

# B.SC. III SEMESTER PAPER :: BOT-231

## MICROBIOLOGY

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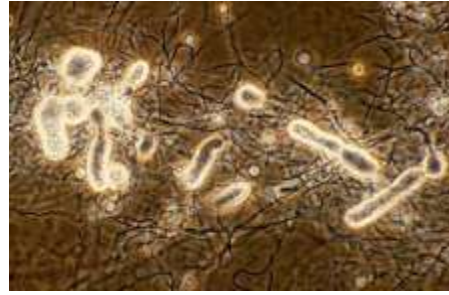
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# ACTINOMYCETES

- Mostly aerobic.
- Gram +ve bacteria.
- Occur abundantly in soil, water, mud, manure, milk & other food products.
- Mostly saprophytes. Some are parasites.
- Parasitic strains cause some serious diseases in plants & animals.
- Primary sources of naturally synthesized antibiotics.  
e.g. *Streptomycetes*

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# DISTRIBUTION



- Found in all types of habitats.

- ❖ Soil, water, decomposing organic matter, etc.

- Some are symbionts (*Frankia sp.*). Some are pathogenic to humans (*Dermatophylus*).

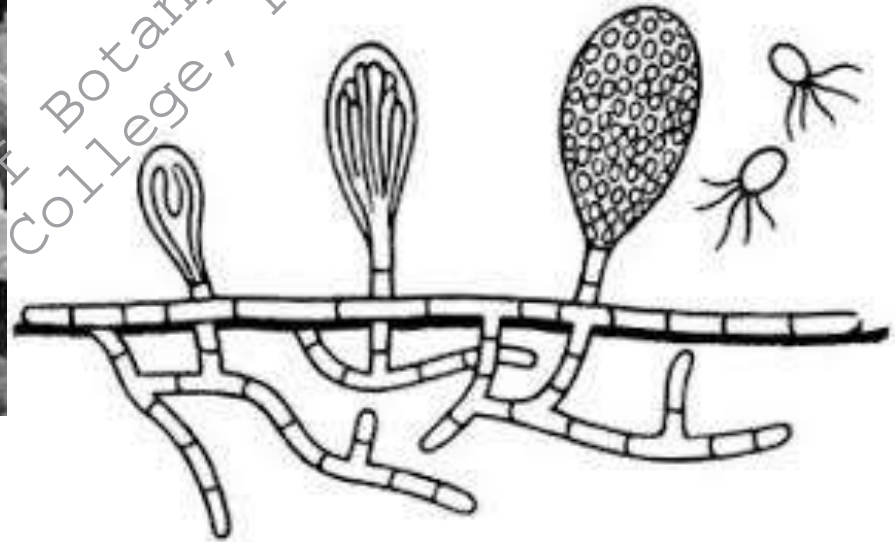
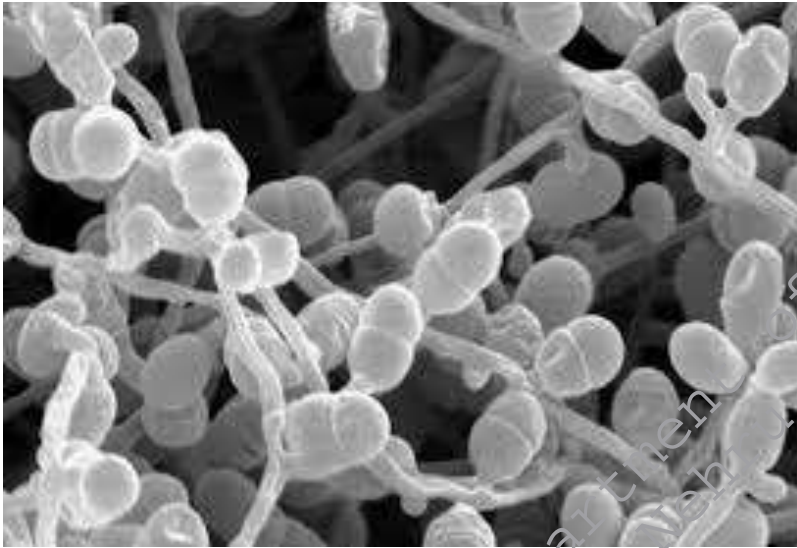


# STRUCTURE

- Greek words: *Actis* = ray; *mykes* = fungus
- Fungus-like bacteria with cylindrical cells which are usually united to form filaments, resembling the mycelium of a true fungus.
- Branched, non-septate, thin.
- In some species, filaments break up into small coccoid cells. They are usually non-motile.
- In *Actinoplanes*, small flagella are present.
- In young filaments, the cytoplasm is homogenous, but at maturity, many vacuoles, fat droplets, granules and few rod-shaped bodies develop in the cytoplasm.
- As in other true bacteria, there is no well-defined nucleus. Instead, many chromatin granules are present.
- At maturity, the cell wall becomes fragile and so, the full-grown filaments break up easily.

# LOCOMOTION

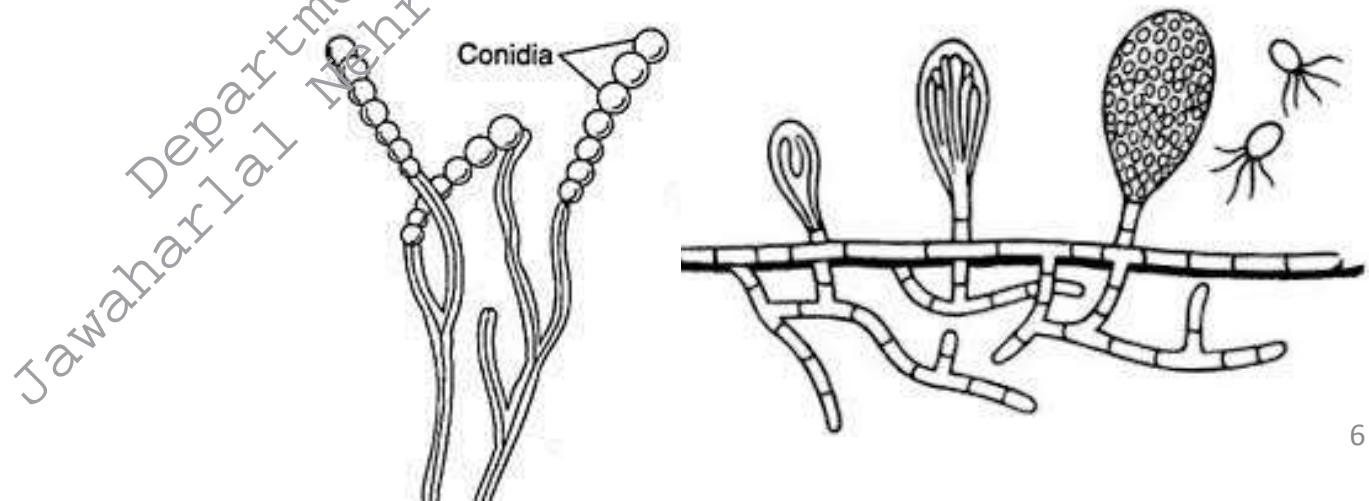
- They are mostly non-motile, except for *Actinoplanes*, which are aquatic and swim about with the help of minute flagella.



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# REPRODUCTION

- They generally multiply by Fragmentation (Asexual method).
- The mycelium breaks up into small coccoid or very rarely, rod-shaped cells, each of which grows into new filaments.
- Some species of Actinomycetes also form asexual reproductive structures in the form of conidia and sporangiospores.
- Conidia develop on conidiophores and sporangiospores develop on sporangiophores, either singly or in long chains.
- Conidia and sporangiospores develop by septa formation at the tip of aerial filaments, usually in response to nutrient deficiency.



# CLASSIFICATION

- Taxonomic classification of Actinomycetes has been done on the basis of morphology, arrangement of spores, cell-wall chemistry, types of sugar present in the cell extract and the heat resistance of the spores.
- The single order Actinomycetales has 8 families.

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# OTHER SIGNIFICANT FEATURES

- Symbiotic species, *Frankia* sp. show symbiosis with a variety of non-leguminous plants, like *Casuarina* (Casuarinaceae), *Rubus* and *Pursia* (Rosaceae).

## ❖ Human Diseases

- Tuberculosis ..... *Mycobacterium tuberculosis*
- Leprosy ..... *Mycobacterium leprae*
- Diphtheria ..... *Corynebacterium diphtheriae*

## Actinomycetes Pathogen

## ❖ Animal Diseases

- TB of Cattle ..... *Mycobacterium bovis*
- TB of Domestic Fowls ..... *Mycobacterium avium* (other birds also)

## Actinomycetes Pathogen

## ❖ Plant Diseases

- Tondu disease of Wheat ..... *Corynebacterium titrici*
- Scab of Potato ..... *Actinomyces scabies*

## Actinomycetes Pathogen



# MYCOPLASMA

- Smallest known aerobic prokaryotes without a cell wall.
- First discovered by Louis Pasteur (1843), while studying Pneumonia of Cattle.
- They were designated as PPLO (Pleuropneumonia-like Organisms).  
*(However, Pasteur couldn't isolate them in pure culture on standard nutrient media & observe them under light microscope. In 1898, two French microbiologists – **Nocard & Roux** were successful in obtaining pure culture of them in media-containing serum. They observed that these microorganisms could produce disease when inoculated into healthy cattle.)*
- Gram –ve, usually non-motile, free-living, parasitic & saprophytic.
- Sensitive to desiccation.
- Do not grow at low pH.
- Heat sensitive (<50°C)

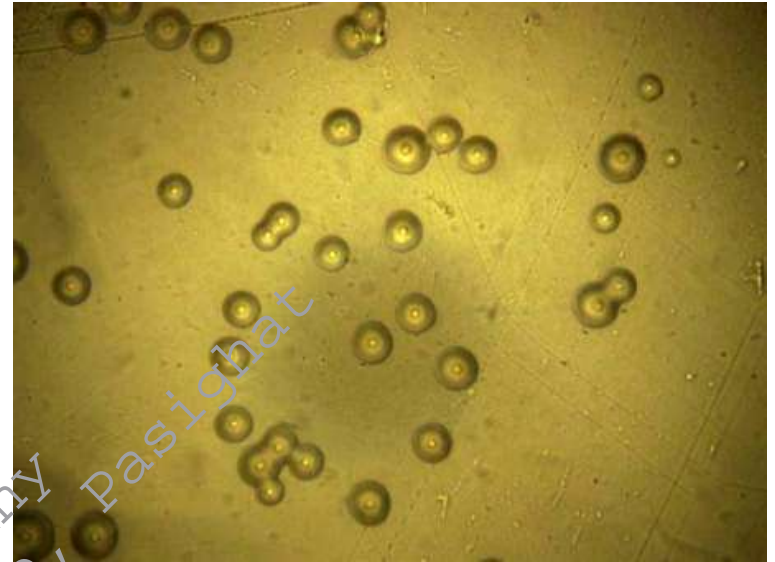
# DISTRIBUTION

- Frequent contaminants in tissue cultures rich in organic matter.
- Abundant in unsterilized areas rich in organic matters.
- Also found in hot-water springs & other thermal environments. They occur in soil, sewage water, different substrates and in humans, animals and plants.
- Mostly they are pathogens and parasites.

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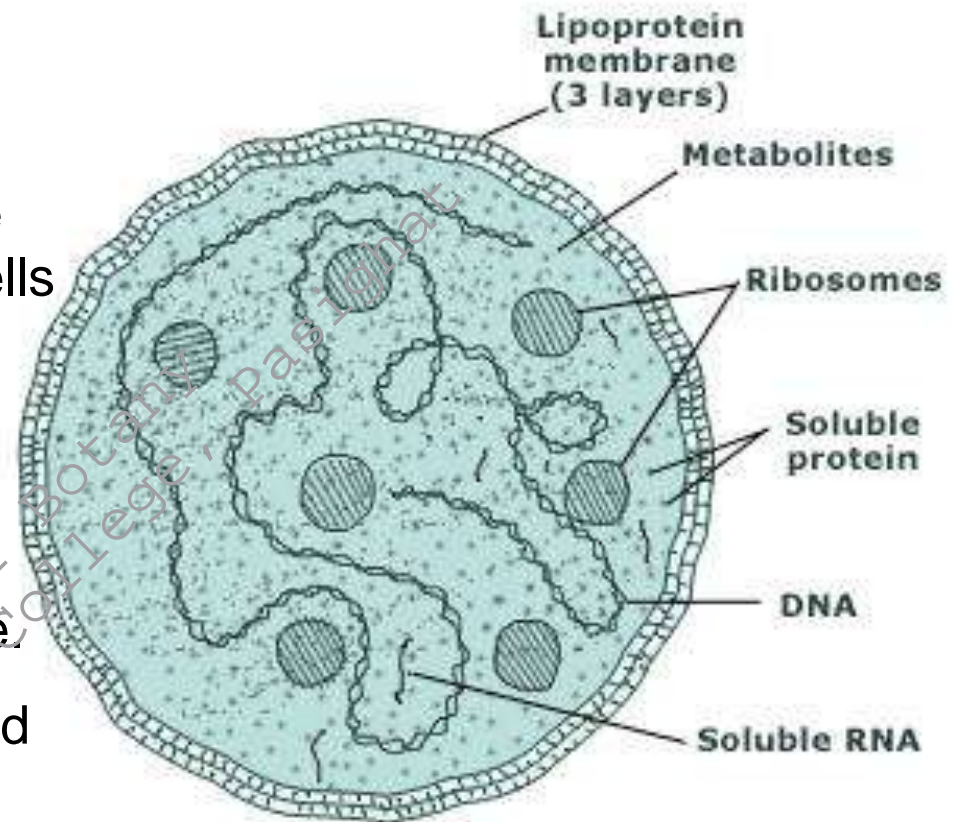
# STRUCTURE

- Unicellular, prokaryotic & non-motile. On media, forms fried-egg shaped colonies.
- Under microscope, they appear small, unicellular bodies and some of them form branched filaments.
- Because of their particularly small size, they can pass through bacterial filters. They can also grow in a medium which contains no living tissues. Because of these two characteristics, Mycoplasmas are considered to be intermediate between bacteria and viruses.



# STRUCTURE

- A true cell wall is absent. This makes these organisms highly elastic and readily deformable. Hence, Mycoplasmas do not have any definite regular shape. The cells may be coccoid, granular, pear-shaped, cluster-like, ring-like or filamentous.
- Cells are covered by a single lipoprotein cytoplasmic membrane.
- Cytoplasm contains ribosomes and nucleoplasm-like structures.
- Resistent to antibiotics acting on cell walls.



# REPRODUCTION

- Mostly by Budding or Binary Fission within the host cell.
- A single cell divides into very minute cells, called *Elementary Bodies*, which are found in the mature cells of host plants and animals.
- Some species forms long filaments and chain of minute spherical conidia. These conidia are initially very small and increase in size later after liberation.

# CLASSIFICATION

❖ On the basis of nutritional requirements, morphology & habitat preferences: 4 genera

- 1. *Mycoplasma*:** Require cholesterol for growth. Parasitic – infects mucous membranes & joints of humans & animals.
- 2. *Acholeplasma*:** Do not require cholesterol for growth. Free-living saprophytes, heat-sensitive. Cannot grow above 45°C.
- 3. *Spiroplasma*:** Bounded by 3-layered membrane. Require cholesterol for growth. Gram +ve, motile, facultative anaerobes.
- 4. *Thermoplasma*:** Heat loving. Do not require cholesterol for growth. Strictly anaerobic, acidophilic. Can grow above 60°C temp.

# DISEASES CAUSED BY MYCOPLASMA

- ❖ In plants, they cause diseases in sieve tubes, upsetting the hormonal balance. Due to infection, the flowers may assume the shape of foliage leaves, because **Anthocyanin** formation is inhibited. It may also cause wilting of leaves, forming a condition called “*Witch’s Broom*.”
- ❖ In human, they cause a disease called PAP (Primary Atypical Pneumonia). PAP has an incubation period of 9–21 days and the disease may last upto 3 weeks, causing headache, cough etc.
- ❖ In animals, they infect the mouth, pharynx and sometimes, urogenital tract. Most common species causing Pneumonia in the upper respiratory tract of animals & humans is *Mycoplasma pneumoniae*.

