SOME IMPORTANT POINTS

(1) *Mycolic acid* *- Present in all filamentous bacteria.*

(2) Bacteroids - Symbiotic bacteria which are present in root nodules of plants are known as bacterioids

(3) *Pus bacteria* –

- Staphylococcus (produces yellow pus)
- Pseudomonas (Produces blue pus)

(4) nif gene - "Nitrogenase Inducing factor"

- *NIF* gene is present in all nitrogen fixing bacteria.

(5) *Bacillus thuingiensis -* This bacteria is relates with "Bt" toxin.

ACTINOYCES- FILAMENTOUS BACTER IA

(A) They were previously included in Fungi and were known as Ray fungi, because structurally they are similar to fungi,

(B)The body of fungi is known as mycelium and the structure of actinomycetes is also similar to mycelium. T here fore they were included in fungi, But fungi are eukaryotic while actinomycetes areprokaryotic.So these are now placed in kingdom Monera.

(C) Now their new name is Mycobacteria, Mycelial bacteria or Filamentous bacteria.
(D) Filmentous bacteria are found more in soil,
(E) These bacteria have economic importance because they are used to pre pare antibotics.
(F) Filamentous bacteria reproduce by means of conidia.

Conidia –

(a) Filamentous bacteria reproduce by means of conidia.
(b) Conidia are spore like structure and are formed in basipetal manner in chains the apex of conidiophores.
(c) Echcondium gives rise to a new bacterium.

eg. Strephomyces, Mycobacterium, Beggiato, Frankia

BLUE GREEN ALGAE (B.G.A)

(A) According to **Two kingdom** system B.G.A was included in class **Cyanophyceae** or **Myxophyceae** of Algae. But now it is included in Kingdom Monera, because it is a prokaryotic cell.

(B) B.G.A. is now known as **cyanobacteria.** This name cyanobacteria was suggested by **ICNB [International Code of Nomenclature for Bacteria]** in 1978.

(C) Cyanobacteria are photosynthetic prokaryotes. Some eubacteria also have photosynthesis process but there is some differences in the photosynthesis of cyanobacteria and eubacteria.
(D) Cynobacteria were the first organisms that produced O_2 on our earth.

Cyanobacteria	Eubacteria
(1) they have membrane bound structure thylakoids for photosynthesis. Phtosynthetic pigments are present on the surface of these thylakoids. (2) In it, photosynthesis is oxygenic i.e. O_2 is evolved during photosynthesis. (3) They have following pigments. ● Chlrophyll 'a' - green ● Carotenoids - yellow ● - Phycoyanin - blue ● C - Phcoerythrin - red	→ Photosynthetic pigments are scattered in groups in the cytoplasm, these groups are known as chromatophore. Chromtophores re membranous structure. → In it, photosynthesis is non - oxygenic i.e. O_2 is not evolved during photosynthesis. → They have following pigments : ● Bcteiocholorophyll 'a' and bacteriochlorophyll - b (In purple bacteria) ● Bacteriochlorophyll- a and bateriovіridin - (In green bacteria)

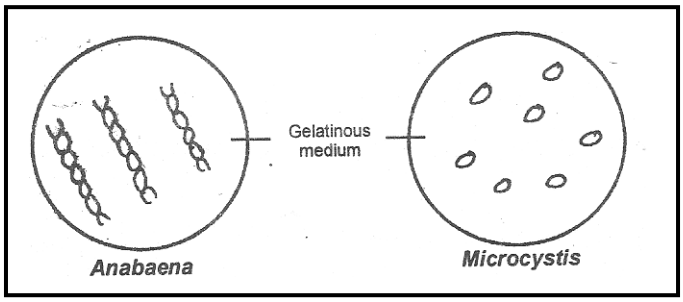
Note : Cynobacteria is not always of blue-green colour. e.g. Trichodesmium is red coloured. The red colour of wter of red sea is due to this algae.

Different from of BGA or Cyanobacteria :

(A) Unicelluar : Some B.G.A are unicellular
eg. *Spirulina*



(B) Colonial : Some B.G.A. are found in colony. i.e. cell colonies.
e.g. Anabaena, Microcystis



(C) Filmentous : Some B.G.A re filamentous. Their are many cells arranged in a row in heir body. The filament of BGA is known as **trichome.**
eg. *Oscillatoria*



Note : Spirulina *is an edible BGA* because it has very large amount of proteins. It can be grown artificially in water tanks. It is used as a fodder for cattle.

Structure of B.G.A. :

(A) The structure of B.G.A. is **similar to Gram (-ve) eubacteria.**

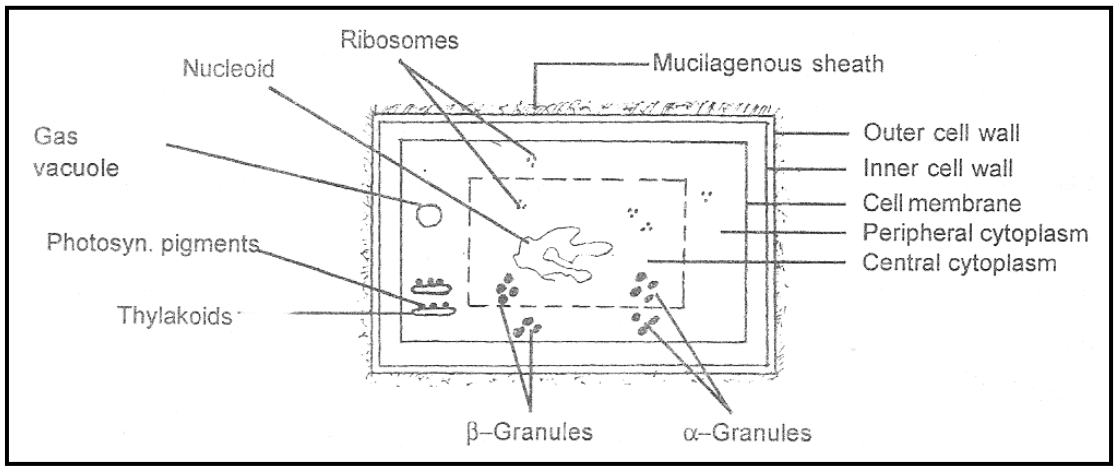
(B) B.G.A is surrounded by a mucilagenous sheath. This sheath is made up of mucopolysaccarides. [Pectic acid]. The cell was of B.G.A. is also bilayered. Outer wall is made up of lipopolysaccharides and the inner wall is made up of peptidoglycan.

(C) The cell membrane of B.G.A. is also made up of lipoproteins like that of eubacteria.

The cytoplasm of B.G.A. is divided into two parts

(a) Peripheral cytoplasm -
It is known as **chromoplasm**. In this part gas vacuoles and photosynthetic thylakoids are found Phtosynthetic pigments are present on the surface of these thylakoids.

(b) Central cytoplasm -
This is known as **centroplasm.** In this region nucleoid is present. Ribosomes are of 70s type, and are scattered in both chromoplasm and centroplasm.



Note :

(1) The cytoplasm of prokaryotes lacks membrane bound cell organelles but exceptionally in B.G.. two membrane bound structure are present.
(i) Gas vacuole - It provides the buoyancy to the B.G. algae in water.
(ii) Thylakoids - Photosynthetic pigments are present on its surface.

(2) Exceptionally gas vacuoles are also present in purple and green photosynthetic bacteria.

Stored food -
B.G.A. stores its food in the form of α - granules and β -granuels.

- α **granuels -** They are made up of cyanophycean starch. It is structurally similar to glycogen.
- β - **granules -** They are made up of fat droplets.

Oscillatoria can survive in hot water springs. The temperature of this water is about 80^0C. *Oscillatoria* have capacity to tolerate high temperature because of -
Homopolar bonds in proteins - Proteins are denatures at high temperature and the living being will die. But homopolar bonds are present in the proteins of cytoplasm of *Oscillatoria,* which can not break easily and the bonds are very much in number so they can tolerate high temperature.

Nitrogen fixation :

(A) Most of the B.G.A. can perform Nitrogen fixation. They convers atmospheric nitrogen in to nitrogenous compounds like amino acids, nitrates. These nitrates increases the fertility of soil. hence B.G.A. improves the fertility of soil by nitrogen fixation.

(B) B.G.A. fixes nitrogen in **two form -**

Symbiotic form and Asymbiotic or free living form

Symbiotic form	Free living from
eg. ***Anabaena*** & ***Nostoc*** These B.G.A. remains in symbiotic association with many plants and performs nitrogen fixation : **for eg :** ☛ In thallus of ***Anthoceros*** ☛ In the leaves of ***Azolla*** ☛ In the coralloid roots of ***Cycas*** ☛ In stem of ***Gunnera*** ☛ In root nudules of ***Trifolium***	eg. ***Anabaena, Nostoc & Aulosira*** Some B.G.A. are found free living in water and soil and perform nitrogen fixation. ***Aulosira*** $\rightarrow$ This B.G.A. is found in plenty in paddy fields. It germinates in water. This B.G.A. performs nitrogen fixation due to which the production of rice is increases. ***Azolla*** $\rightarrow$ If Azolla is grown with rice, than the production increases up to 50% [because ***Anabaena*** are found in the leaves of ***Azolla***]

IMPORTANT POINTS

1. A special type of cell is found for nitrogen fixation in BGA which is known as **heterocyst.** Heterocysts is thick walled, non green cell.

2. Heterocysts don't perform the phtosynthesis like other vegetative cells.

3. **Nitrogenase enzyme** is necessary for nitrogen fixation For the synthesis of this enzyme, their is a special type of gene present in BGA which is known as nif - gene [nif = nitrogenase inducing factor]. This gene stimulates the production of nitrogenase enzyme.

- The discovery of nitrogen fixation in BGA was done by an Indian scientist - P.K. De
- Detailed study of N_2 - fixation - Prof. R.N. Singh (Indian)

Reproduction :-

In BGA reproduction is done by two main processes
(1) Vegetative (2) Asexual

(1) Vegetative Reproduction :

(i) Binary fission :

This is the most common method of reproduction in prokaryotes. By this process only unicellular prokaryotes can reproduce.
eg. *Spirulina*

(ii) Fragmentation :

Filamentous prokaryotes, reproduce by this process. AT the time of reproduction, some cells become thick walled, which are known as harmocyst (**harmogonia)**. Due to the formation of harmogania, the filament gets breaked and each part will grown into a new filament.
eg. *Oscillatoria, Nostoc, Anabaena*

(2) Asexual Reproduction :

It is method of protection from unfavourable conditions.

Note : In B.G.A. genetic recombination first discovered by H.D. kumar

WATER BLOOM :

"Excessive growth of plants in water, that pollute the water"

(A) It mainly develops due to BGA

eg. *Anabaena flos-aquae,Microcytis aeruginosa, Aphanizomenon flos-aquae*

(B) GBA grows rapidly in water and secretes toxic substance. These toxic substances are known as **death factor.** Death factor is the main cause of death in aquatic animals. It also gives toxicity and bad odour to the water.

ECONOMIC IMPORTANCE OF BGA

Useful activities :

(1) They provides fertility to soil by nitrogen fixation.

eg. *Nostoc, Anabaena*

(2) The most proteineous food for animals -

eg. *Spirulina*

(3) It gives fertility to sterile alkaline soil and usar soil. BGA secretes an acidic chemical which decreases the alkalinity of soil

eg. *Nostoc comune, Scytonema ocellatum, Aulosira fertilissima*

(4) Some BGA are used as green manure

eg. *Anabaena, Spirulina*

(5) Some BGA secrete toxin, which inhibits the growth of mosquito larva in water.

eg. *Oscillatoria, Annabaena, Aulosira*

Harmful activities :

(1) Water bloom

(2) BGA that grow in water tank, pollute the water.

eg. *Oscillatoria*

SOME IMPORTANT POINTS

- Cyanoacteria re Gram (-ve) oxygenic photosynthesizing organisms. It is believed that origin of O_2 on earth is due to cyanobacteria.
- Maximum cyanobacteria are non motile but some filamentous cyanobacteria show gliding and oscillatory movement.

eg.*Oscillatoria show oscillatory movement*

- ***Rivularia & Scytonema*** develop slipperyness at wet places.

RCHAEBACTERI

"Group of ancient bacteria"

1. Evolutionary they are primitive. They were the first to be born on our planet and they are present nowdays with their primitive characters. They are the **"Oldest living fossils".**

2. They are different from eubacteria in many ways.

3. All archaebacteria re **bligate anaerobes.**

4. Thermococcus, methanococcus and methanobacteriaum exemplify archaebacteria that contain protein homologous to eukryotic core histones.

5. Their cell wall is not made up of peptidoglycan like that of eubacteria. Their cell wall is made up of complex polysacchrides and complex polypeptide.

6. Their cell membrane is not a unit membrane, while in eubacteria the cell membrane is unit membrane.
Note : Cell membrane of archaebacteria is composed of a single layer of branched chain molecules of lipids while the lipids present in the cell membrane of eubacteria are straight chain molecules. Due to the branched chain structure, archaebacteria have more resistance ability as compared to eubacteria. i.e. Archaebacteria are not effected by high temperature, high salinity, radiations and change in pH. They are resistance to all these. So that Archaebacteria are found in highly unfavourable habitat.

7. In archaebacteria sequence of nucleotide in 16 s - r RNA is differ from other prokaryote.

Archaebacteria includes following bacteria

1. Methanogens :

"Methane producing bacteria"

(i) These bacteria convert CO_2 of swampy area (marshy) into methane (CH_4)

eg. *Methanobaterium, methanococcus, methanomicrobium.*

(ii) These bacteria convert the organic substance (cellulose) present in cow dung into methane by fermentation (Gobar gas fermenter).

eg. *Methanobacterium, Methanococcus, Methanomicrobium*

(iii) An archaebacteria is found in the rumen of cattle, where it digests the cellulose by fermentation and convert it into methane.

eg. *Rumenococus*

2. Halophiles :

These archaebacteria are found in highly saline areas.

eg. *Halobacterium*
Halococcus

Halophiles surrounded by purple membrane. This membrane absorbs the bright light and **directly forms ATP.** i.e. They cannot prepare food (carbohydrates) like eubacteria. Instead of it they directly form ATP. Therefore Helophiles are **non photosynthetic.**

3. Thermo acidophiles :

(A) These archaebacteria are found at those places where temperature is approx 80^0C and medium is cidic [pH = 2]

(B) They are found in **hot sulphur springs.** These can also survive at 100^0C temperature.

(C) They oxidise sulphur to H_2SO_4 and obtain energy. This is used to prepare food. Due to conversion of sulphur to H_2SO_4 the medium (water) becomes acidic in nature.

(D) These are chemoautorophs.

(E) Hot water sulphur springs re found in the Himalayan region.

(F) Exceptionally these archaebacteria are **obligate aerobes.**

eg. *Thermus, Sulpholobus, Thermoplasma*

RICKETTISIA

(A) They are also called as bacteria because they are similar to eubacterias in structure.

(B) These are Intracellular.

(C) These are non motile.

Diseases caused by rickettisia in humans :

(1) Typhus fever - **Rickettsia prowazekii**

(2) Rocky mountain spotted fever - **R.rickettsii**

Note : (1) Barophilic prokaryotes - Prokaryotes which grow and multiple in very deep marine sediments.

(2) Root knot disease of vegetable is caused by ***Meloidogyne javanica.***