

# **COURSE- M.Sc. BOTANY PART-I PAPER – II**

## **Topic – Nutritional Classification of Bacteria (MICROBIOLOGY)**

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On the basis of the mode of nutrition, the bacteria are grouped mainly into two types:

- (A) Autotrophic bacteria.
- (B) Heterotrophic bacteria.

Autotrophic bacteria synthesize all their food from inorganic substances ( $H_2O$ ,  $CO_2$ ,  $H_2S$  salts). They are of two types: (i) Photosynthetic bacteria *i.e.* Phototrophs, and (ii) Chemosynthetic bacteria *i.e.* Chemotrophs.

### **Phototrophs -**

- Obtain energy from sunlight to get high energy electrons attached to high redox carriers.
- Use  $CO_2$  and Calvin-Benson cycle to make all organic molecules.

Phototrophs can further be divided into two groups on the basis of the source of electron -

- Photolithotrophs: These bacteria obtain energy from light and use reduced inorganic compounds such as  $H_2S$  as electron source. *e.g.* *Chromatium okenii*.
- Photoorganotrophs: These bacteria obtain energy from light and use organic compounds such as succinate as electron source.

Anaerobic photosynthetic bacteria comprise three common groups: (a) Purple bacteria *e.g.* *Chromatium vinosum*, *Thiospirillum jenense* (b) Purple non-sulfur bacteria. *e.g.* *Rhodospirillum rubrum*, *Rhodobacter sphaeroides vannielii* (c) Green sulfur bacteria (some are brown) **e.g.** *Chlorobium limicola*, *Prosthecochloris aestuarii*,

Aerobic photosynthetic bacteria are cyanobacteria formerly called blue-green algae/bacteria. They have two photosystems.

### **Chemotrophs -**

- These bacteria obtain energy from chemical compounds
- They cannot carry out photosynthesis

Chemotrophs can also be further divided into two groups on the basis of the source of electron.

**Chemolithotrophs:** They obtain energy from oxidation of chemical compounds and reduce inorganic compounds such as  $\text{NH}_3$  as electron source. Eg. *Nitrosomonas*

- Chemoorganotrophs: They obtain energy from chemical compounds and use organic compounds such as glucose and amino acids as source of electron. eg. *Pseudomonas pseudoflava*

**Hydrogen Bacteria:** These bacteria obtain energy by oxidizing hydrogen gas.

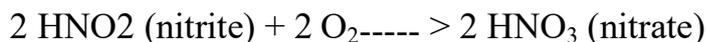
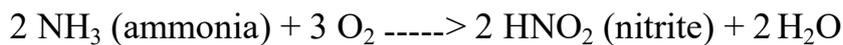


Hydrogen bacteria are usually facultative chemolithotrophs.

**Sulfur Bacteria;** They oxidize sulfur compounds e.g. *Thiobacillus thiooxidans*.



**Nitrifying Bacteria:** They are very important soil organisms. They process all ammonia, nitrite in soils, break down amino acids and nitrogen bases. They belong to two different groups: one oxidizes ammonia (e.g. *Nitrosomonas*) and the other oxidizes nitrite (e.g. *Nitrobacter*)



**Iron Bacteria:** They carry out oxidation of iron e.g. *Ferrobacillus ferrooxidans*..



### **Autotrops:**

These bacteria use carbon dioxide as a sole source of carbon to prepare its own food.

Autotrops are divided into two types on the basis of yje energy utilized to assimilate carbon dioxide. i.e. Photoautotrophs and chemoautotrophs.

Photoautotrophs: They utilize light to assimilate  $\text{CO}_2$ . They are further divided into two groups on the basis of electron sources i.e. Photolithotropic autotrophs and Photoorganotropic autotrophs

Chemoautotrops: They utilize chemical energy for assimilation of  $\text{CO}_2$

### **Heterotrophs:**

- These bacteria use organic compounds as carbon source
- They lack the ability to fix  $\text{CO}_2$
- Most of the human pathogenic bacteria are heterotrophic in nature
- Some heterotrophs are simple, because they have simple nutritional requirement. However, there are some bacteria that require special nutrients for their growth and they are known as fastidious heterotrophs.

# Nutritional classification to show carbon, energy and electron sources

## Carbon source

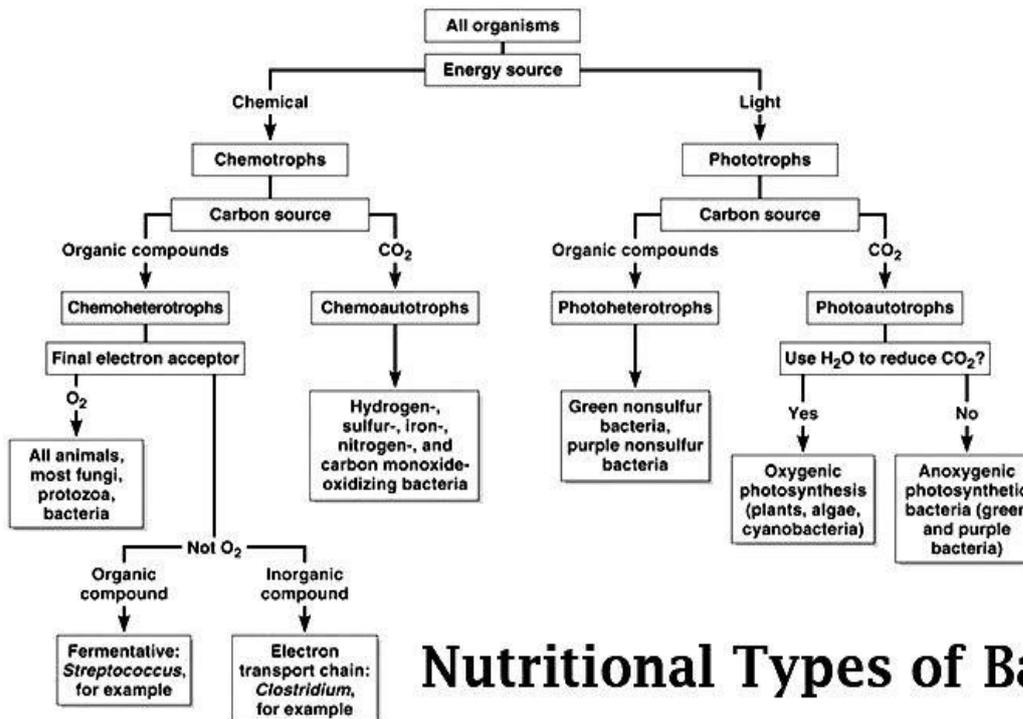
Autotrophs	CO <sub>2</sub> sole or principal biosynthetic carbon source
Heterotrophs	Reduced, preformed, organic molecules from other organisms

## Energy source

Phototrophs	Light
Chemotrophs	Oxidation of organic or inorganic compounds

## Electron source

Lithotrophs	Reduced inorganic molecules
Organotrophs	Organic molecules



# Nutritional Types of Bacteria