Structure

- Unique, waxy, lipid-rich structure
- Components:
  - Peptidoglycan
  - Arabinogalactan
  - Mycolic acids
  - Lipoarabinomannan (LAM)
- Responsible for:
  - Acid-fastness
  - Resistance to antibiotics and disinfectants
  - Immune evasion

### 4. Classification and Major Species

- **M. tuberculosis**
- **M. leprae**
- **Nontuberculous Mycobacteria (NTM):**
  - Environmental, opportunistic pathogens

### 5. Pathogenesis

- Intracellular survival in macrophages
- Immune response: Granuloma formation



## Department of biology



- Delayed-type hypersensitivity (DTH)
- Virulence factors:
  - Cord factor
  - ESAT-6, CFP-10 proteins

### 6. Diseases

#### A. Tuberculosis (TB)

- Transmission: Aerosolized droplets
- Primary TB, Latent TB, Reactivation TB
- Symptoms: Cough, weight loss, fever, night sweats
- Extrapulmonary TB: Meningitis, Pott's disease, etc.

#### B. Leprosy (Hansen's disease)

- Transmission: Prolonged contact
- Tuberculoid vs Lepromatous leprosy
- Skin lesions, nerve damage

#### C. NTM Infections

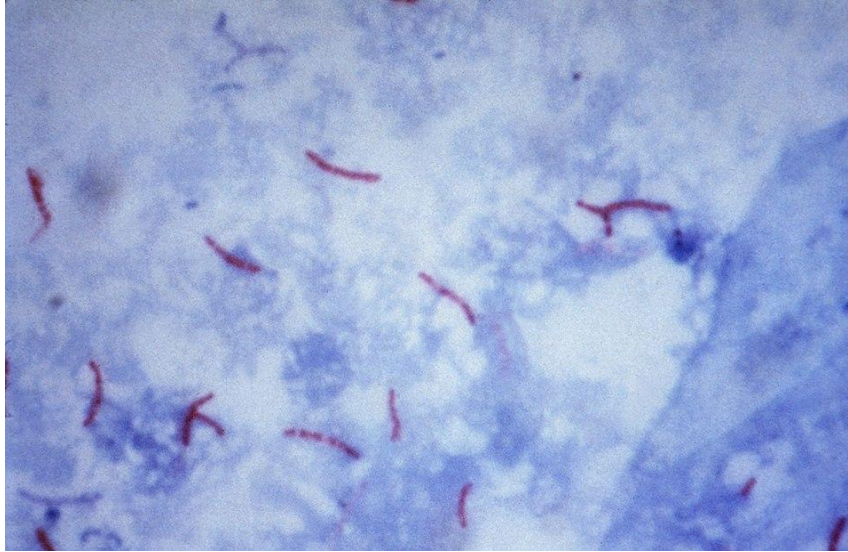
- Pulmonary disease
- Skin and soft tissue infections
- Lymphadenitis

### 7. Diagnosis

- Microscopy: AFB staining
- Culture: Lowenstein-Jensen medium (slow-growing)
- PCR and molecular tests: GeneXpert, NAAT
- Tuberculin Skin Test (TST), IGRA for TB



## Department of biology



### 8. Treatment

- **TB:** RIPE regimen (Rifampin, Isoniazid, Pyrazinamide, Ethambutol)
- DOTS (Directly Observed Treatment, Short-course)
- MDR-TB, XDR-TB: Use of second-line drugs
- **Leprosy:** Dapsone, Rifampin, Clofazimine
- **NTM:** Macrolides, Rifampin, Ethambutol (varies)

### 9. Prevention

- BCG vaccine (Bacillus Calmette–Guérin)
- Public health measures: Screening, isolation, treatment
- Contact tracing and prophylaxis