Molecular Motar – ATP Synthase
INTRODUCTION

- All living organisms, from bacteria, fungi, spinach and worms to crocodiles and humans, use ATP for energy conversion. Originally, the energy comes from the sun.

- Plants capture it during photosynthesis and convert it to chemical energy as ATP. Using this energy, plants produce carbohydrates, fats and proteins which are eaten by animals and human beings. In metabolism, the food is broken down and the energy released is used to make ATP.
ATP is the most commonly used "energy currency" of cells from most organisms. It is formed from adenosine diphosphate (ADP) and inorganic phosphate (Pi), and needs energy.

ADP and Pi are joined together by ATP synthase.

• ATP synthase utilizes the energy stored in this electrochemical gradient to drive nucleotide synthesis.
ATP SYNTHASE

- ATP synthase—also called FoF1 ATPase is the universal protein that terminates oxidative phosphorylation by synthesizing ATP from ADP and phosphate.

- ATP Synthase is one of the most important enzymes found in the mitochondria of cells.
Chemiosmosis

Thylakoid

SUN

H⁺ H⁺ (Proton Pumping)

H⁺ H⁺ H⁺ H⁺ high H⁺ concentration

Thylakoid Space

H⁺ ATP Synthase

ADP + P ATP

low H⁺ concentration
STRUCTURE
STRUCTURE

- ATP Synthase is a large (400kDa) multisubunit complex, also known as coupling factor or CF0 – CF1, consists of two multipeptide complexes.

- CF0 is an integral membrane protein that forms a proton channel through the thylakoid membrane.

- CF1 is attached to the stromal side of CF0 and consists of five different subunits, α3, β3, γ, δ, ε.

- CF0 consists of four different subunits with a proposed stoichiometry of a, b`, c10.
WORKING

- ATP synthesis does not require the input of energy, but the release of the newly synthesized ATP does require energy.

- The movement of protons through the F0 channel causes the γ subunit to rotate which drives a conformational change in the structure of the β-subunit resulting in the binding of substrates (ADP and Pi) and the release of the product ATP.
THANK YOU