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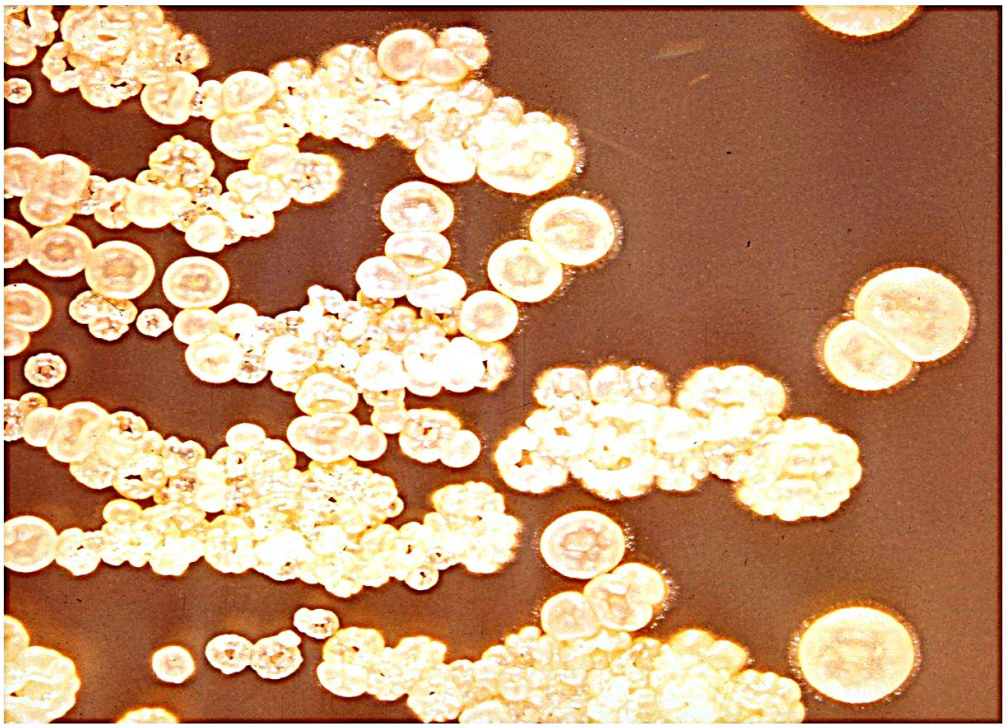
Actinomycetes

For Botany
B.Sc. Part-3 (H)
Paper - VI
Group - A.

- Actinomycetes are prokaryotes, Gram positive bacteria with high GC content, mostly inhabiting soil.
- They produce mycelial structure just like fungi. When grown on agar media, they produce mycelium which is partly aerial and partly submerged in the medium, formed from much branched but thin hyphae of 1 µm or less in diameter with a maximum of 2 µm.
- Most members also produce single-celled spores (resembling fungal colonies). In liquid media also, they form individual colonies and do not make the medium turbid like other bacteria. The spores are formed either externally as conidia or in few cases inside sporangia as sporangiospores.
- The hyphae usually divide into long cells with more than one nucleoid in them. The spores are easily detached and dispersed.
- Many actinomycetes produce pigments of various shades.



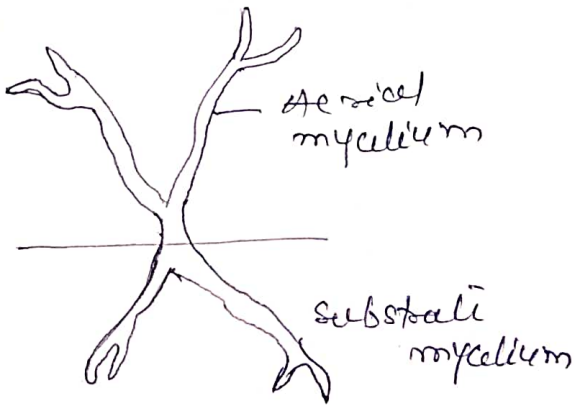
- Thus, the actinomycetes were earlier placed under fungi (because of mycelial structure), but are now grouped with eubacteria because of their prokaryotic nature and the cell wall composition.

- The cell wall composition is similar to Gram positive bacteria i.e., consisting of several layers of peptidoglycan or murein (made up of sugar, amino sugar and amino acids)

- Majority of clinically useful antibiotics are produced by actinomycetes. The genus Streptomyces is known to produce a large number of antibiotics (it is the type genus of the family streptomycetaceae, with over 500 species)

- Six main groups of Actinomycetes have been recognised –

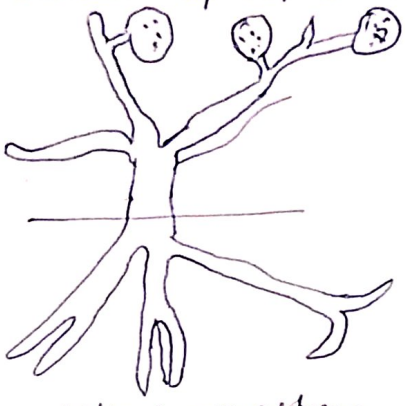
Nocardioforms: they develop substrate mycelium, in addition to aerial mycelium, which easily breaks up into individual cells.
They are mostly saprophytes in soil and water, but Nocardia asteroides causes a lung disease in human and animals of low resistance.



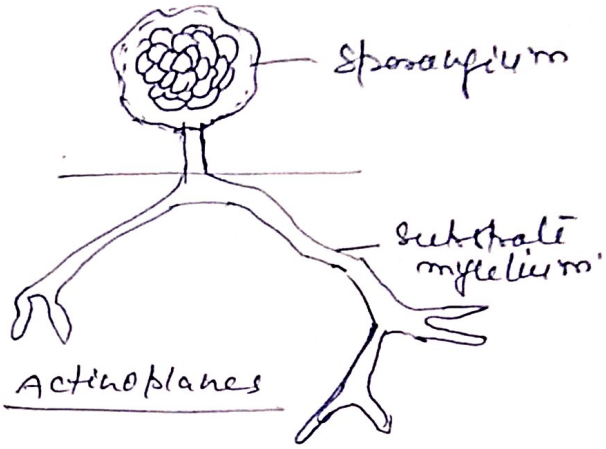
Nocardia sp.

Actinomycetes with multilocular sporangia: It includes Frankia and Geodermatophilus. The hypha divides in two planes to produce clusters of spores. Frankia form root nodules and live in symbiosis with actinorhizal plants, similar to the Rhizobium in the root nodules of legumes.

Actinoplanetes: In this group extensive substrate mycelia are formed but aerial mycelium is absent or rudimentary, with sporangiospores arising above the agar surface. The spores are arranged in coils or parallel rows in the sporangium (e.g., Actinoplanes) Micromonospora produces single sporangiospores on branched sporophores.

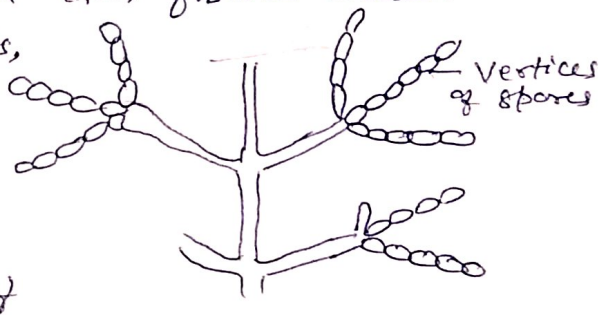


Micromonospora.



Actinoplanes

Streptomyces and related forms: Streptomyces comprises a large genus with over 500 species. They are aerobic, produce aerial and substrate mycelia and chains of non-motile spores (conidia) enclosed in a thin fibrous sheath. They are mainly soil inhabitants, and occur in large numbers, especially in tropical soils, as they can decompose a large variety of organic substrates and also withstand desiccation. The characteristics earthy smell that soil gives out after a shower is due to volatile substance, geosmin etc, that they produce.



Streptomyces

Streptomycetes produce over two-thirds of clinically useful antibiotics of natural origin, e.g., neomycin, cyperomycin, griseomycin, bottromycins, chloramphenicol, and not very commonly used Streptomycin.