

**Plant cell,
Photosynthesis, and
Ecological biology**

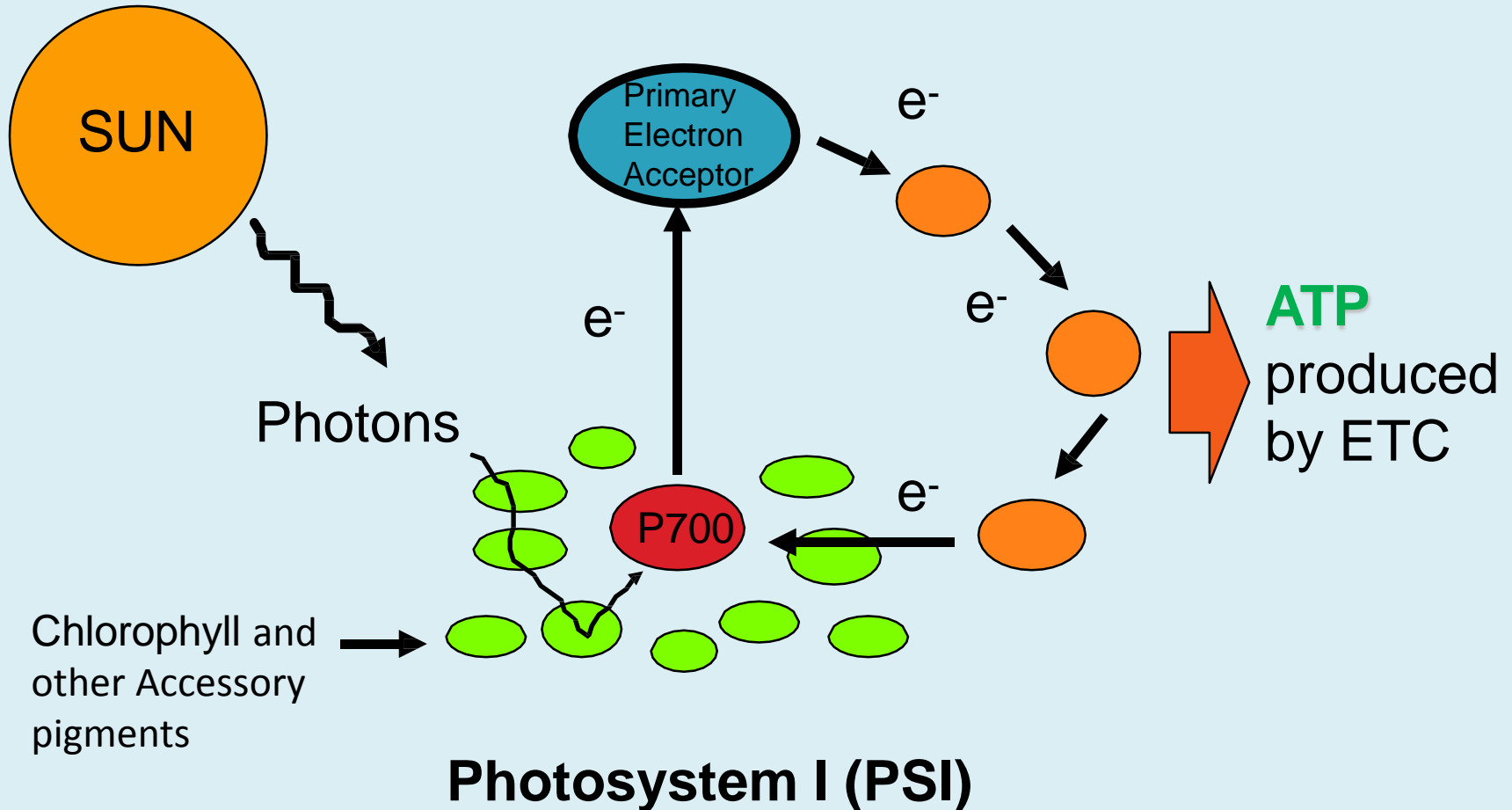
405 Biochem

By

Prof. Entsar Saad

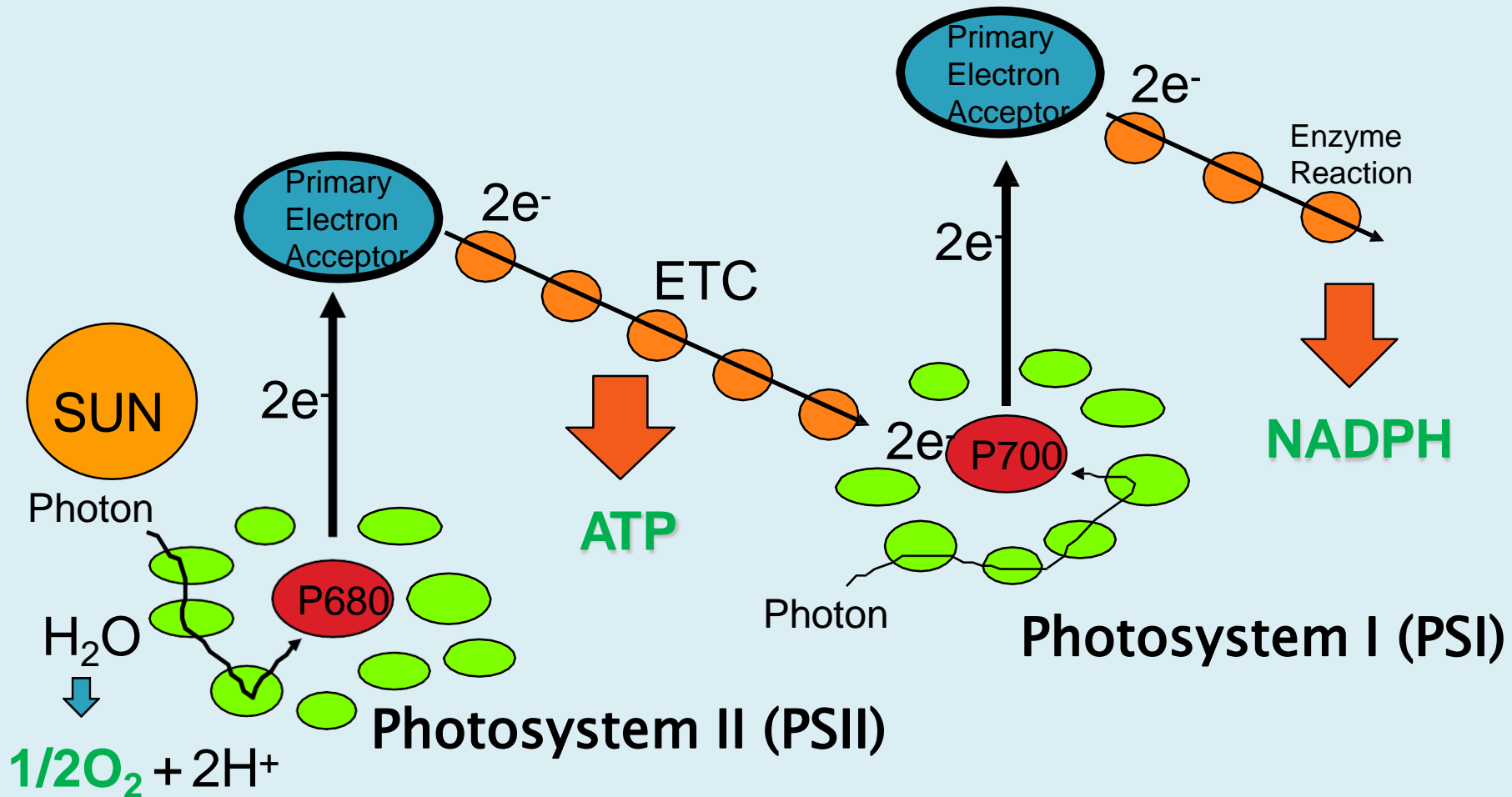
2020

Cyclic Electron Flow (Cyclic photophosphorylation)



- Pigments absorb light energy & excite e⁻ of Chlorophyll a to produce ATP

Noncyclic Electron Flow (Noncyclic photophosphorylation)



- H_2O is split in **PSII** & **ATP** is made, while the energy carrier **NADPH** is made in **PSI**

Stages of Photosynthesis

➤ *The energy transfer is similar to the chemiosmotic electron transport occurring in the mitochondria.* Light energy causes the removal of an electron from a molecule of P680 that is part of Photosystem II. The P680 requires an electron, which is taken from a water molecule, breaking the water into H^+ ions and O^{-2} ions. These O^{-2} ions combine to form the diatomic O_2 that is released. The electron is "boosted (improved)" to a higher energy state and attached to a primary electron acceptor, which begins a series of redox reactions, passing the electron through a series of electron carriers, eventually attaching it to a molecule in Photosystem I. (to be continued.....)

Stages of Photosynthesis

Light acts on a molecule of P700 in Photosystem I, causing an electron to be "boosted" to a still higher potential. The electron is attached to a different primary electron acceptor (that is a different molecule from the one associated with Photosystem II). The electron is passed again through a series of redox reactions, eventually being attached to NADP^+ and H^+ to form NADPH, an energy carrier needed in the Dark Reaction. The electron from Photosystem II replaces the excited electron in the P700 molecule. Thus, there is a continuous flow of electrons from water to NADPH.

Stages of Photosynthesis

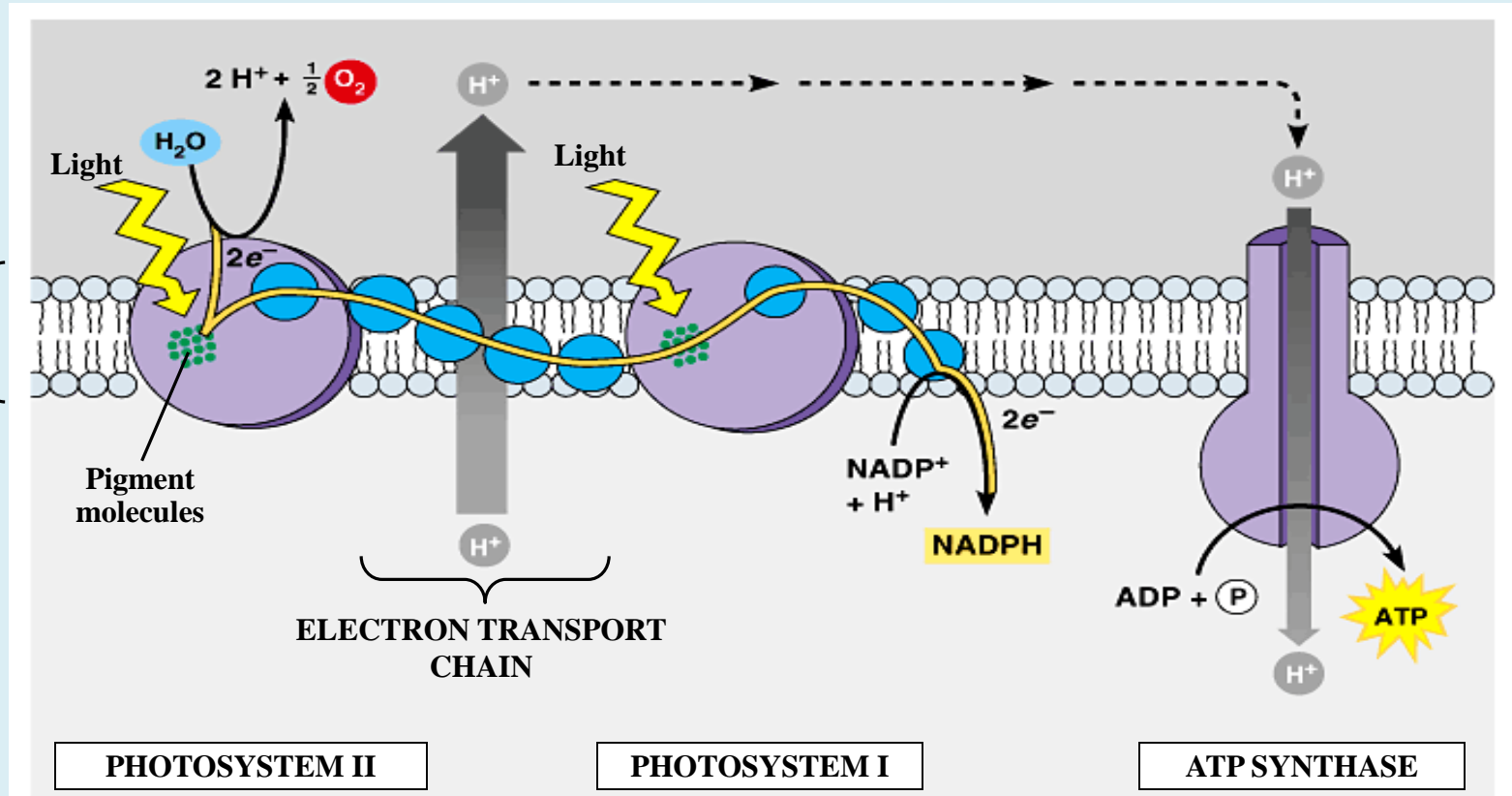
CHEMIOSMOSIS

- Powers ATP synthesis
- Takes place across the thylakoid membrane
- Uses ETC and ATP synthase (enzyme)
- H^+ move down their concentration gradient through channels of ATP synthase forming ATP from ADP

Thylakoid interior
(high H^+)

Thylakoid membrane

Stroma
(low H^+)



The production of ATP by chemiosmosis in photosynthesis

Stages of Photosynthesis

- **(2) The dark reactions (Calvin cycle)**
 - **The Dark Reactions are also known as Carbon-Fixing Reactions (or Light Independent Reactions or Calvin cycle).**
 - **Occurs when the products of the Light Reactions are used to form C-C covalent bonds of carbohydrates.**
 - **Occurs in the stroma**
 - **Forms sugar from carbon dioxide, using ATP for energy and NADPH for reducing power**