Mycobacterium leprae
Morphology:

Straight rods. 1 - 8 x 0.2 - 0.5\(\mu\)m

Single / groups. Intracellular.

Acid fast bacilli with 5% \(H_2SO_4\).

Bound together like cigar bundles by lipid-like substance: Glia.

Globi present in virchow’s lepra cells or Foamy cells.
No artificial media / tissue culture available.

**Mouse:**
- Intradermally into *Foot pads.*
- Granulomatous lesions in 1-6 months.

*Intact CMI:* Limited replication.

↓ *CMI:* Generalized leprosy.

**Armadillo:** Highly susceptible.
- Chimpanzees, Manghabey monkey.
Resistance

Warm humid environment  9 - 16 days.

46  days in Moist soil

2  hours in Sunlight

30  minutes U V rays

Surface lipid – Peptidoglycolipid (PGL-I ) A carbohydrate antigenic determinant.
Epidemiology

World wide (tropics).
Least infectious.
Transmission - Nasal secretions.
(Nasal blow releases $8 \times 10^8$ bacilli)
Incubation period is 3-5 years.
Continuous close contact.
Rare in children < 5 Years.
India: 12 million cases
estimated -- 1980
2 millions -- 1996
## Classification of leprosy

### I. Madrid (1953)

1. Lepromatous leprosy.
2. Tuberculoid leprosy.
3. Dimorphous leprosy.
4. Indeterminate leprosy.

### II. Ridley & Jopling

1. Tuberculoid (T T).
2. Borderline tuberculoid (BT).
5. Lepromatous leprosy (LL).
III. WHO classification

Based on bacterial load.

1. Paucibacillary

I, T T, BT

2. Multibacillary

BB, BL, LL.
Leprosy

Slow, chronic & progressive Granulomatous disease of Peripheral nerves, skin and Muco-cutaneous tissues (Nasal mucosa).
It affects Skin, Lungs, liver, testes, bones.
**Source**: Nasal or Skin discharges from lesion.

**Portal of entry**: Damaged skin - Inoculation.

*Nasal mucosa* - Inhalation
Infiltration of bacilli in cooler body tissues like skin (nose, outer ear), testicles & superficial nerve endings → (maculae) visible lesions.

A non-specific or Indeterminate skin lesion is the First sign of disease.

Schwann cell is target cell. Neuritis leads to Anesthesia & muscle paralysis.
**Tuberculoid leprosy**

- Lesions are large maculae on skin, superficial nerve endings.
- CMI is intact.
- Low infectivity

**Lepromatous leprosy**

- Extensive maculae, papules or nodules;
- Extensive destruction of skin.
- CMI severely depressed
- High infectivity

**Regression**

**Progression**
Lepromatous leprosy

Generalized form with decreased CMI.

“Lepromata” : Granulation tissue with plenty of vacuolated cells, from MN cells to Lepra cells.

↓

Ulceration

↓

Secondary infection & Mutilation of limbs.

Skin lesions are extensive and bilaterally symmetrical.
- Face, ear lobules, hands and feet.
- Symmetrical thickening of peripheral nerves & anesthesia.
- Bacilli invade mucosa of Nose, Mouth and Respiratory tract → shed in secretions.
  Bacteremia present.
- *Lepromin test* is negative. CD8+ cells in plenty
- Auto antibodies are produced.
- Lateral part of eyebrows are lost.
Complications:

- Acute exacerbations.
- Testicular atrophy, Gynaecomastia
- Diffuse thickening of face - (Leonine face).
- Necrosis of nasal bones, cartilage with loss of upper incisors.
- Corneal ulcers.
Localized form in individuals with intact CMI.

**Skin lesions:**

- Few hypo or hyper pigmented macular patches.
- Seen on Face, trunk and limbs.
- Bacilli are scanty or absent.

Infectivity is low.
• Diagnosed with Clinical + Histological evidences.

Nerves: Peripheral Nerves to bigger nerves involved.

Thickened, hard and tender.

Lepromin test is positive. Auto antibodies production is rare. CD4+ cells.
Complications

- Peripheral neuropathy.
- V & VII th cranial nerve: Corneal ulcers.
- Ulnar nerve: Claw hand.
- Lateral popliteal nerve: Foot drop.
- Posterior tibial & medial nerve: Trophic ulcers, Loss of digits.
Dimorphous type:

Lesions resemble both LL (bacteriology) & T T (Clinically).

May turn to complete LL or T T type.

Indeterminate type:

Early stages: Maculoanesthetic patches.

Lesions are not like T T or LL

Spontaneous healing. Turn to either LL or T T type.
Indeterminate type
Immunity: High degree of innate immunity.

Induces both AMI & CMI. Antibodies are not effective.

LL Pts: Large number of CD8 cells.

TT Pts: Predominantly CD4 cells.

Genetic relation:

TT: HLA - DR2
LL: HLA MT1
Lepra reactions:

Acute inflammation of the disease due to *immunological reactions* against bacilli. Medical emergency.

Two types:

**Jopling type 1: CMI response against bacilli**

*Synonym:* Reversal reaction

*Occurrence:* Spontaneous, Chemotherapy.

Seen in BT, BB, BL.

Due to influx of lymphocytes into lesions and changed to TT morphology.

*Lesions are painful, tender, Erythema and swelling.*
Jopling type 2: (Erythema nodosum leprosum)

Due to vasculitis (Antigen - Antibody complex).

Seen in LL & BL few months after starting the chemotherapy.

**Characterised by:**

- Tender, inflamed subcutaneous nodules.
- Fever.
- Lymphadenopathy, arthralgia.

**Lucio phenomenon:**

Cutaneous hemorrhagic infarct in LL cases.
**Main features of leprosy reactions.**

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Immunological basis:</strong></td>
<td>CMI</td>
</tr>
<tr>
<td></td>
<td>Vasculitis with Ag – Ab deposits.</td>
</tr>
<tr>
<td><strong>2. Type of patient:</strong></td>
<td>BT,BB, BLBL, LL.</td>
</tr>
<tr>
<td><strong>3. Systemic disturbances:</strong></td>
<td>Not seen.</td>
</tr>
<tr>
<td></td>
<td>Present.</td>
</tr>
<tr>
<td><strong>4. Hematological disturbances:</strong></td>
<td>Not present</td>
</tr>
<tr>
<td><strong>5. Proteinuria:</strong></td>
<td>Not seen.</td>
</tr>
<tr>
<td></td>
<td>Frequently present.</td>
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<tr>
<td><strong>6. Relation to therapy:</strong></td>
<td>Seen in first 6 months.</td>
</tr>
<tr>
<td></td>
<td>Rare in first 6 months.</td>
</tr>
</tbody>
</table>
Lepromin test:

Skin test for *delayed hypersensitivity* to lepra bacilli.

*Antigens:*

1. Boiled extract of Lepromatous tissue in isotonic saline.
2. Leprosins: Ultrasonicates of tissue-free bacilli from lesions.
   - a). leprosins – H
   - b). leprosins – A
3. Dharmender’s antigen.
4. Soluble antigen.
Two types of reactions on Intradermal injection

1. Early reaction of *Fernandez*:
   Erythema & Induration within 1 - 2 days

   Remains for 3 - 5 days.

   Poorly defined with little significance.

2. Late reaction of *Mistuda*:
   Erythematous, indurated, granulomatous nodular skin lesion.

   Seen in 1 - 2 weeks reaches to peak in 4 weeks.

   Indicates CMI status in leprosy patients.
Significance:

1. To classify the lesions of leprosy.
   - T T ( + )
   - L L ( - )
   - Borderline ( +/- )

   - Positive: Good prognosis
   - Negative: Bad prognosis

3. To assess the resistance of individuals to leprosy.
Lab. Diagnosis

Specimens:

1. **Scrapings** from

   Lesion, Nasal mucosa.

   Z-N staining.

   Acid fast bacilli within the undifferentiated macrophages: L L

   **Live bacilli**: Solid, uniformly stained.

   **Dead bacilli**: Fragmented and granular.
Load of bacilli:

1. Bacteriological index:
   1-10 / 100 oil immersion fields : 1+
   1 -10/10 “ “ “ : 2+
   1 -10 / 1 “ “ “ : 3+
   10-100/ field : 4+
   100-1000 /field : 5+

2. Morphological index(% of uniformly stained bacilli)

   = Uniformly stained bacilli X 100
   Total number of bacilli
2. Skin & Nerve biopsy.

3. Ear lobules (Slit skin smear).

5. Lepromin test: To know prognosis. Not for diagnosis.

6. Serological test:
   (a). MLPA  (b). ELISA (Antibody against PGL-I).

Treatment:
Until 1982: Dapsone only.

Now MDT being given because of resistant strains.

WHO recommended Multi drug therapy

Paucibacillary case.

Rifampicin 600 mg/ month
Dapsone 100mg / day

\{ 6months \}
**Multi bacillary case:**

- Rifampicin 600mg / month
- Dapsone 100 mg / day
- Clofazimine 300 mg / month + 50 mg / day

2 or more years

**Vaccines:** BCG, MAI complex vaccine. Mycobacterium w vaccine.

**Chemoprophylaxis:** MDT