

Phylum *Actinobacteria*

The High G + C Gram-Positive Bacteria were grouped in this phylum; figure 1 demonstrates the phylogenetic position of this phylum.

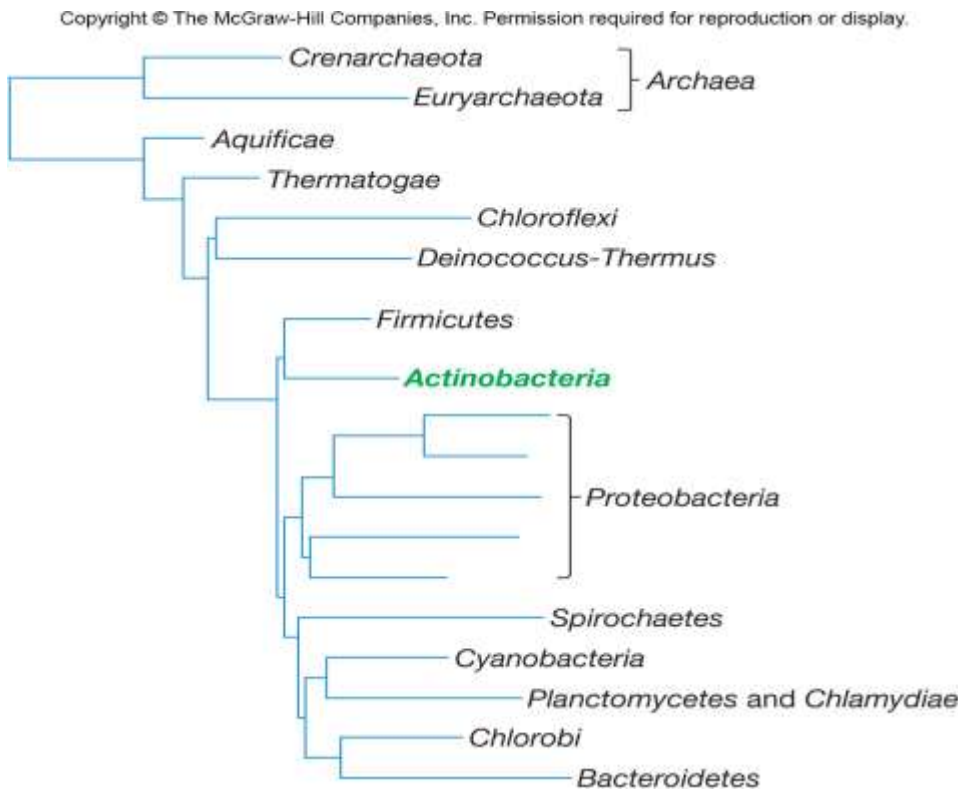


Figure .1 Phylogenetic position of *Actinobacteria*

16S rRNA evidence of this phylum shows 1 class only (*Actinobacteria*), classified into five subclasses distributed to six orders with 14 suborders categorized to 44 families (figure.2) .

Phylum *Actinobacteria* Consists of Actinomycetes and their high G + C Gram-positive relatives.

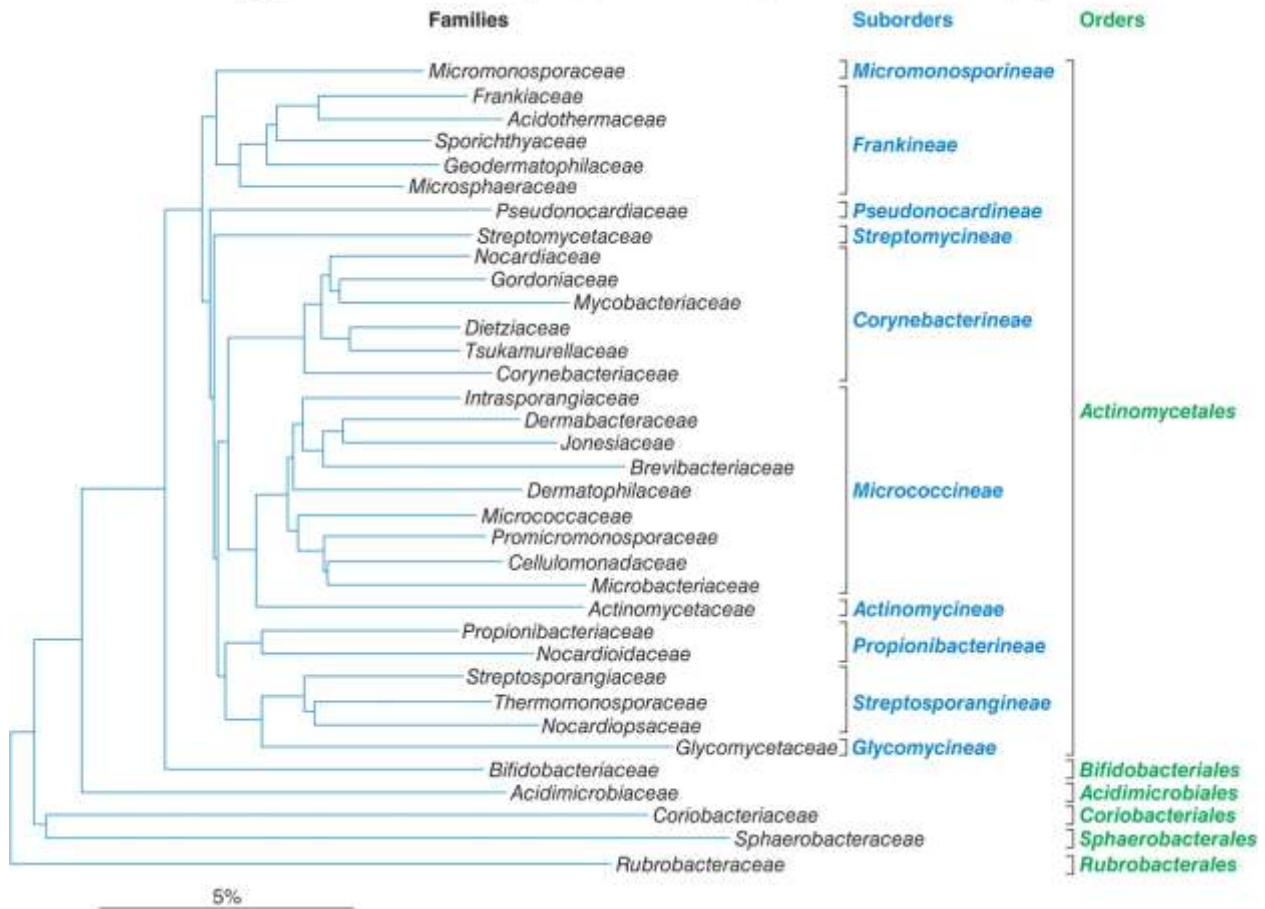


Figure.2 Classification of Actinobacteria

In this lecture we will explain two orders of phylum Actinobacteria :Actinomycetales and Bifidobacteriales

General Properties of the Actinomycetes

- ❖ Gram-positive, aerobic bacteria that produce filamentous cells called hyphae and differentiate into asexual spores.
- ❖ Adapt to climates similar to fungi.
- ❖ Source of most currently used antibiotics.
- ❖ Also produce metabolites that are anticancer, antihelminthic, and immunosuppressive.
- ❖ Complex life cycle.
- ❖ Most are not motile and motility is restricted to flagellated spores

Characteristics Used in Actinomycetes Taxonomy

According to peptidoglycan structure and sugar content other than N-acetylglucosamine and N-acetylmuramic acid, four major cell wall types were characterized.

Life Cycle of Actinomycetes

Involves development of filamentous cells (hyphae) and spores. Hyphae can form branching network. Aerial mycelium can form.

Ecological Significance of Actinomycetes

Widely distributed in soil. Play important role in mineralization of organic matter. Most are free living, but a few are pathogens

***Actinomycetales* order is divided into 10 suborders (fig.2)**

Suborder *Actinomycineae*

This group contains one family *Actinomycetaceae* with five genera

Irregularly shaped, Gram-positive rods, swelling, club shapes, or other deviations from normal rod morphology. Aerobic or facultative metabolism

Genus *Actinomyces*

Scientific classification

Domain Bacteria

Phylum Actinobacteria

Class Actinobacteria

Order Actinomycetales

Family Actinomycetaceae

Genus *Actinomyces*

- ❖ Straight or slightly curved rods and slender filaments with true branching : may have swollen, clubbed, or clavate ends (fig.3).
- ❖ Facultative or obligate aerobes (require CO₂).
- ❖ Peptidoglycan contains lysine and not diaminopimelic acid or glycine.
- ❖ Normal inhabits of oral mucosa.

Cause of lumpy jaw in cattle, ocular infection, actinomycoses, and peridontal disease in humans.

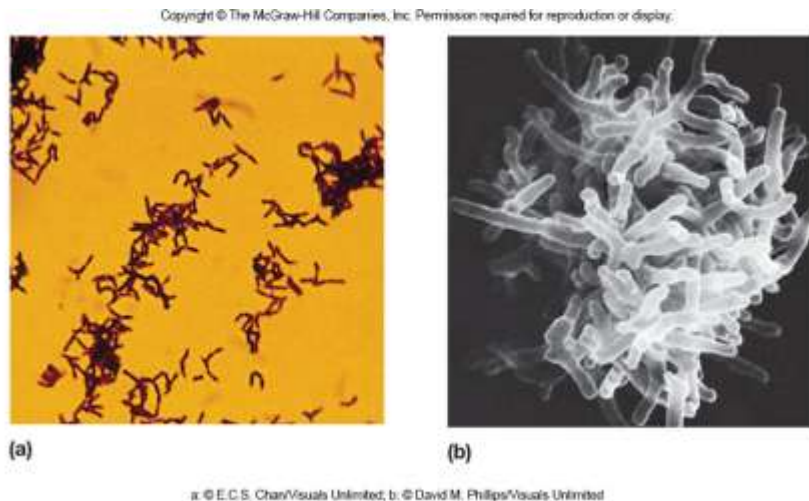


Figure.3 *Actinomyces*

Suborder *Micrococccineae*

Genus *Micrococcus*

Scientific classification

Domain Bacteria

Phylum Actinobacteria

Class Actinobacteria

Order Actinomycetales

Family Micrococcaceae

Genus Micrococcus

- ❖ Aerobic, catalase-positive rods that occur in pairs, tetrads, or irregular clusters (fig.4)
- ❖ Usually non motile
- ❖ Often pigmented yellow, orange, or red
- ❖ Widespread in soil, water, and on human skin
- ❖ Does not undergo morphological differentiation

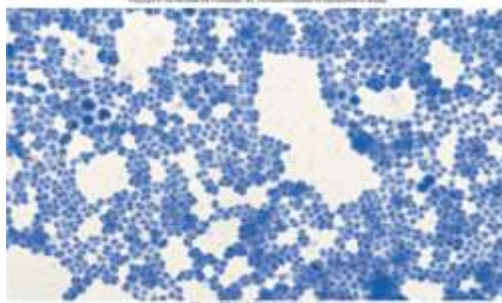


Figure .4 *Micrococcus*

Suborder Corynebacterineae

This suborder has seven families with many known genera such as ; *Corynebacterium* , *Mycobacterium* , *Nocardia*

Genus *Corynebacterium*

Scientific classification

Domain Bacteria

Phylum Actinobacteria

Class Actinobacteria

Order Actinomycetales

Family Corynebacteriaceae

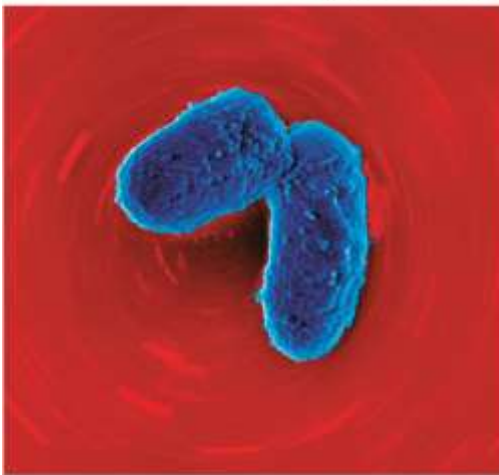
Genus Corynebacterium

Species *C. diphtheriae*

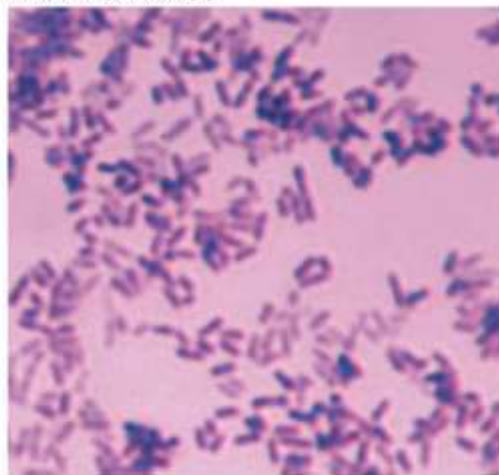
- ❖ Aerobic and facultative, catalase positive . Straight to curved rods with tapered ends and club shaped (fig.5 b).
- ❖ After snapping division bacteria often remain partially attached resulting in palisade arrangements of cells(fig.5 a).
- ❖ Form metachromatic granules.
- ❖ Cell walls have meso-diaminopimelic acid.
- ❖ Some are harmless soil and water saprophytes.
- ❖ Many are animal and human pathogens.

Most common and important genus is ***C. diphtheriae*** which causes diphtheria in human.

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(a)



(b)

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