Tuberculosis

Introduction

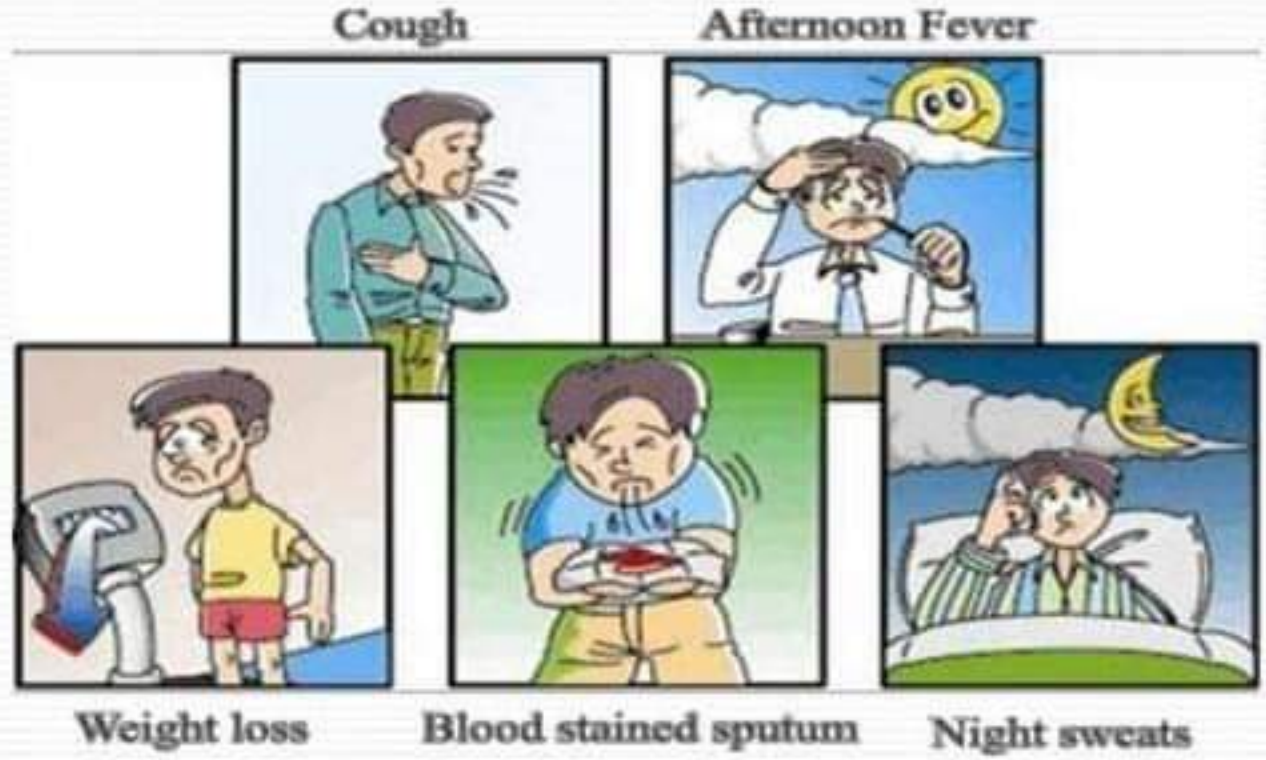
- **Tuberculosis** (**TB**) is a common and deadly infectious disease caused by mycobacteria, mainly *Mycobacterium tuberculosis*.
- Tuberculosis most commonly attacks the lungs (as pulmonary TB) but can also affect the central nervous system, the lymphatic system, the circulatory system, the genitourinary system, bones, joints and even the skin.
- Other mycobacteria such as *Mycobacterium bovis*, *Mycobacterium africanum*, *Mycobacterium canetti*, and *Mycobacterium microti* can also cause tuberculosis, but these species do not usually infect healthy adults.
- When someone's immune system is weakened, chances of developing TB are increased. On average, 10 percent of the infected individuals develop the disease during their lifetime.
- If left **untreated**, each person with smear-positive pulmonary TB will infect, on average, between 10 and 15 persons in each year.

Sources of Infection

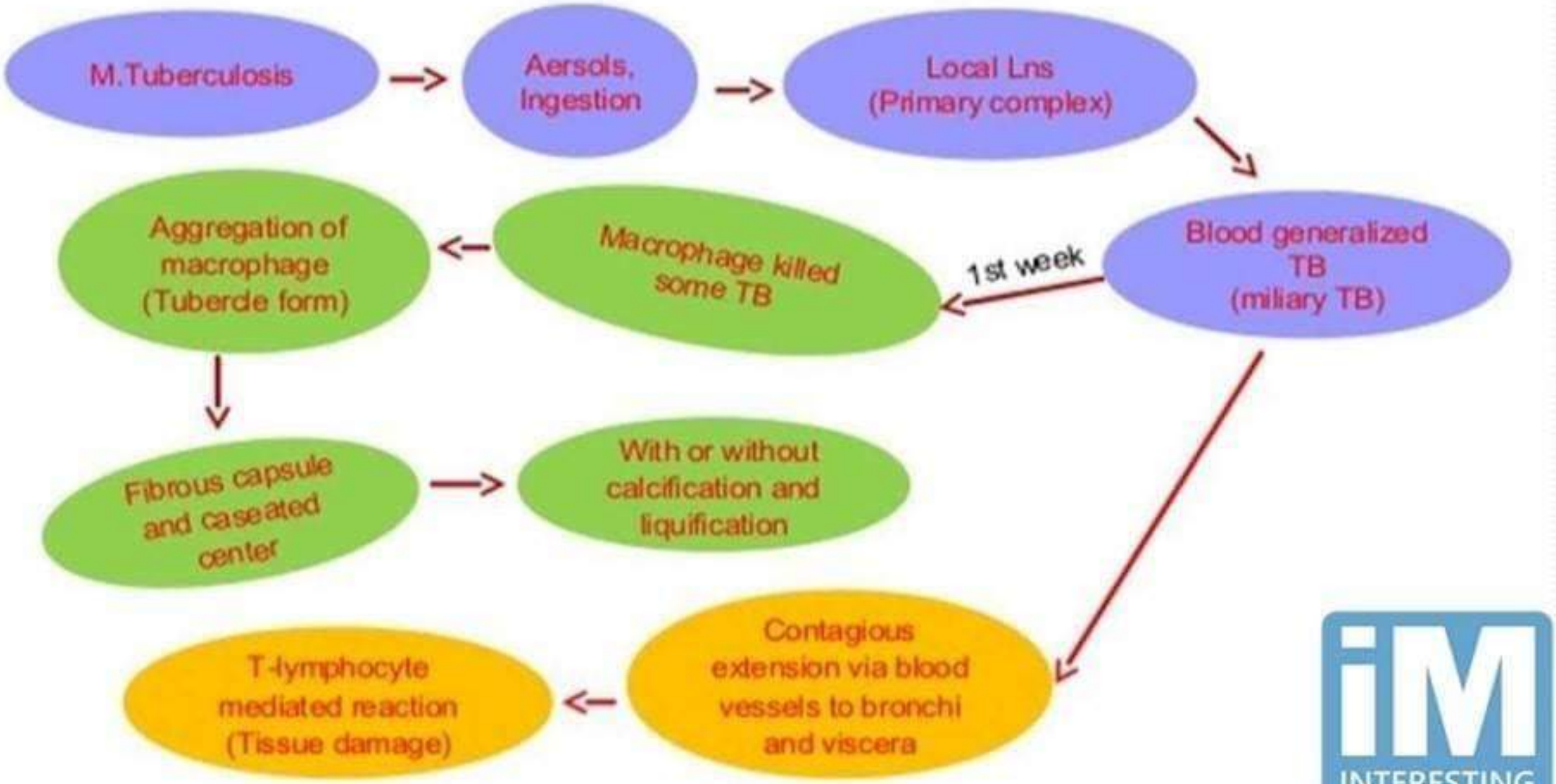
- TB bacilli are passed through the air when a person who is sick with TB disease coughs, sings, sneezes, or laughs speaks, or another person breathes the air into their lungscontaining the TB bacteria.
- Dried bacilli in dust are much less infectious.
- Spread occurs most often among household or other close contacts with infected person's sputum.
- Infection also occurs by ingestion.
- Several other factors- genetic suspectiblity , age, stress, nutrition- influence the outcome of infection.

Common Symptoms of TB Disease

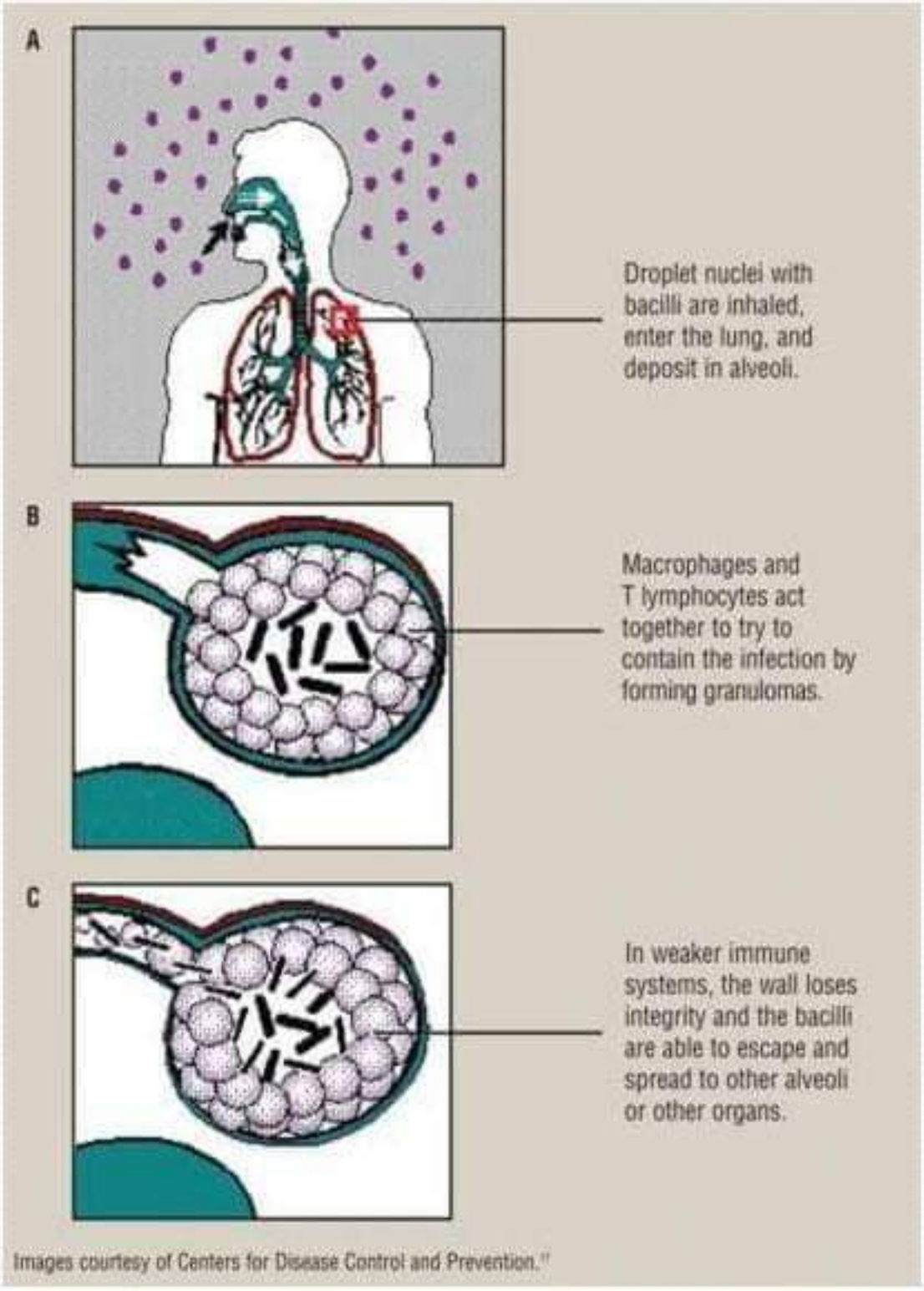
- Cough (2-3 weeks or more)
- Coughing up blood
- Chest pains
- Fever
- Night sweats
- Feeling weak and tired
- Losing weight without trying
- Decreased or no appetite



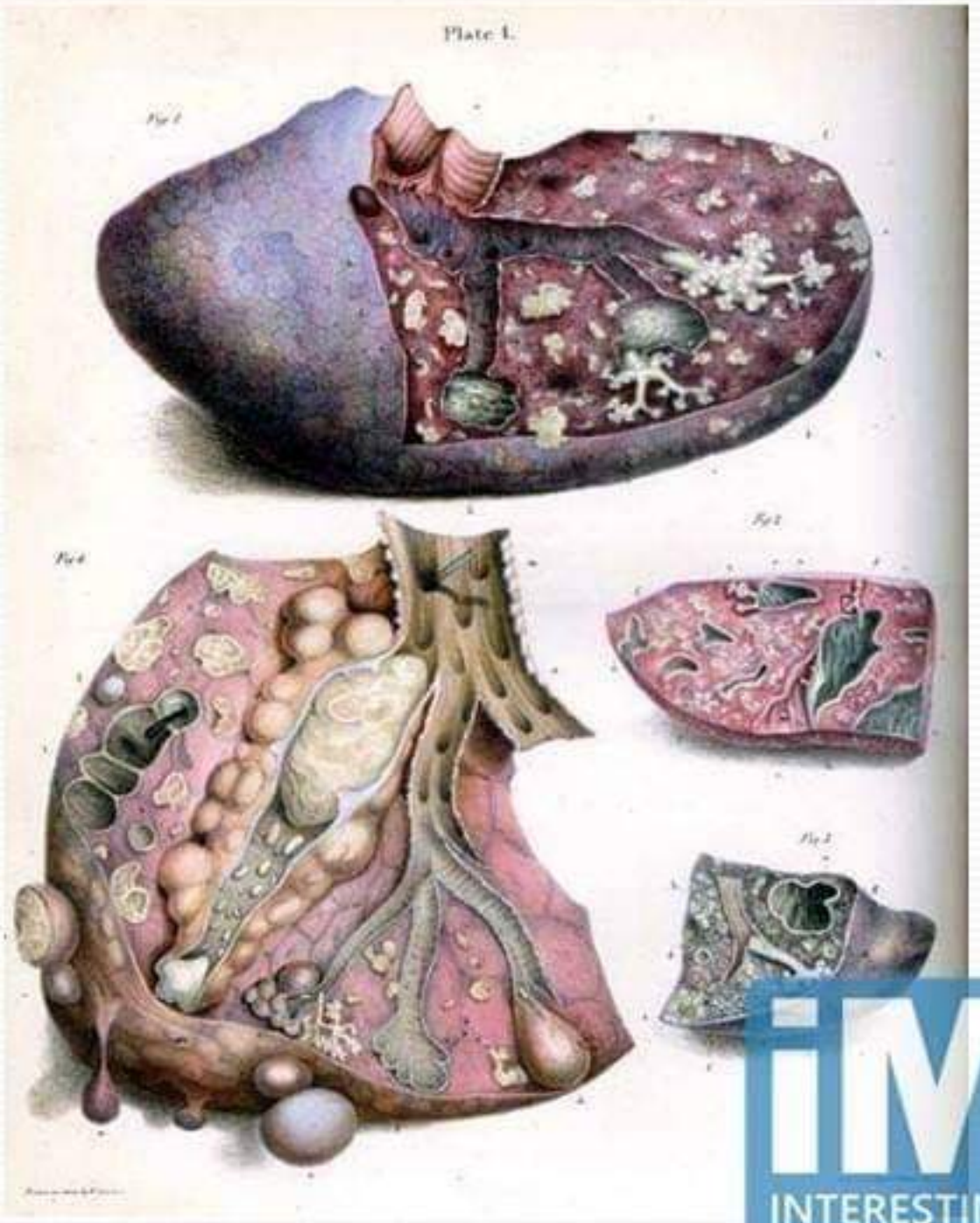
Pathogenesis of Tuberculosis



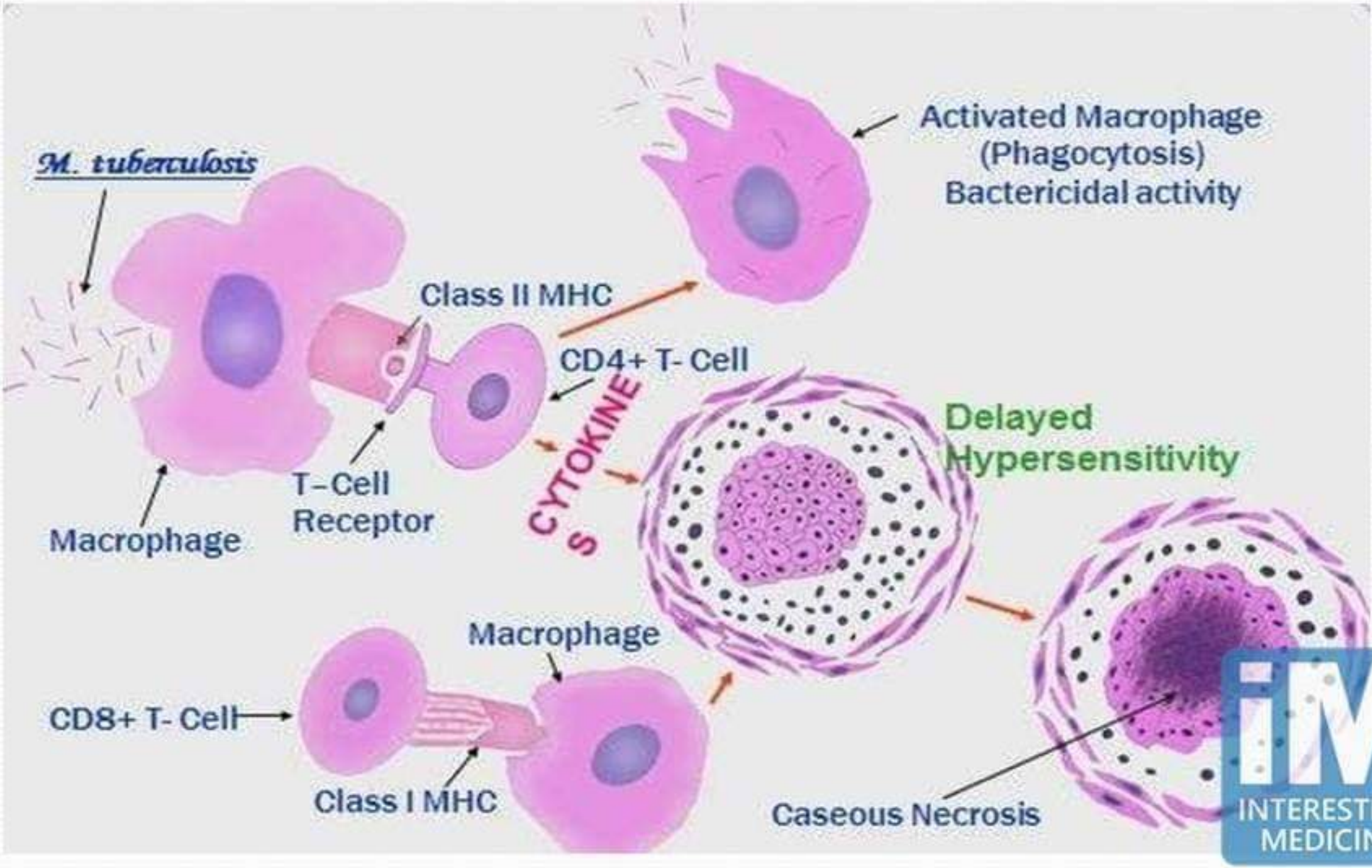
Pathogenesis



Images courtesy of Centers for Disease Control and Prevention.[11]



Immunopathology



Koch's Phenomenon

- Cell mediated immunity develops 2-12 weeks after infection along with delayed hypersensitivity (allergy).
- The result of these determines the course of infection.
- The response of a tuberculous animal to re-infection was originally described by **Koch**.
- Tuberculosis infected Guinea pig if injected with living Tubercle bacilli.
- The site around the injection becomes necrotic.
- Koch found the same reaction when injected with old Tuberculin (heated and concentration of the tubercle bacilli)
- It has produced the same reaction.
- This is called as Koch's Phenomenon.

Classification of TB

- Depending on the time of infection and types of response, TB may be classified as; **Primary and Secondary.**

1. Primary Tuberculosis:

- It is initiated after first contact with tubercle bacilli.
- Events of Primary complex

1. Bacilli are engulfed by Alveolar Macrophages
2. Multiply and give raise to Sub pleural focus of Tuberculosis Pneumonia, involve lower lobes and lower part of upper lobes called as **Ghon's focus**.
3. The hilar lymph nodes are also involved.
4. The Ghon focus together with hilary lymph node consitute the **Primary complex**.

- Ghon's focus with Enlarged lymph nodes appear after 3-8 weeks after infection.
- Heals in 2–6 months calcified,
- Some bacteria remain alive and produce latent infections.
- Infection activated in Immunosuppressed conditions Eg. HIV infections and AIDS
- Can produce Meningitis, Miliary tuberculosis, other disseminated Tuberculosis.

2. Secondary Tuberculosis:

- Mainly occurs due to Reactivation of Latent infection.
- May also due to Exogenous reinfection
- Differs from Primary Infection.
- Leads to –

  Cavitation's of Lungs, Enlargement of Lymph nodes, expectoration of Bacteria laden sputum.
- Dissemination into Lungs and other extra pulmonary areas

Epidemiology

- According to the World Health Organization (WHO), nearly 2 billion people—one third of the world's population—have been exposed to the tuberculosis pathogen .
- Annually, 8 million people become ill with tuberculosis, and 2 million people die from the disease worldwide.
- Death is recorded more in poor countries like India.
- More than 40% Indians are affected.
- **Reason for increase incidence :**

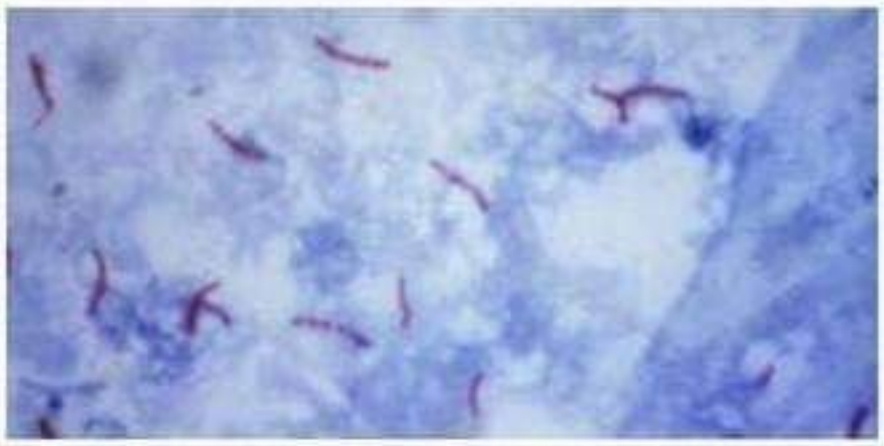
1. HIV infections and the neglect of TB control programs.
2. Lack of access to health care
3. Poverty

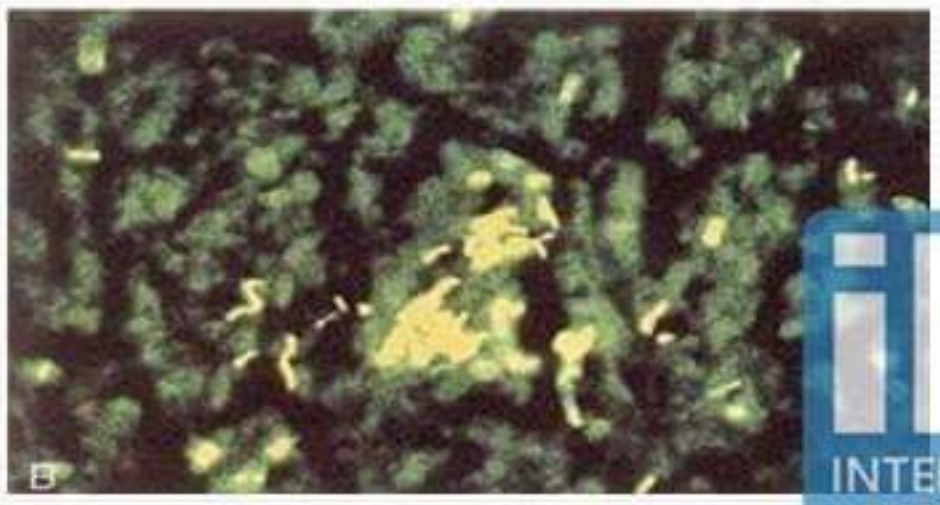
Laboratory Diagnosis

- Tests may include:
  - medical history
  - chest X-ray
  - physical examination
  - Radiology
  - Tuberculin skin test
  - microbiological detect of smears and cultures.
  - Blood test.

Direct smear microsopy

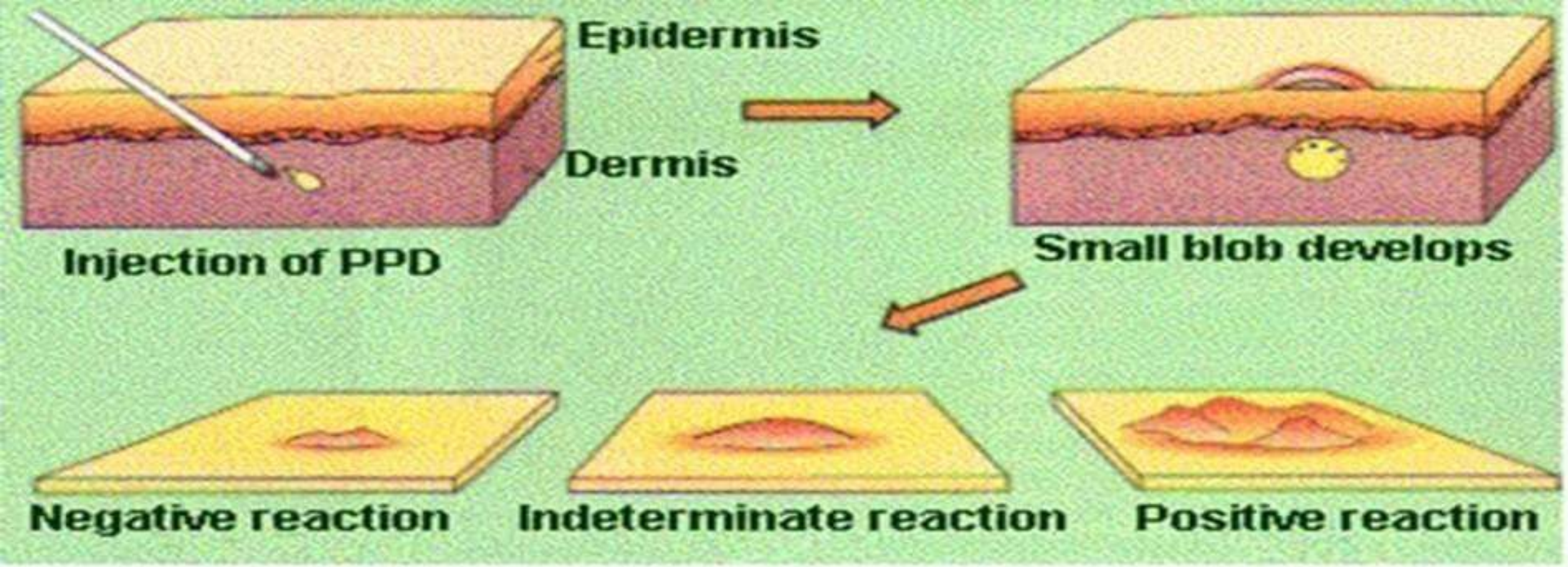
- The direct smear microscopy of sputum is a reliable and simple technique for detecting Mycobacteria in order to diagnose pulmonary TB.
- The method consists of microscopic examination of a specimen of three morning successive sputum that has been spread on a slide, and stained by the Ziehl-Neelsen method or Auramine rhodamine stain (florescent microscopy).





Tuberculin Skin Test (TST)

- Mantoux tuberculin skin test (PPD) is a skin test for identifying exposure to the TB bacteria, *Mycobacterium tuberculosis*.
- In the Mantoux test, 0.1 ml of tuberculin is injected intradermally.
- Most people infected by M. tuberculosis or vaccinated by BCG will react to TST and develop an **induration** at the site of injection.
- The diameter of this induration is measured after 48 to 72hours.
- Induration of diameter 10mm or more is considered positive, 5mm or less is negative.



Tuberculin Skin Test

Treatment

- **Chemotherapy** has revolutionized the management of tuberculosis.
- Treatment for TB uses antibiotics to kill the bacteria. The two antibiotics most commonly used are **rifampicin** (10 mg/kg) and **isoniazid** (5 mg/kg(300 mg max per day).
- However, instead of the short course of antibiotics typically used to cure other bacterial infections, TB requires much longer periods of treatment (around 6 to 12 months) to entirely eliminate mycobacteria from the body.
- **Multiple-drug therapy** to treat TB means taking several different antitubercular drugs at the same time.
- The standard treatment is to take isoniazid, rifampin, ethambutol, and pyrazinamide for 12 months.
- **Directly Observed Treatment (DOT).**

Prevention

- For the prevention of TB, general measures such as <u>adequate nutrition, health education, cover the mouth and wear mask, wash your hands frequently</u> are very important measures.
- Intradermal injection of live attenuated vaccine **BCG** (Bacille Calmette-Guerin).
- Immunity lasts for 10-15 years.