ATYPICAL MYCOBACTERIA

Synonyms

- Nontuberculous mycobacteria (NTM)
- Mycobacteria other than tubercle bacilli (MOTT)
- Opportunistic mycobacteria
- Paratubercle bacilli
- Tuberculoid bacilli
- Anonymous mycobacteria
- Unclassified mycobacteria

Characteristics

- Nonmotile, Nonsporing, Noncapsulated
- Acid fast
- Exists as saprophytes
- Resistance to antituberculous drugs
- No evidence of direct transmission from man to man
- Low virulence
- Produces opportunistic infections
- Induce low level tuberculin reactivity

Differences between Atypical & typical mycobacteria

Atypical mycobacteria	Typical mycobacteria
Opportunistic	Obligate pathogen
Some are rapid growers	All are slow growers
Some produce pigment	Do not produce pigment
Some grow at 25^0C & some at 45^0C	Cannot grow below 25^0C & above 45^0C

Niacin - negative	Niacin - positive
Aryl sulphatase - positive	Aryl sulphatase -negative
Catalase – strong positive	Catalase – weak positive
Resistant to anti tuberculous dugs	Sensitive to anti tuberculous dugs
Non pathogenic to guinea pig	Pathogenic to guinea pig

Classification

- Ernest Runyon (1959)
- Classified into 4 groups depending upon pigment production & rate of growth

1. PHOTOCHROMOGEN
2. SCOTOCHROMOGEN
3. NONPHOTOCHROMOGEN
4. RAPID GROWERS

PHOTOCHROMOGEN

- Colonies produce yellow-orange pigment when culture is exposed to light for 1 hour in the presence of air & reincubated for 1-2 days
- Colonies are nonpigmented in dark
- Species

M. kansasii – grow at 37^0C
M. simiae – grow at 37^0C
} chronic pulmonary disease

M. marinum (fish tubercle bacillus) - poor growth at 37^0C

SCOTOCHROMOGEN

- Produce yellow-orange pigmented colonies even in the dark
- Species

  M. scrofulaceum - scrofula

  M. szulgi – Scotochromogen at 37^0C

  Photochromogen at 25^0C

  - pulmonary disease, bursitis

  M. gordonae - tap water

NONPHOTOCHROMOGEN

- Do not produce pigment even on exposure to light
- Species

  M. avium (avian tubercle bacillus) } MAC
  M. intracellulare (Battey bacillus) } Complex

  - lymphadenopathy, pulmonary disease, disseminated disease in AIDS patients

  M. malmoense - pulmonary disease

  M. xenopi – isolated from xenopus toad

  - thermophile - 45^0C
  - chronic lung disease
  - hot tap water – occ. Scotochromogenic

  M. ulcerans

RAPID GROWERS

- Heterogeneous group of mycobacteria
- Rapidly growing (within 7 days) - 37^0C or 25^0C
- Photochromogenic, scotochromogenic, nonchromogenic
- Species

M. fortuitum (frog tubercle bacilli) } nonchro-
M. chelonei (turtle tubercle bacilli) } mogenic

- chronic abscesses
- post injection abscesses

M. vaccae – immunomodulator

Skin pathogen

M. ulcerans

- Australia, Uganda (Buruli ulcer), Congo, Nigeria, Mexico, Malaysia, New Guinea
- Infection through minor injury - indurated nodules - ulcerated lesion - edge containing large clumps of acid & alcohol fast bacilli - on legs, arms
- Toxin (Buruli toxin)
- L.J. medium - slow growth (4-8weeks)
  - 30 - 33^0C

M. marinum

- natural pathogen of cold blooded animal (fish, amphibia)
- saprophytes in fresh or salt water
- Humans – contaminated swimming pool or fish tanks, those involved in aquatic hobbies – papule – ulcer (scanty bacilli) – on the prominences (elbow, knees, ankles, nose, fingers) – swimming pool granuloma – self limited
- Growth in 2 weeks at 30^0C ($25\text{-}30^0$C)
- Photochromogenic

MYCOBCTERIUM LEPRAE

Armauer Hansen in 1873

Morphology

– straight, or slightly curved, slender AFB (5% H_2SO4)

- Non alcohol fast
- Intracellular – dense clumps (globi) – lepra cell

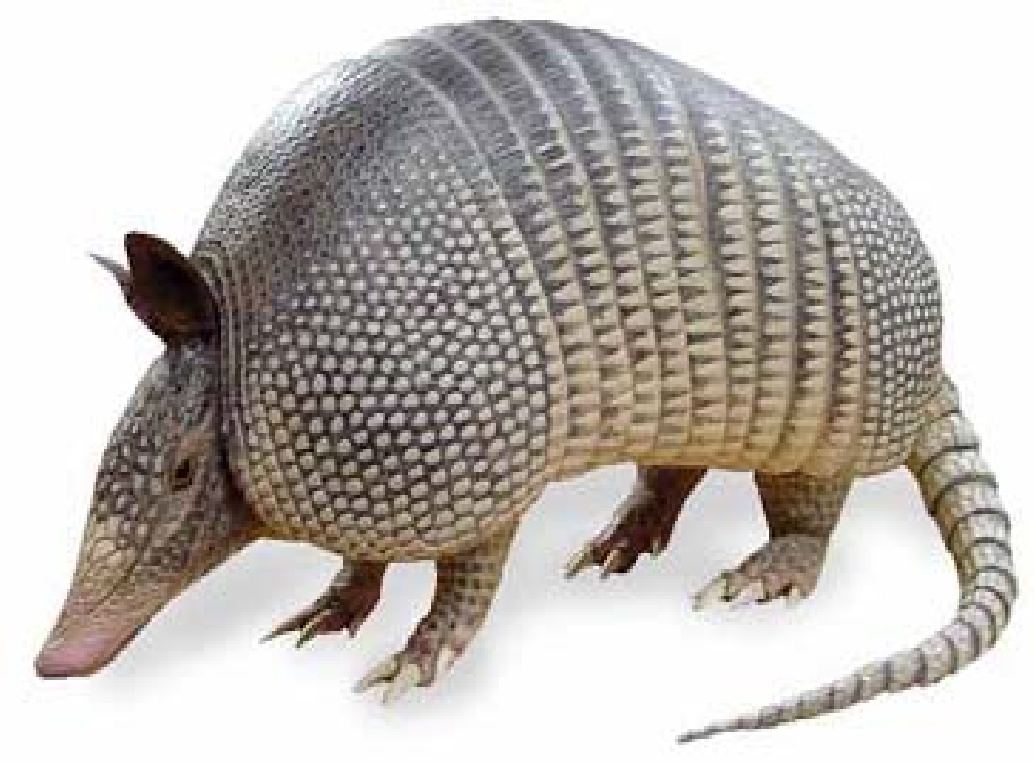
Cultural characteristics

Cannot be cultivated on artificial culture media

generation time 12-13 days

Experimental animals

1. Nine banded armadillo
2. Mice



Pathogenicity

- Leprosy is a chronic disease of the skin, mucous membranes and nerve tissue.
- Prevalent in tropical countries
- Primary reservoir is infected humans
- Acquired through infected humans

transmission – person to person through inhalation of M. leprae discharged in nasal secretions

- contact with infected skin

Principal target cell is schwann cell

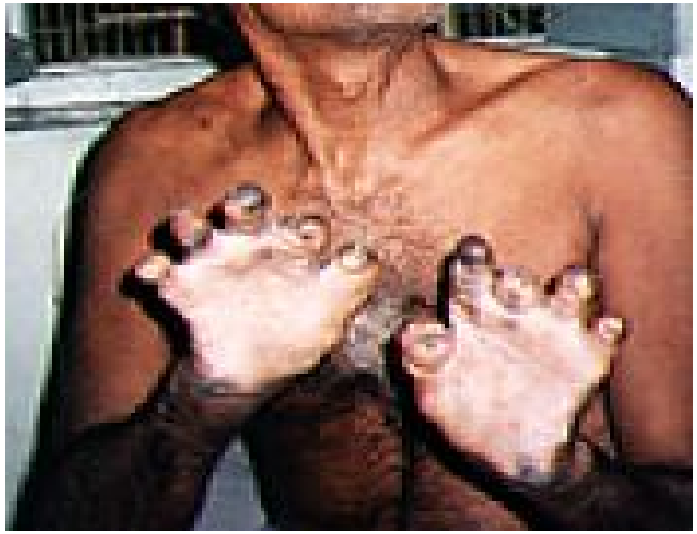
Damage to schwann cell – Nerve damage – loss of sensation, muscle paralysis – repeated injury & infection – gradual loss of limbs

Symptoms

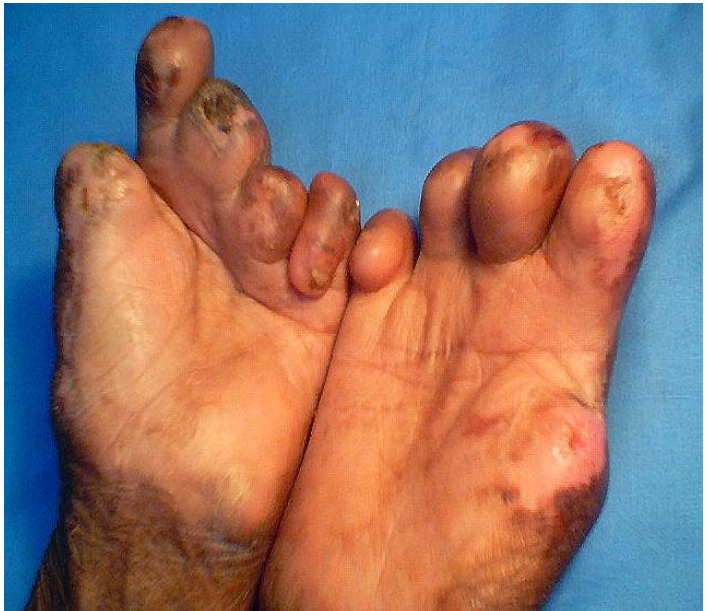
- Leprosy affects the peripheral nerves. Due to loss of feeling in the hands and feet, injuries or infections may go unnoticed. M. leprae also internally affects the nose, which causes it to collapse.

Leprosy damages the nose

And feet



Hands



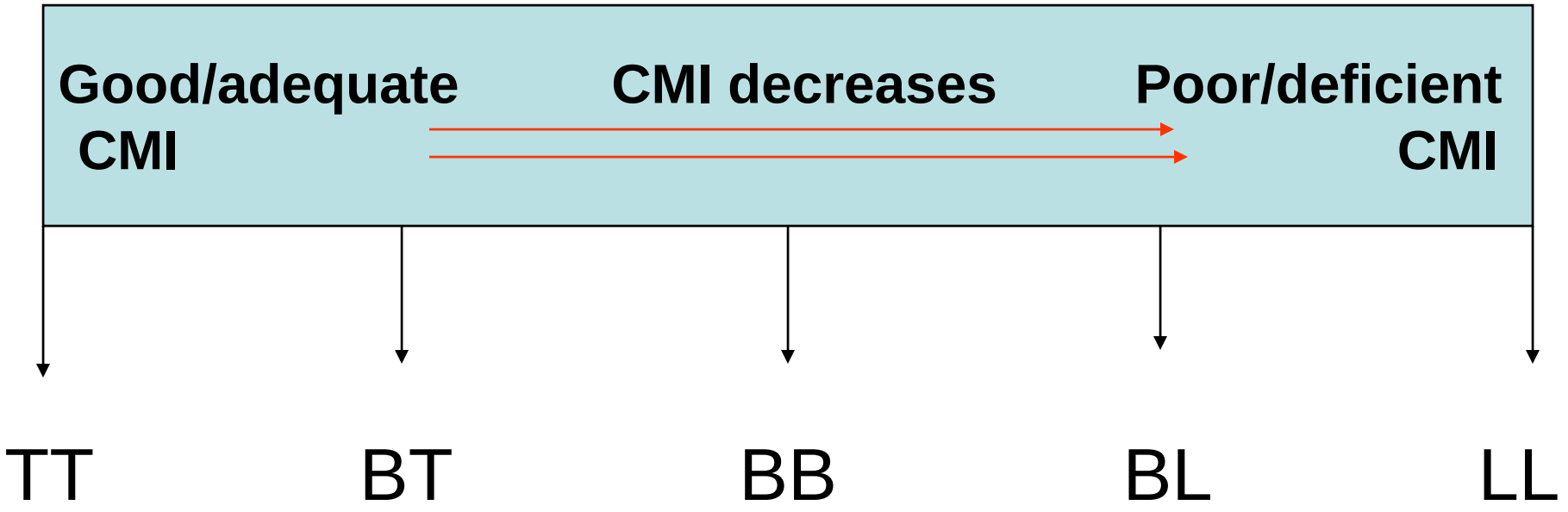
Clinical types
Depending upon immune status

- Madrid classification, 1953

1. Lepromatous
2. Tuberculoid
3. Dimorphous/ Borderline
4. Indeterminate

- Ridely & Jopling classification, 1966

1. Tuberculoid (TT)
2. Borderline tuberculoid (BT)
3. Borderline (BB)
4. Borderline lepromatous (BL)
5. Lepromatous (LL)


Good/adequate CMI
CMI decreases
Poor/deficient CMI
TT
BT
BB
BL
LL

Lepromatous	Tuberculoid
Nodular lesions on face, earlobes, hands, feet, trunk. Thickening of peripheral nerves – late sign Less anaesthesia	Small no. of localised skin lesions. Hypo pigmented patches with anaesthesia. Thickening of peripheral nerves – Early sign
Dermal macrophages & schwann cells filled with bacilli	Many lymphocytes, noncaseating granuloma but few bacilli
Progressive, severe	Non progressive, benign
Multibacillary	Paucibacillary

Lepromatous	Tuberculoid
Highly infectious	Minimal infectivity
CMI – Deficient/ Absent	CMI - Adequate
Lepromin test - negative	Lepromin test - positive
Poor prognosis	Good prognosis
AutoAb & anti mycobacterial Ab more	AutoAb & anti mycobacterial Ab - rare

Lepromatous vs. Tuberculoid Leprosy

Lepromin test

Ag – Mitsuda Ag : Human derived (lepromin H)

– Armadillo derived : lepromin A

Intradermal skin test

- not used for diagnosis nor does indicate prior contact with lepra bacilli

Aims 1) To classify leprosy

2) To assess the prognosis & response to the treatment

3) To assess resistance of the individuals to a leprosy

Response

Early reaction of Fernandez

↓

- In 24-48 hrs erythema & induration – 3-5 days
- Analogous to T.T.
- Less meaningful

Late reaction of Mitsuda

↓

Indurated skin nodules appears in 1-2 weeks – ulcerates, reaches peak in 4 weeks – subside gradually

Not indicate pre-existing DTH

Measures CMI induced by injected lepromin Ag

Laboratory diagnosis

Bacteriological diagnosis is easy in LL but may be difficult in TL.

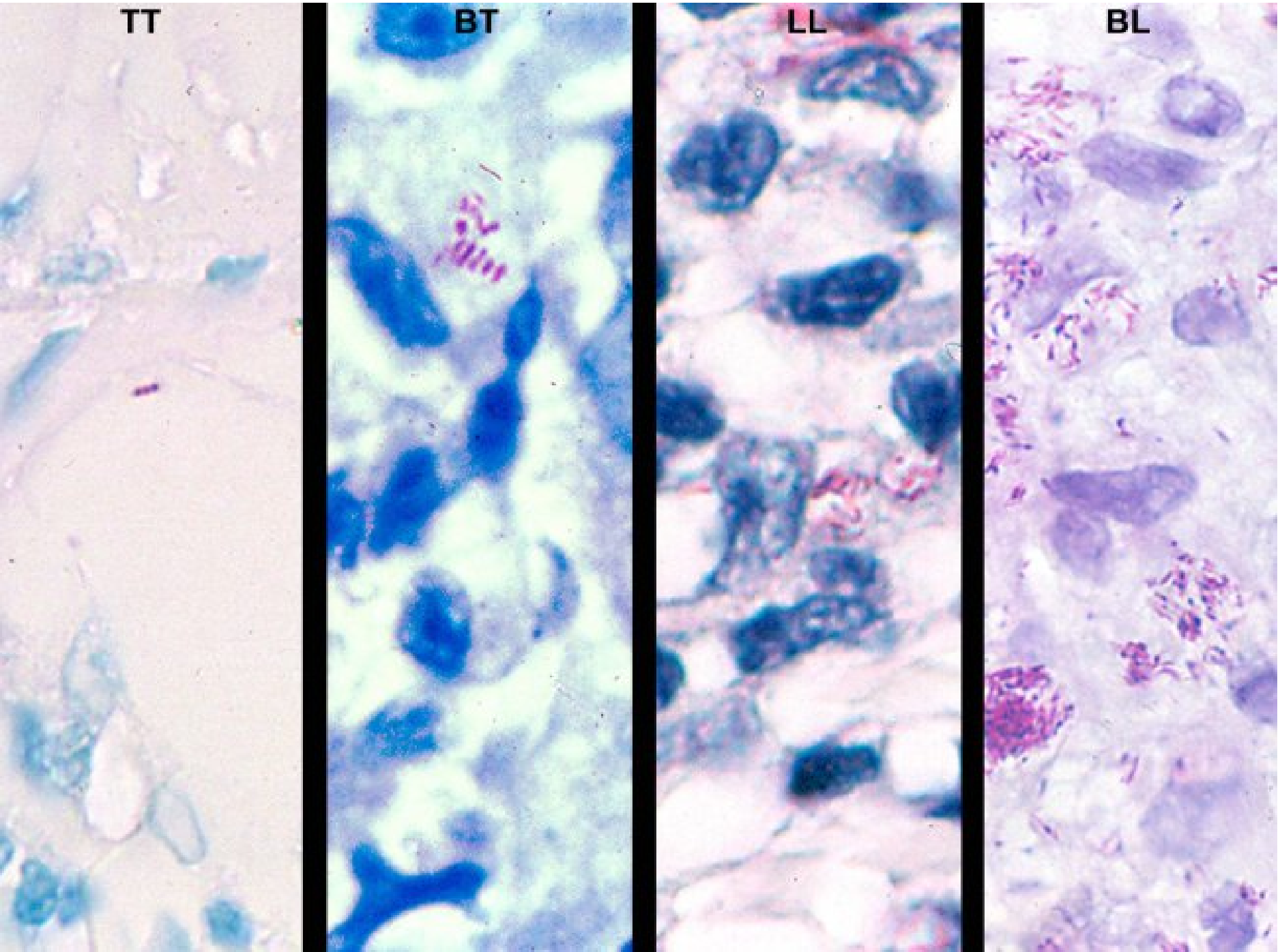
1. Demonstration of AFB in lesions
2. Mouse foot pad inoculation
3. Detection of Ab against M. leprae phenolic glycolipid Ag

1. Skin lesion biopsy and nasal scrapings:

   ***Numerous AFB within foamy macrophages are seen in lepromatous forms, but few or no AFB observed in tuberculoid leprosy.**
   ***Nerve involvement with AFB is pathognomonic**.

2. Lepromin skin test: Positive, confirm the clinical diagnosis of tuberculoid form.

3. In Vivo culture: Foot pads of mice and armadillos.


TT
BT
LL
BL

Grading of the smear

Bacilli	OIF	Grade
1-10	100	1+
1-10	10	2+
1-10	1	3+
10-100	1	4+
10-1000	1	5+
➢1000	1	6+

(or in globi)

❖ Bacteriological index (BI)

Morphological index

Percentage of uniformly stained bacilli out of the total number of bacilli counted.

To judge response to the treatment


Thank You