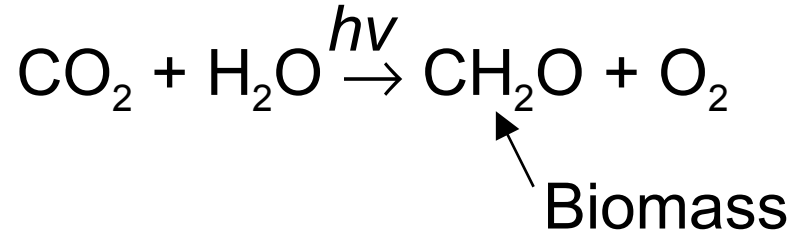
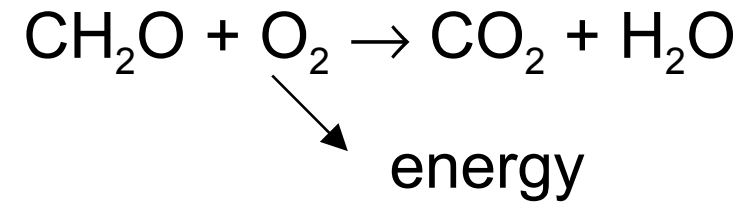


Organisms can obtain their energy from organic compounds, from light or from inorganic compounds.

Photosynthesis



Respiration



Three main groups of organisms:

Archaea

Bacteria

Eukaryotes

Organisms need energy to:

- Find, gather and process the sources of energy (forage, hunt, chew, transform food into useful energy)
- Build and repair complex molecules
- Send signals (chemical, electrical)
- Respond to environmental stress
- Growth and reproduction

In organisms, chemical energy is used in such a way that unfavorable reactions are coupled with (very) favorable reactions through enzymes or pathways.

ATP (Adenosine triphosphate) is the “energetic currency” of the cell.

- Many reactions are coupled to ATP hydrolysis
- ATP hydrolysis is energetically favorable
- ATP transports and temporarily stores energy
- ATP is “recharged” by bonding a P to an ADP

(general) Steps in ATP production:

- Source of energy
- Energy is used to produce high energy e-
- high energy e- pump H⁺ and generate an H⁺ gradient
- H⁺ gradient is used to produce ATP

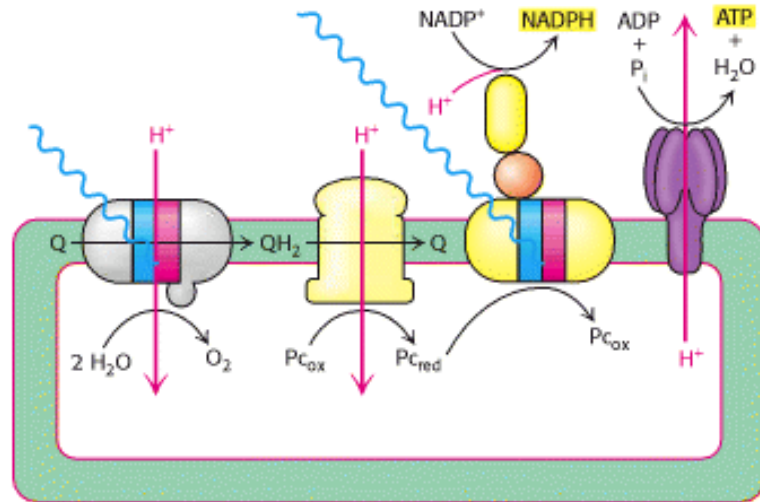
ATP production can take place in the chloroplast or the mitochondria

ATP synthase transforms potential energy (H⁺ gradient) into mechanical energy (rotation and change in shape of the proteins) and into chemical energy (ATP bonds)

ATP production

- Source of energy
- Energy is used to produce high energy e-
- high energy e- pump H^+ and generate an H^+ gradient
- H^+ gradient is used to produce ATP

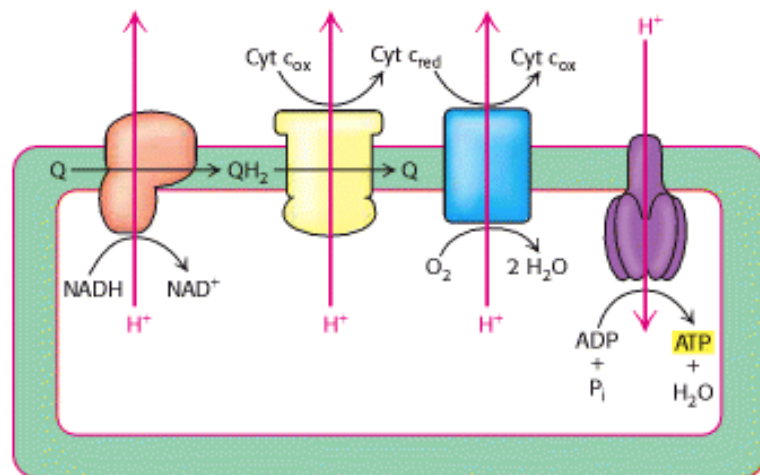
PHOTOSYNTHESIS



PHOTOSYNTHESIS

Light provides the energy for high energy electrons.
The source of electrons is water

OXIDATIVE PHOSPHORYLATION



OXIDATIVE PHOSPHORYLATION

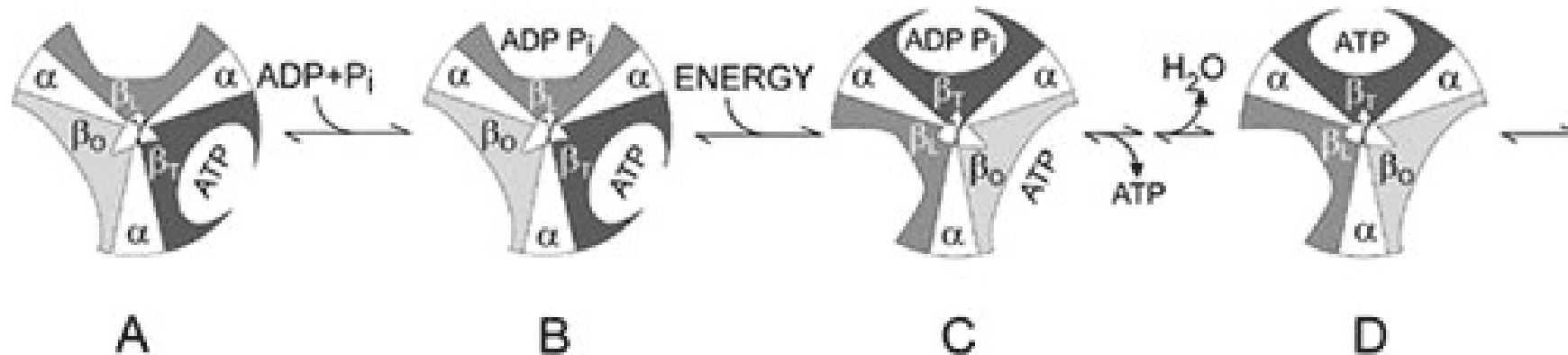
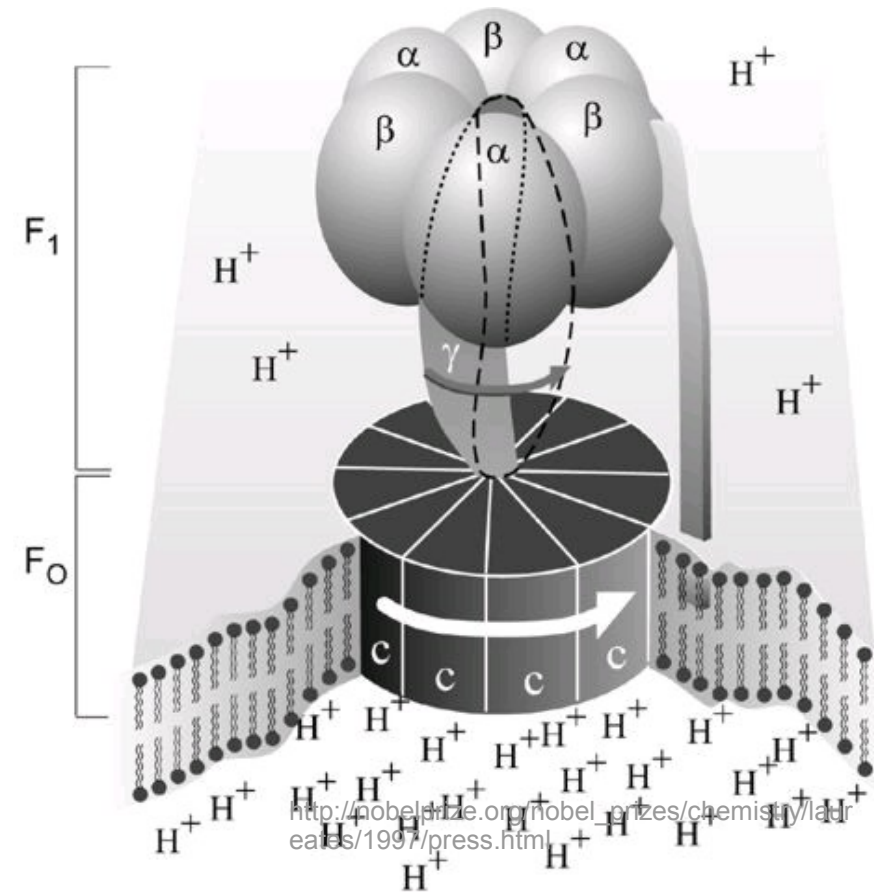
Organic compounds provide the energy for high energy electrons.

The source of electrons are the organic compounds (through NADH)

ATP Synthase: potential to mechanical to chemical energy

Protons (H^+) flowing through the channel, mechanically change the shape of the β units of the enzyme, smashing the ADP & P together.

Awarded Nobel Prizes:
1978 – Peter Mitchell (gradient in H^+ concentration drives ATP synthesis)
1997 – Paul D. Boyer & John E. Walker (elucidating mechanism of ATP synthesis)



Photosynthesis is a process by which radiative energy is transformed into biomass. It take place in two steps:

- **Light reactions**
 - Capture light
 - Convert EM energy into ATP and NADPH
- **Dark reactions**
 - Use ATP and NADPH to convert CO₂ to carbohydrates.

Different organisms have different pigments that absorb light at different wavelenghts