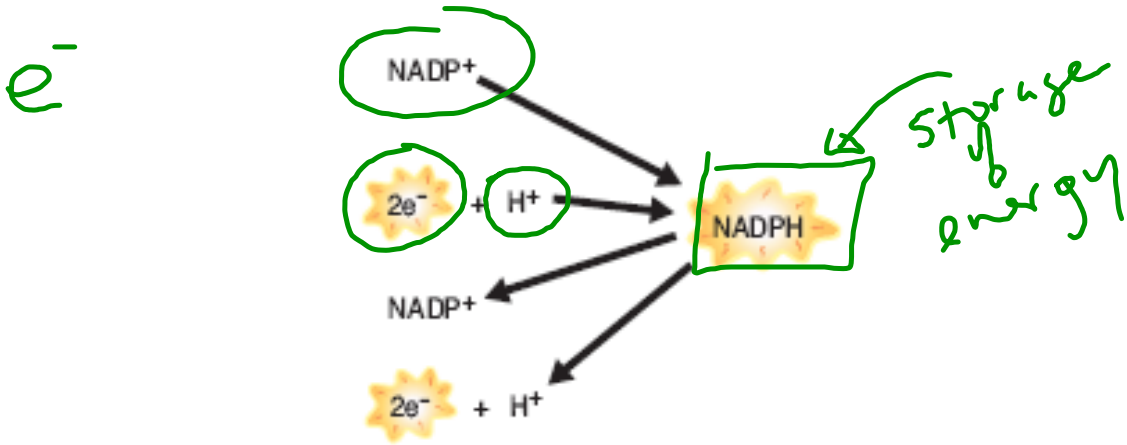
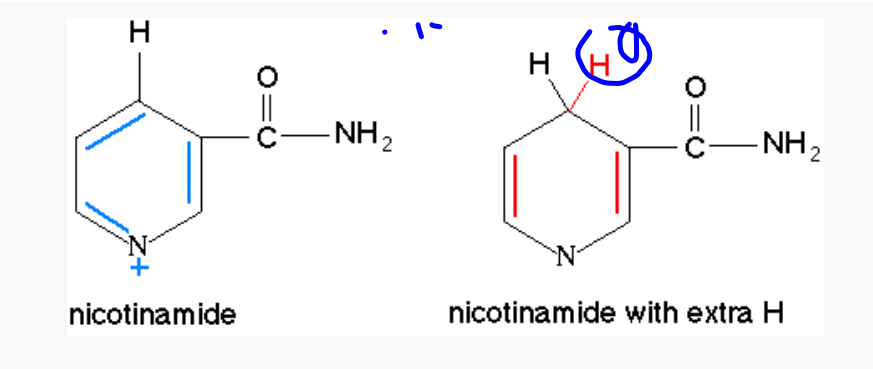
A carrier molecule is a compound that can accept a pair of high-energy electrons and transfer them along with most of their energy to another molecule. This process is called electron transport and the electron carriers themselves are known as the electron transport chain.

One of these carrier molecules is the compound nicotinamide adenine dinucleotide phosphate or $NADP^+$.

$NADP^+$ accepts and holds 2 high-energy electrons along with a hydrogen ion (H^+). This converts $NADP^+$ into NADPH. This is one way the energy of sunlight can be trapped in chemical form.



The NADPH then carry high-energy electrons to chemical reactions elsewhere in the cell.



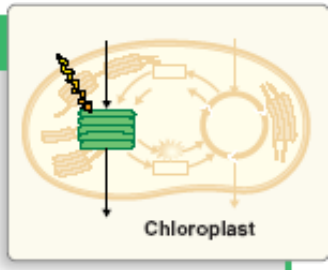
Reactions of Photosynthesis

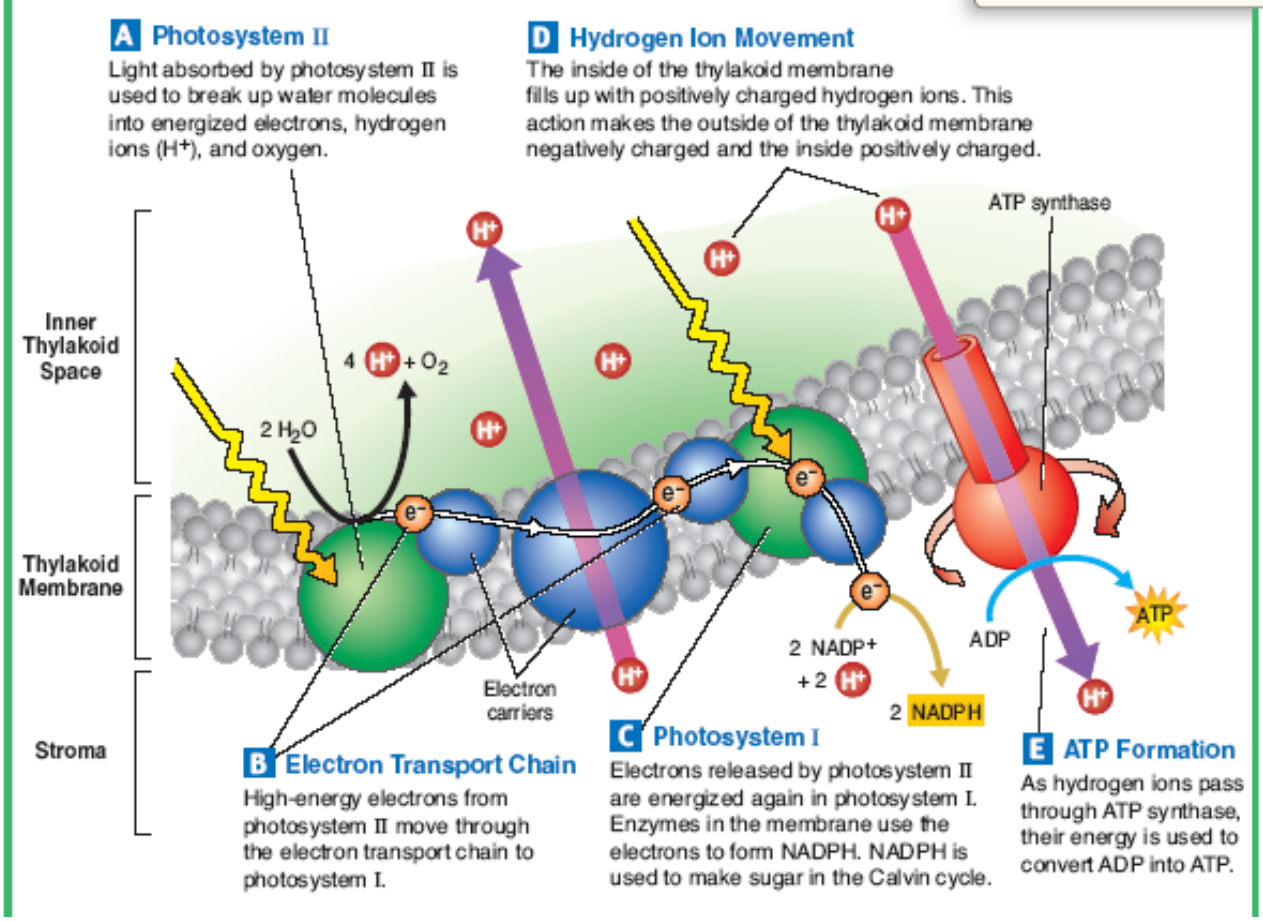
The light-dependent reactions require light and take place within the thylakoid membranes. p.210

The light-independent reactions (Calvin cycle) do not require light and take place in the stroma.

LIGHT-DEPENDENT REACTIONS Page 211

Figure 8–10 The light-dependent reactions use energy from sunlight to produce ATP, NADPH, and oxygen. The light-dependent reactions take place within the thylakoid membranes of chloroplasts.





Photosynthesis:

$$6CO_2 + 6H_2O \xrightarrow{light} C_6H_{12}O_6 + 6O_2$$

Summary
Light-Dependent Reactions

Needed	Produced
light	
water	O_2
$NADP^+$	NADPH
ADP	ATP

A Photosystem II

photosystem II pigments absorb light

↓

electrons in chlorophyll become energized and are passed onto the electron transport chain

---

enzymes on the inner surface of thylakoid membranes break up water molecules

↓

one water molecule breaks into:

- energized electrons ($2e^-$) → replace the high energy electrons that chlorophyll lost to the electron transport chain
- hydrogen ions ($4H^+$) → released inside the thylakoid membrane
- oxygen ($1\ O_2$) → released into the air

☆

B Electron Transport Chain

high energy electrons move through the electron transport chain from photosystem II to photosystem I

↓

energy from the electrons is used by the molecules in the electron transport chain to transport H^+ ion from the stroma to the inner thylakoid space

C Photosystem I

pigments in photosystem I use
light energy
to reenergize the electrons
from photosystem II

↓

$NADP^+$ picks up high energy electrons
along with a H^+ ion at the outer
surface of the thylakoid membrane to
become NADPH

D Hydrogen Ion Movement

more hydrogen ions are pumped across the membrane as electrons are passed to $NADP^+$

↓

inside of thylakoid membrane fills up with H^+ ions

↓

the outside of membrane becomes negatively charged

E ATP Formation

ATP synthase (protein) allows H^+ ions to pass through the thylakoid membrane

↓

ATP synthase rotates as H^+ ions pass through it

↓

as it rotates, ATP synthase binds ADP and a phosphate group to produce ATP

The NADPH and ATP formed by the light-dependent reactions contain a lot of energy, but they are not stable enough to store that energy for more than a few minutes.

electron carrier
NADPH
2 high energy e^-'s

ATP
energy stored in bonds between phosphate groups

Attachments

Two_Types_of_Cells__Prokaryotic_and_Eukaryotic.asf

Bacteria.asf