HITACHI Page No.
Date / /

Microbial Metabolism
Respiration

→ Metabolism is the sum of all chemical reactions occuring in the living cells.

Metabolism
- Catabolism (Breadown) energy conserving rxns
- Anabolism (Formation) energy consuming rxns.

Respiration → Catabolic Procers which generally inuves exchange of environmental oxygen and body's CO_2 to utilize the O_2 for oxidation of nutrients. i.e glucose.

Need of Respiration
1. Chemical work → Biosynthesis of Biomdecules
2. Transport " → intake of nutr., elimination of wastes
3. Mechanical " → cellular motility, movements.

Types of Microbes on the Basis of Source of Energy

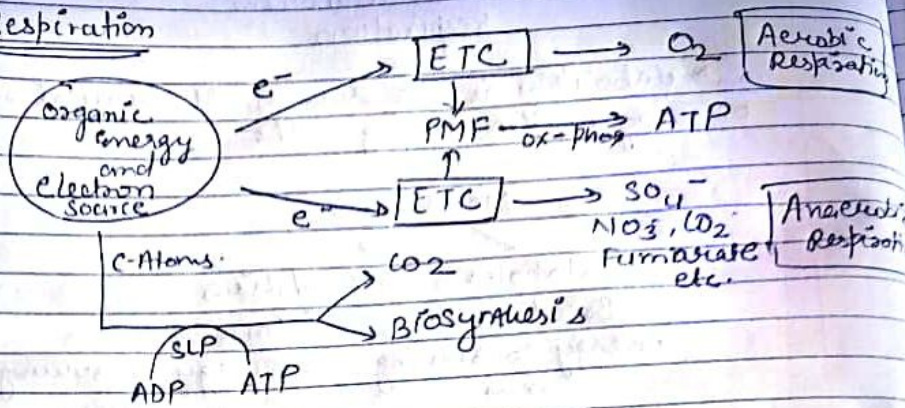
1. Chemo organoheterotophs. → microbes use organic compounds as their source of energy Carbon & electrons.

Processes involved:-
1. Fermentation
2. Aerobic Respiration
3. Anaerobic Respiration

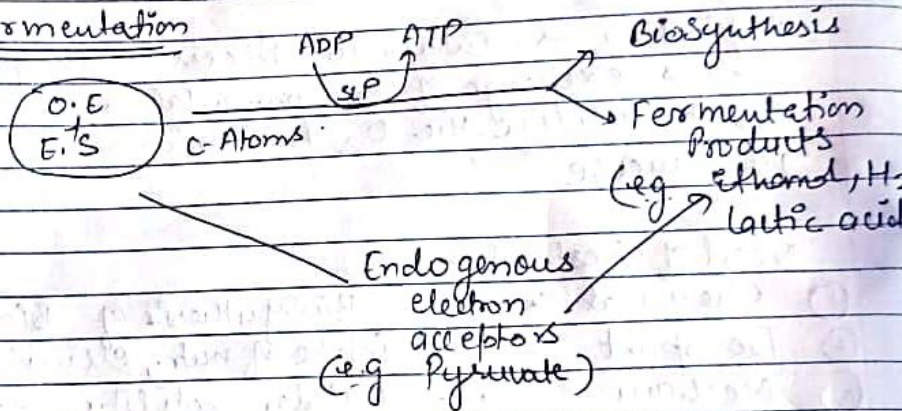
HIRAISH Page No.
Date / /

(B)

→ Respiration



Fermentation



(A) Aerobic Respiration is characterized by :-

(i) occurs in the Presence of O_2 because Final acceptor is O_2.

(ii) Stages :- (a) Hydrolysis of Complex organic Compounds i.e Proteins, Carbohydrates etc.

(b) Breaking of monomeric Org. compds e.g Glycolysis

(c) Conversion of Pyruvic acid (3C) to acetyl CoA (2C) by Oxidative decarboxylation

(d) Acetyl Co-A → to Kreb Cycle or TCA.

(e) ETC → PMF

(f) e^- finally accepted by O_2 end of ETC

(B) Anaerobic Respiration is characterized by :-

(i) absence of O_2 & exogenous acceptors are inorganic radicals like NO_3^-, SO_4^{2-}, CO_2, Fe^+. or organic acceptor like Fumaric or Humic acid.

(ii) also involves Formation of $FADH_2 + NADH_2 \rightarrow$ movements $\rightarrow$ ETC $\rightarrow$ PMF.

(iii) Found is many types of Bacteria

(iv) Desulfovibrio & archaebacteria ~~eg. Methanogens~~ e.g. Methanogens obligatory anaerobes

Paracoccus denitrificans $\rightarrow$ Facultative anaerobes

Both are Dinitrification Bacteria $\rightarrow$

(C) Fermentation is characterized by :-

(i) Substrate organic compound undergoes dehydrogenation & ~~Finally~~ Finally accepted by endogenous acceptor like Pyruvic acid.

(ii) does not involves ETC + PMF

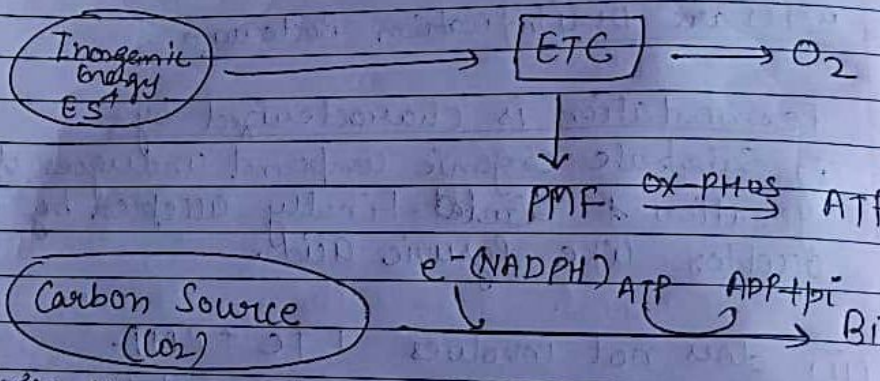
(iii) Fermentation is widely used by microbes & has Imp Practical applications.

(2) Chemolithoautotrophs :-

→ organisms which used reduced inorganic molecules as their energy + electron acceptor. but C from CO_2

e.g:- Nitrifying bacteria. Nitrobacter ($NH_3 \rightarrow NO_3^-$)
Sulphur " Beggiatoa alba (H_2S)

Steps (i) These bacteria oxidise inorganic Compands like NH_3 + H_2S.
(ii) e^- moved along ETC whic e^- finally accepted by O_2
(iii) on ETC, ATP molecules are Produced → PMF
(iv) much less energy is Produced.



Nitrification Rxns

(a) Ammonia oxidized to Nitrite

$$NH_4^+ + \frac{1}{2}O_2 \xrightarrow{\text{Nitrosomonas}} NO_2^- + H_2O + 2H^+$$

(b) Nitrite is oxidized to Nitrate

$$NO_2^- + \frac{1}{2}O_2 \xrightarrow{\text{Nitrobacter}} NO_3^-$$

(3) Phototrophs :-
→ These organisms use light as their energy source. Again of two types on the basis of electron source & carbon source.

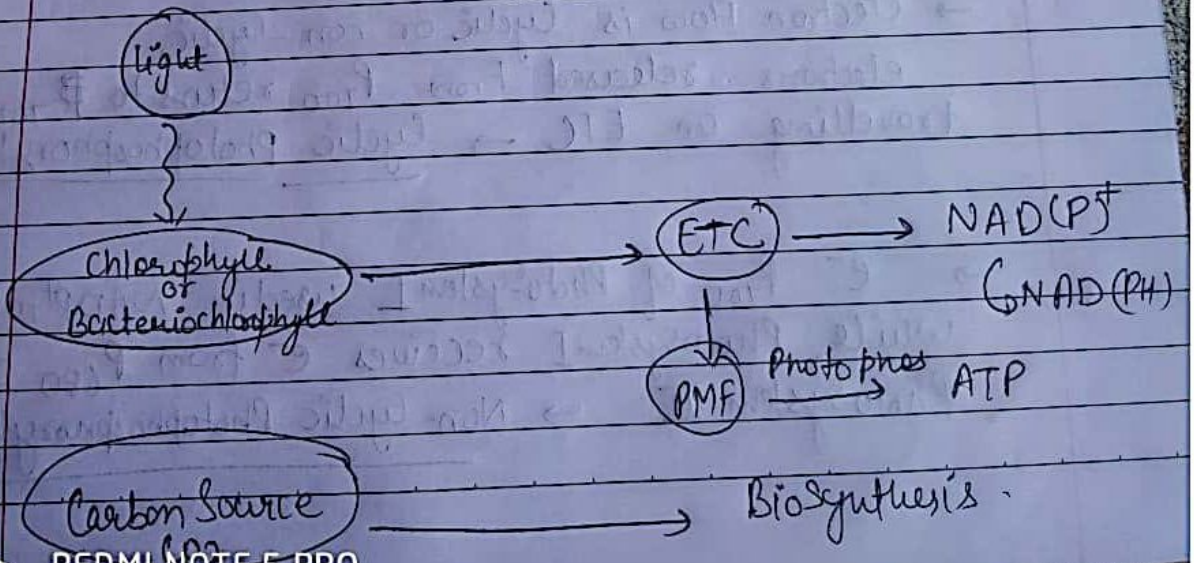
(i) Photolithoautotrophs :-

e.s → Inoogenic molecules, H_2, H_2S
C.S → CO_2,
e.g.:- Purple and green sulphur bacteria.
→ These undergoes Oxygenic photosynthesis or Anoxygenic photosynthesis

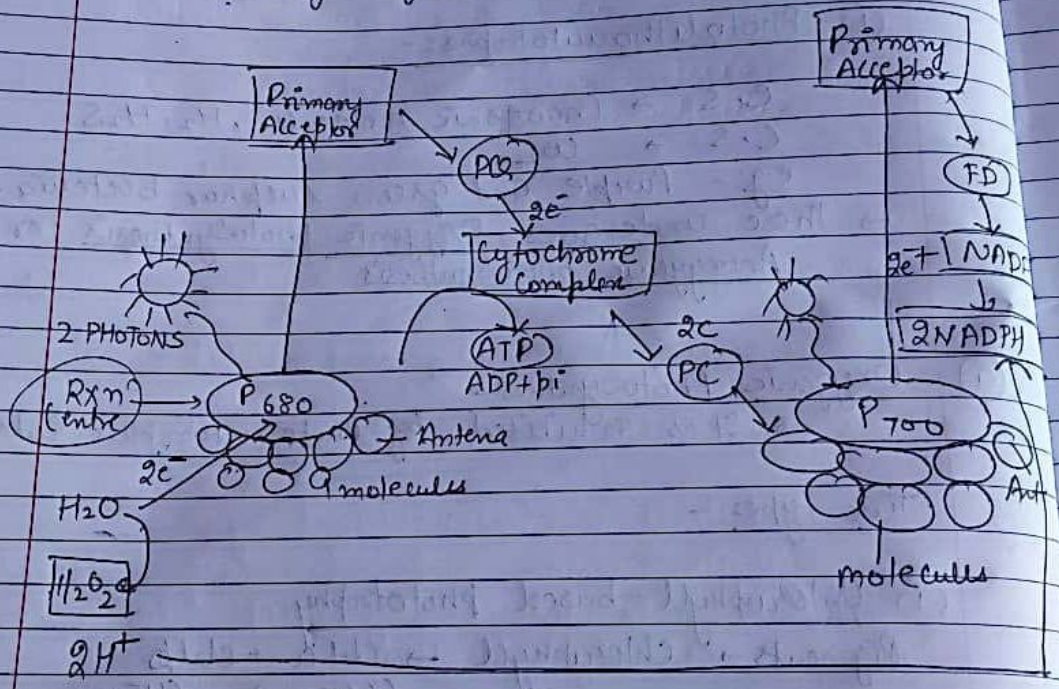
(a) Oxygenic PhotoSynthesis
→ It is exhibited by Photoautotrophic Eukaryots

Two types:-

(i) Chlorophyll-based phototrophy
Pigments → Chlorophyll → Chl a + Chl b
(665 nm) (430 nm) 645 nm



Other pigments :-
Carotenoids (β-Carotene) in Cyanobacterium
Fucoxanthin in diatoms
Phycoerythrin, (etc. Red algae)

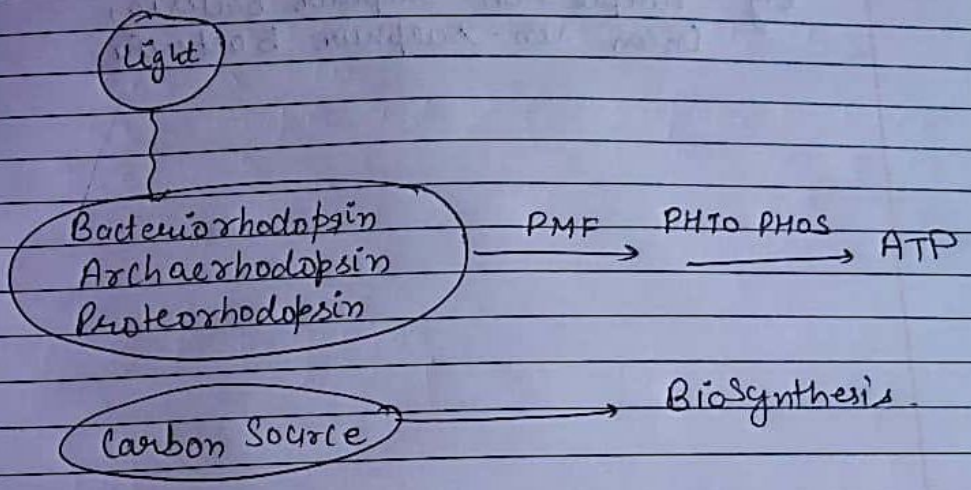


→ Electron Flow is Cyclic or non-Cyclic.
Electrons released From P_{700} returns to P_{700} after travelling on ETC → Cyclic Photophosphorylation

→ e^- P_{700} of PhotoSystem I used in NADP to NADPH while PhotoSystem I receives e^- from P_{680} of PhotoSystem II → Non-Cyclic Photophosphorylation

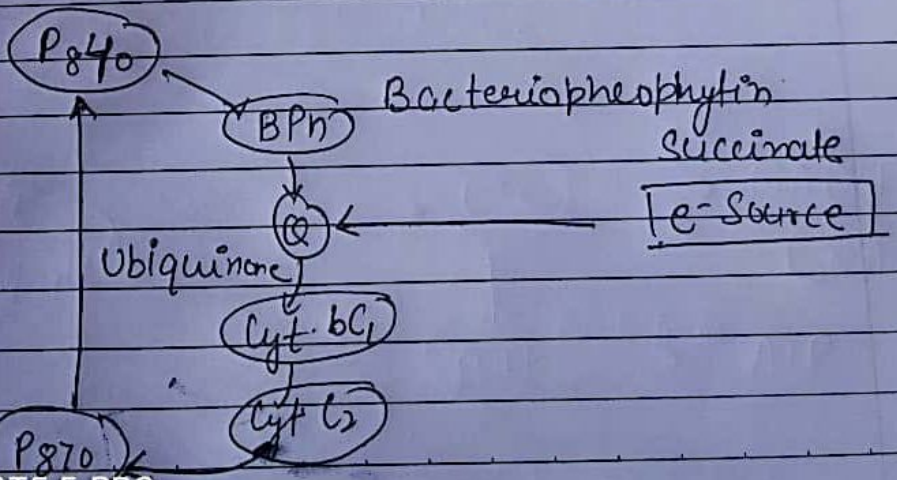
(ii) Rhodopsin-based Phototrophy :-

It is found in Archaebacteria e.g. Halobacterium Salinarum
→ having Bacteriorhodopsin → deep Purple pigment



(B) Anoxygenic PhotoSynthesis :-

(i) Water is not used as an electron source.
e.g:- green bacteria, Purple bacteria, hellobacteria.



(ii) Photoorganoheterotrophs

→ electrons source are always organic compounds while carbon source are organic compounds, but CO_2 may also be used.

e.g Purple non-sulphur bacteria,
Green non-sulphur bacteria.