**Cyanobacteria**

are arguably the most successful group of microorganisms on the earth.

Due to their ability to release the oxygen during photosynthesis, makes it’s a source of oxygen on earth.

The vast majority of cyanobacteria are aerobic photoautotrophs. They only need water, carbon dioxide, inorganic substances, and light to sustain their life processes. In these organisms, photosynthesis is the primary mode of energy metabolism.

Cyanobacteria were the first lifeform on planet that absorb sunlight or water produce energy and oxygen with the help of photosynthesis.

**Habitat of Cyanobacteria**

1. Cosmopolitan
2. Found in moist rocks or soil and deserts, volcanoes.
3. Found in seas, lakes, recovers, ponds, and springs.
4. They grow on snow or hot springs
5. They grow in acidic and alkaline environments.
6. They grow in stagnant or flowing, shallow or deep, and fresh salt waters.
7. They grow as endophytes, as constituents of lichens, and as endosymbionts in diverse animals.
8. They have High osmotic pressure.

**Reproduction in Cyanobacteria**

Cyanobacteria reproduce by two methods only- **vegetative and asexual reproduction.** **Vegetative reproduction is generally occur in four ways:**

1. Binary fission
2. Fragmentation
3. Hormogonia
4. Asexual reproduction

**1. Vegetative reproduction**

Vegetative reproduction is generally in four ways:

1. **Binary fission:** A cell divides into two in roughly equal halves. Nucleus divides mitotically first and then the cytoplasm. Each grows to original form. This is the most common type.
2. **Fragmentation:** Filaments break into small pieces. Each piece grows into new filament. Mostly occurs in colonial forms
3. **Hormogonia:** Trichomes separate within the sheath into short segments known as hormogonia or hormogones. Each segment develops into a new filament (such as in **Nostoc and Oscillatoria).**
4. **Asexual reproduction:** Cyanophyceae reproduce through non-motile, asexual spores, which are as follows:
   * **Akinetes (resting spore)**
     + Are found close to heterocysts.
     + Cells increase in size and a thick layer is formed around them.
     + Under favourable conditions, new filaments are formed from them, e.g. Cylindrospermum
   * **Nannocytes**
     + They are present in Merismopedia, and found in non-filamentous algae such as Microcystis.
     + Cell division occurs repeatedly, resulting in the formation of many cells (naked protoplasts) within the parent cell.
     + They are much smaller than vegetative cells. They germinate in their natural environment, forming new typical colonies.
   * **Spores**
     + Sporulation is the most common type of asexual reproduction. Spores are of two types:-
     + **Baeocytes (endospores):**
       - They are created by coccoid (spherical) cyanobacteria.
       - The protoplasm splits numerous times into distinct planes, with no development between each division.
       - These cells are smaller than the original ones.
       - These are very similar to bacterial endospores.
       - In Dermocarpella, they emerge from an apical pore after secreting a wall around it and grow to become mature organisms.
     + **Exospore:**
       - Exospores are formed by cutting off the spores at the far end of the protoplast during transverse division. Chamaesiphon is an example of a thin membrane that surrounds each spore.

Reclamation of alkaline soil.

Nitrogen fixation- Cyanobacteria have heterocyst, help in nitrogen fixation.

Oxygenic photosynthesis- Release O2 due to their photosynthetic activity

Pollution indicator\_ Oscillataria and few other can be used as pollution indicator.

denitrification is a process by which the nitrogen compound is released back into the atmosphere by converting the nitrate (NO3-) into the gaseous nitrogen. so they are released back into the atmosphere so that is called as the denitrification step now when this step is being carried out so this step particular step is being carried out during the absence of oxygen so this step this particular step is being carried out during the absence of oxygen by the theo bacillus species such as clostridium bacteria which is present in the soil so in this process the genus of the gram negative bacteria degrades nitrate compounds present in the soil and aquatic system into the nitric nitrous oxide that is n2o and nitrogen gas which are even actually released into the atmosphere so this is the process of denitrification now in this particular process there are a large number of microorganisms that are involved so therefore it is also called so this process is also called as the microbial process this process is also called as the microbial process this biogeochemical process is one of the main responses to changes in the oxygen concentration in the environment so this particular process is responsible for the changes in the oxygen concentration in the environment now denitrification is a universal process for both the terrestrial it is responsible for both the terrestrial and the aquatic ecosystems which occurs naturally under the extreme concentration in managed ecosystem that is marine fresh water environments in tropical and temperate soils in wastewater treatment plants in manure stores etc so this is about the denitrification now how does this process goes on so as you can see this particular diagram so first of all i have told you that denitrification is the last step of the nitric nitrogen fixation cycle it is naturally occurring microbially mediated process where nitrate is used in the form of energy for the tree denitrifiers so as you can see in this particular process the nitrogen fixation here is the there are nitrogen fixing bacteria which convert the nitrogen which is present in the soil into the nh3 further there are nitrifying bacterias which converts it into no3 and then there are denitrification bacteria which gets converted into n2 so if i see the equation for this then in this particular process soil bacteria converts plant available soil nitrate that is no3 minus into nitrogen gas that is into that was that a loss from the soil so denitrification produces several gases that is the nitric oxide nitrous oxide and dinitrogen so this is the equation for the denitrification process that there is a nitrate then there's a nitric oxide after that nitrous oxide and finally the nitrogen gas has been released into the atmosphere now where does this denitrification process occurs so this particular process is a microbial process as i have told you in the first slide as well this is a microbial process of removing the valuable nitrogen from the soil and releasing the greenhouse gases such as the nitrous oxide and trophophoric pollutant which is nitric oxide so the biological cycle of the denitrification involves a cascade of enzymes which reduces nitrate to the dinitrogen that is the end so this is what is the process where where the denitrification process occurs now why why this process is occurring so why the denitrification process is important and why it is occurring so when the oxygen supply in the soil becomes limited there are a variety of bacteria which uses the oxygen instead of nitrate for the respiration so die nitrification most commonly occurs in wet moist or the soil flooded with water where the supply of oxygen for respiration is reduced or limited so there are some fun fungi that can denitrify but they are also considered insignificant so that is why the process of denitrification is important because oxygen supply becomes limited and there are variety of bacteria which uses the oxygen instead of nitrate for the respiration so it commonly occurs where it commonly occurs in the wet moist or soil flooded with water where the supply of oxygen for respiration is reduced or limited so this is why that is important now when does the denitrification process occur so the denitrification process is considered as one of the most active process in the regions where the water filled pore space in the soil exceeds about 60 percent so when there is a x when the water fill pore space is in the soil exceeds 60 percent then this process occurs so the end product gas depends upon the soil conditions and the microbial community so when the deficiency of oxygen increases these microbes perform its function by converting the nitrate into the nitrogen gas that is the n2 for the purpose of nutrient management the denitrification process in a result in the loss of a valuable nitrogen but the impact in the atmosphere will vary but their impact and atmosphere will always vary now final is what are the factors that affect this process of denitrification so the complete process of denitrification has been influenced by many factors one of the main factors which influence the process of denitrification is the organic content in the soil so the organic matter available within the soil is the only source of nutrient for the bacteria therefore the soil bacteria requires a source of readily available organic matter either from the plants from the soil or from other additional sources as well and the other factors so these are some of the other factors which are the soil ph the soil texture then temperature oxygen content in the soil moisture content in the soil and concentrate of the nitrate in the soil so these are some of the factors that affect the process of the denitrification

Structure of Cyanobacteria

Cyanobacteria are photosynthetic prokaryotes. These form small groups or multicellular colonies forming long filamentous chains of cells. These are without flagella and pilli.

A typical cells of cyanobacteria consist following details-

Slimy layer or Gelatinous Sheath

It is the outermost covering present outside the cell wall. It is gelatinous in nature. Because of slimy layer, cyanobacteria can glide over.

Cell wall

It resembles the cell wall of bacteria and is formed of lipoproteins, lipopolysaccharides and mucoproteins.

Plasma membrane

It is formed of unit membrane.

Cytoplasm

The cytoplasm lacks ER, Golgi complex, mitochondria and lysosomes. The ribosomes are 70s type. They are freely distributed in the cytoplasm and form polyribosomes during protein synthesis.

The cytoplasm also contains photosynthetic pigments, the bacteriochlorophyll and carotenoids. These occur in flattened sacs called thylakoids.

The cytoplasm also contains blue pigment phycocyanin and red pigment, phycoerythrin collectively known as phycobillin. These are found inside the small granules called cyanosomes or phycobilisomes.