Phylum *Actinobacteria*

Suborder Corynebacterineae

Genus *Mycobacterium*

Scientific classification

Domain **Bacteria**

Phylum **Actinobacteria**

Class **Actinobacteria**

Order **Actinomycetales**

Family **Mycobacteriaceae**

Genus **Mycobacterium**

Species ***M.tuberculosis***

- Straight or slightly curved rods that sometimes branch or form filaments
- Aerobic and catalase positive
- Filaments readily fragment into rods and coccoid bodies
- Very slow growing on culture media.

Mycobacterial Cell Walls

- Contain waxes with 60 to 90 carbon mycolic acids
- Cell wall surface contains the glycolipid trehalose dimycolate
- cell wall very hydrophobic
- impenetrable by antibiotics
- acid-fast

- basic fuchsin dye not removed by acid alcohol treatment(fig.1).

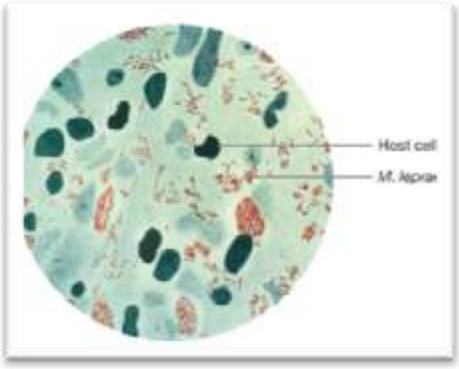

Figure.1 *Mycobacterium* stained with acid fast stain

Important Species of *Mycobacterium*

- *M. bovis* causes tuberculosis in cattle, humans
- *M. tuberculosis* causes tuberculosis in humans
- *M. avium* complex (MAC) causes various diseases
- *M. leprae* causes Leprosy.

Genus Nocardia

- Along with genus *Rhodococcus* make up the family *Nocardiaceae*.
- Develop a substrate mycelium that readily breaks into rods and coccoid elements.
- Some also form an aerial mycelium and conidia(fig.2).

Figure.2 *Nocardia*

Impact of *Nocardia*

- Most are free-living saprophytes.
- Can degrade many molecules e.g., petroleum hydrocarbons, detergents, benzene
- Involved in biodegradation of rubber joints in water and sewage pipes.
- Some are opportunistic pathogens causing nocardiosis
- usually infect lungs; can infect central nervous system

Suborder *Micromonosporineae*

- Only one family, *Micromonosporaceae*
- extensive substrate mycelia
- lack or have rudimentary aerial mycelia
- sporangiospores motile or nonmotile
- found in soil and aquatic habitats (especially freshwater).

Genus *Propionibacterium*

- Found on skin and in digestive tract of animals
- also in dairy products such as cheese
- used in production of Swiss cheese

Most important genus *P. acne* which involved in development of body odor and acne vulgaris.

Suborder *Streptomycineae*

- One family, three genera
- Aerial hyphae that divide in single plane to form chains of 3–50 nonmotile spores
- All have type I cell wall
- G+C DNA content is 69–78%
- Filaments grow by tip extension (fig.3).

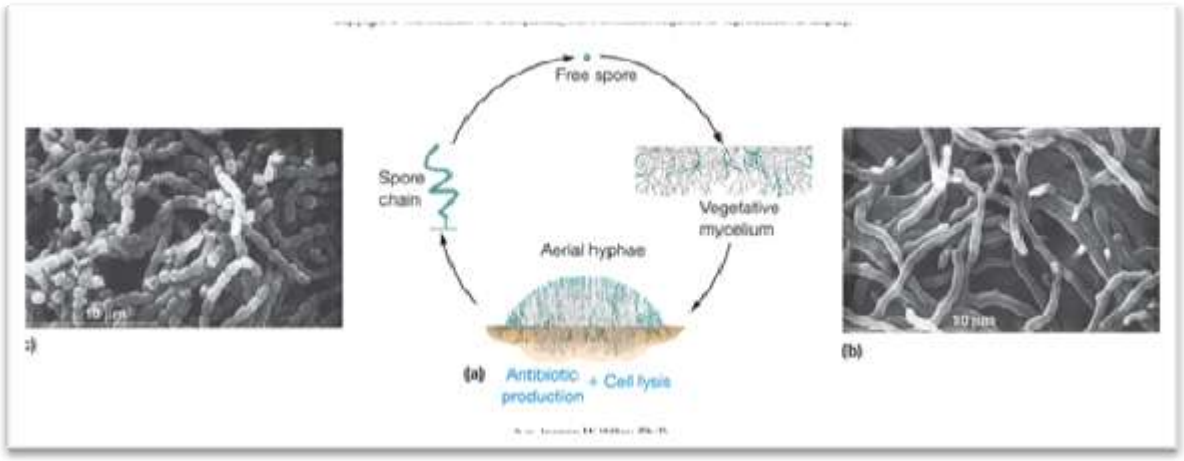

Figure .3 Life cycle and cell morphology of *Streptomycineae*

Genus *Streptomyces*

Scientific classification

Domain Bacteria

Phylum Actinobacteria

Class Actinobacteria

Order Actinomycetales

Family Streptomycetaceae

Genus Streptomyces

- Are 1 to 20% of culturable soil microbiota.
- Produce geosmin.

- volatile substance that is source of moist earth odor
- Important in mineralization process.
- Aerobically degrade many resistant substances (e.g., pectin, lignin, and chitin).
- Produce vast array of antibiotics, other bioactive compounds, and antibiotic resistance genes (table 1).
- Most are nonpathogenic saprophytes.

Table 1 Some products of Streptomycetes

Table 24.3	Examples of Natural Products Made by Streptomycetes	
Microbe	**Natural Product**	**Application**
Streptomyces orientals	Vancomycin	Antibiotic; cell wall inhibitor
S. mediterranei	Rifamycin	Antibiotic: transcription inhibitor
S. rimosus	Tetracycline	Antibiotic: protein synthesis inhibitor
S. venezuelae	Chloramphenicol	Antibiotic: protein synthesis inhibitor
S. clavuligerus	Clavulanic acid	β-lactamase inhibitor
S. nodosis	Amphotericin B	Antifungal
S. noursei	Nystatin	Antifungal
S. peucetius	Daunorubicin, doxorubicin epirubicin	Anticancer
S. verticillus	Bleomycin	Anticancer

Pathogenic Streptomycetes

- usually infect lungs as well as can infect central nervous system.

- ❖ *Streptomyces somaliensis causes* actinomycetoma infection of subcutaneous tissues in humans leads to swelling, abscesses, and bone destruction.

Order *Bifidobacteriales*

One family and ten genera

Most important genera are; *Gardnerella* which found in human genitourinary tract and thought to be major cause of vaginitis and *Bifidobacterium* nonsporing rods that found in mouth and intestinal tract of warm-blooded animals, in sewage, and in insects.

Bifidobacterium bifidus

Scientific classification

Domain Bacteria

Phylum Actinobacteria

Class Actinobacteria

Order Bifidobacteriales

Family Bifidobacteriaceae

Genus Bifidobacterium

Species *B.bifidum*

- ❖ Pioneer colonizer of human intestinal tract
- ❖ Does not appear to be major cause of disease
- ❖ Probiotic agent.