Metabolism in Microbes

Phototroph = organism which obtains energy from light

Chemotroph = organism which obtains energy from ...
...ORGANIC chemical COMPOUNDS

Autotroph = Organism which requires only CO_2 as a source of carbon. It can make all its own carbohydrates, lipids etc (organic molecules).

Heterotroph = Organism which requires organic molecules (def: _____________) as carbon sources.

Organic	Compounds containing carbon that are found in living organisms (except hydrogen carbonates, carbonates and oxides of carbon).

Photoautotroph:
an organism that uses light energy to generate ATP and produce organic compounds from inorganic substances.

Photoheterotroph:
an organism that uses light energy to generate ATP and obtains organic compounds from other organisms.

Chemoautotroph:
an organism that uses energy from chemical reactions to generate ATP and produce organic compounds from inorganic substances.

Chemoheterotroph:
an organism that uses energy from chemical reactions to generate ATP and obtain organic compounds from other organisms.

Can you give an example of each....that you have met on the IB course?

	Photoautotrophic	Chemoautotrophic	Photoheterotrophic	Chemoheterotrophic
Energy source	Light	Chemical – from the oxidation of inorganic substances during respiration	Light	Chemical – from the oxidation of inorganic substances during respiration
Types	Green bacteria, cyanobacteria (blue-green bacteria), sulfur bacteria and some purple non-sulfur bacteria	Nitrifying and sulfur bacteria	Purple non-sulfur bacteria (very few)	Most bacteria – saprotrophs, parasites and mutualists.

Figure 1732 Nutritional characteristics of bacteria (table)

Identify each column of the table

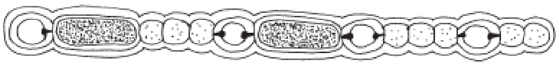
Compare photoautotrohs and photoheterotrophs

Compare Chemoautotrophs & chemoheterotrophs.

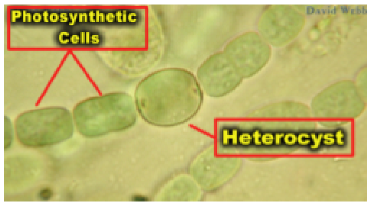
Compare photoautotrophs with photoheterotrophs in terms of energy sources and carbon sources.

Compare chemoautotrophs with chemoheterotrophs in terms of energy sources and carbon sources.

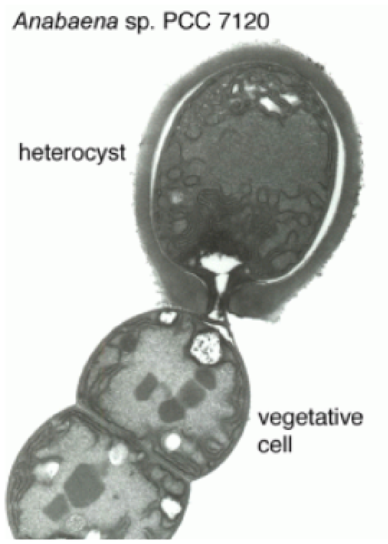
Figure 1733 shows the structure of *Anabaena*, a nitogen fixing, filamentous cyanobacterium.



Anabaena

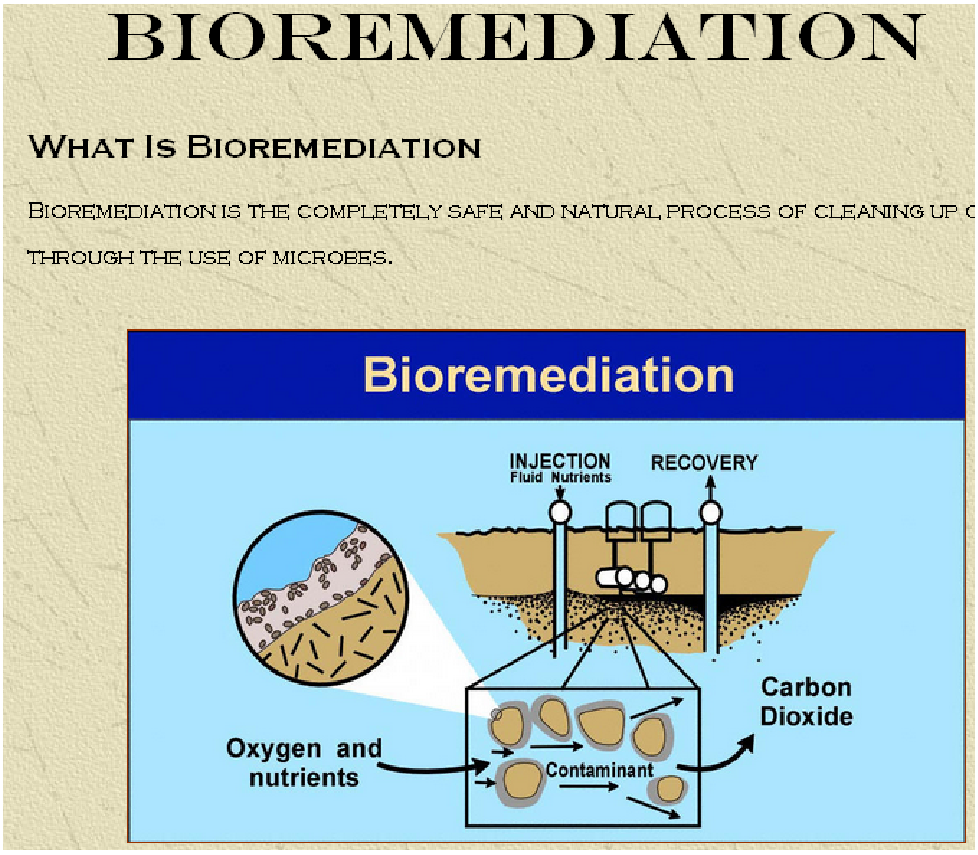


F.5.5 Draw and label a diagram of a filamentous cyanobacterium. Use Anabaena and label the photosynthetic cell and the heterocyst.



Nitrogen fixing cyanobacteria are photosynthetic micro organisms that gain their energy from sunlight, their carbon and their nitrogen from air, and their reductant from water. Oxygen derived from photo-oxidation of water is highly damaging to nitrogenase, the enzyme responsible for reduction of molecular nitrogen. So, these cyanobacteria had to develop strategies to reconcile two incompatible processes, oxygenic photosynthesis and N_2 fixation. Some genera (eg *Anabaena*) of multicellular cyanobacteria solved the problem by differentiation of about every 10th cell of a filament into a heterocyst; a cell specialized for the task of N2 fixation. Heterocysts develop from photosynthetically active, vegetative cells upon N-starvation. Prospective heterocysts loose the capacity to fix CO_2, form a special envelope that limits the entrance of O_2, and enhance their respiratory capacity. This allows the mature heterocyst to generate a micro aerobic environment suitable for nitrogenase functioning. Adjacent vegetative cells supply heterocysts with carbohydrates that are then oxidised to provide reductants required for N_2 fixation and respiration. In turn, heterocysts provide vegetative cells with the needed fixed nitrogen. The prokaryotic organisation of DNA, the relative short live cycle, and the existence of cell types with distinct functions make heterocyst-forming cyanobacteria not only suitable for the study of biological N_2 fixation but also for the elucidation of developmental processes like pattern formation and

F.5.6 Explain the use of bacteria in the bioremediation of soil and water. 3
Examples include selenium, solvents and pesticides in soil, and oil spills on water.



Bioremediation by Oil Eating Bacteria

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The science of biodegradation, the process by which compounds are naturally broken down by microbes, is examined in this experiment. This naturally occurring process can be enhanced by bioremediation to minimize the catastrophic effects of such things as oil spills. Students will grow a mixture of oil eating bacteria and demonstrate how the enzymes produced by these microbes digest hydrocarbon molecules, causing degradation. Experiment includes: complete instructions, background information, study questions, oil-eating bacteria pellets, growth medium, and pipets. Grades 6-12.