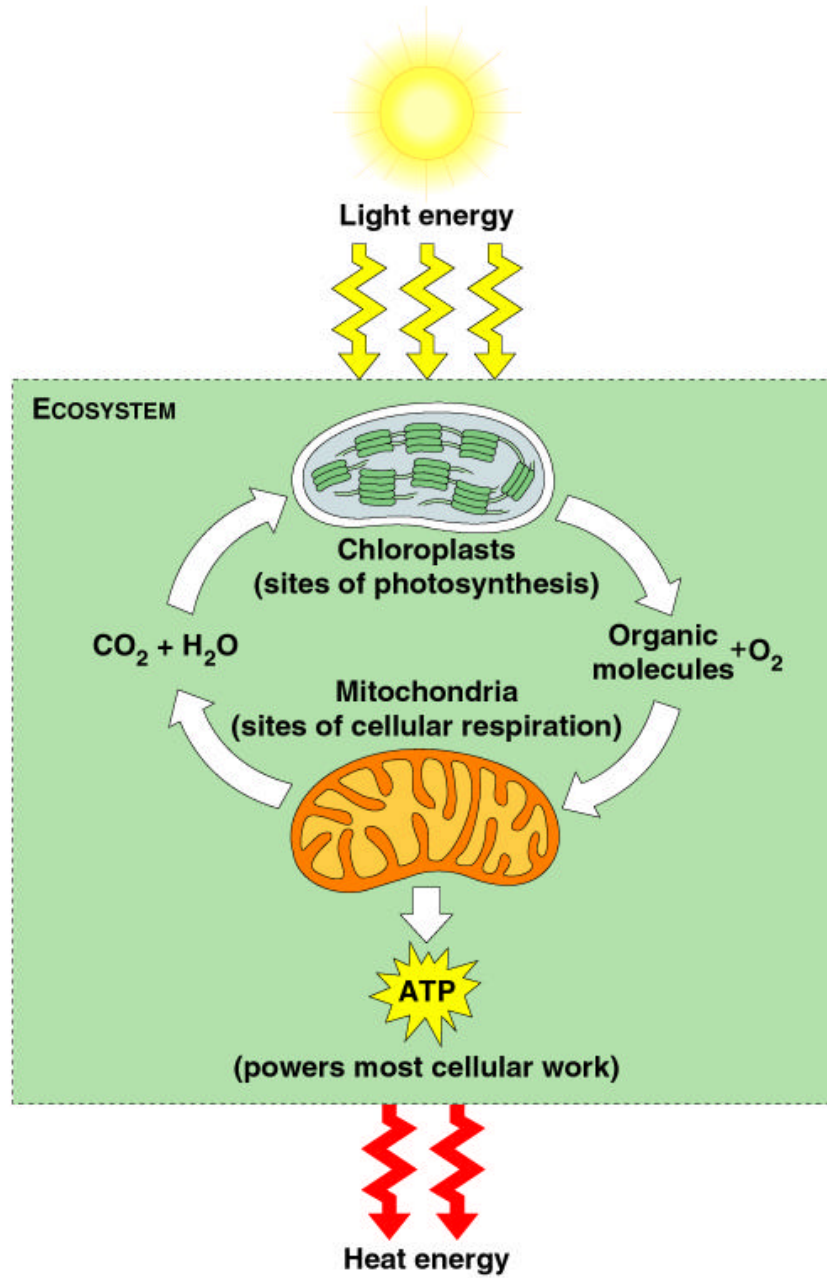


# Cellular Respiration

## Chapter 9: Principles of Energy Harvesting

# Objectives

- Describe energy flow through the biosphere
- Understand and explain redox reactions
- Understand the role of NADH
- Understand how an electron transport chain operates



# Energy Principles

- Energy of organic molecules is stored in their arrangement of atoms
- Energy is released through catabolic processes e.g. fermentation, cellular respiration
- ATP releases energy (phosphorylation) then is recycled
- The anabolic and catabolic pathways of ATP are the result of oxidative and reduction chemical processes

# Oxidation-Reduction Reactions

oil rig

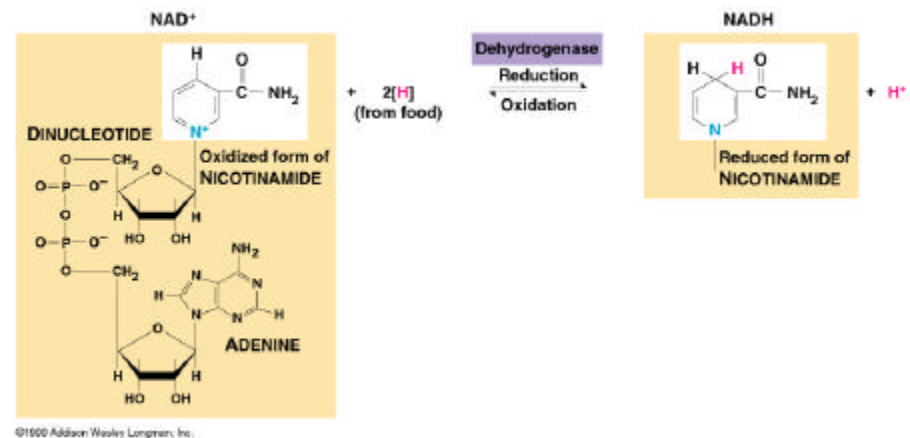
- **Oxidation** reactions result in a **loss** of electrons
- Oxidation may also occur through the addition of oxygen (more electronegative) to a molecule
- **Reduction** reactions result in a **gain** of electrons
- Reduction may also occur through the addition of hydrogen to a molecule

Electron orbital position is the key: when electrons move to closer orbitals they lose potential energy,  $-\Delta G$



# Cellular Respiration is a Redox Reaction

- Method of energy release is gradual and methodic
  - increases efficiency
  - enzyme catalyzed
- Hydrogen atoms removed from foods as they are oxidized are added to  $\text{NAD}^+$  resulting in reduction to  $\text{NADH} \& \text{H}^+$



This process is assisted by enzymes generically referred to as **Dehydrogenases**

# Energy stored in NADH is released through an Electron Transport Chain

- Electron Transport Chain mechanisms stepwise enable electrons to move to lower orbitals before being accepted by oxygen, resulting in a gradual release of energy
- Each progressive carrier is more electronegative than its predecessor

