

Photosynthesis



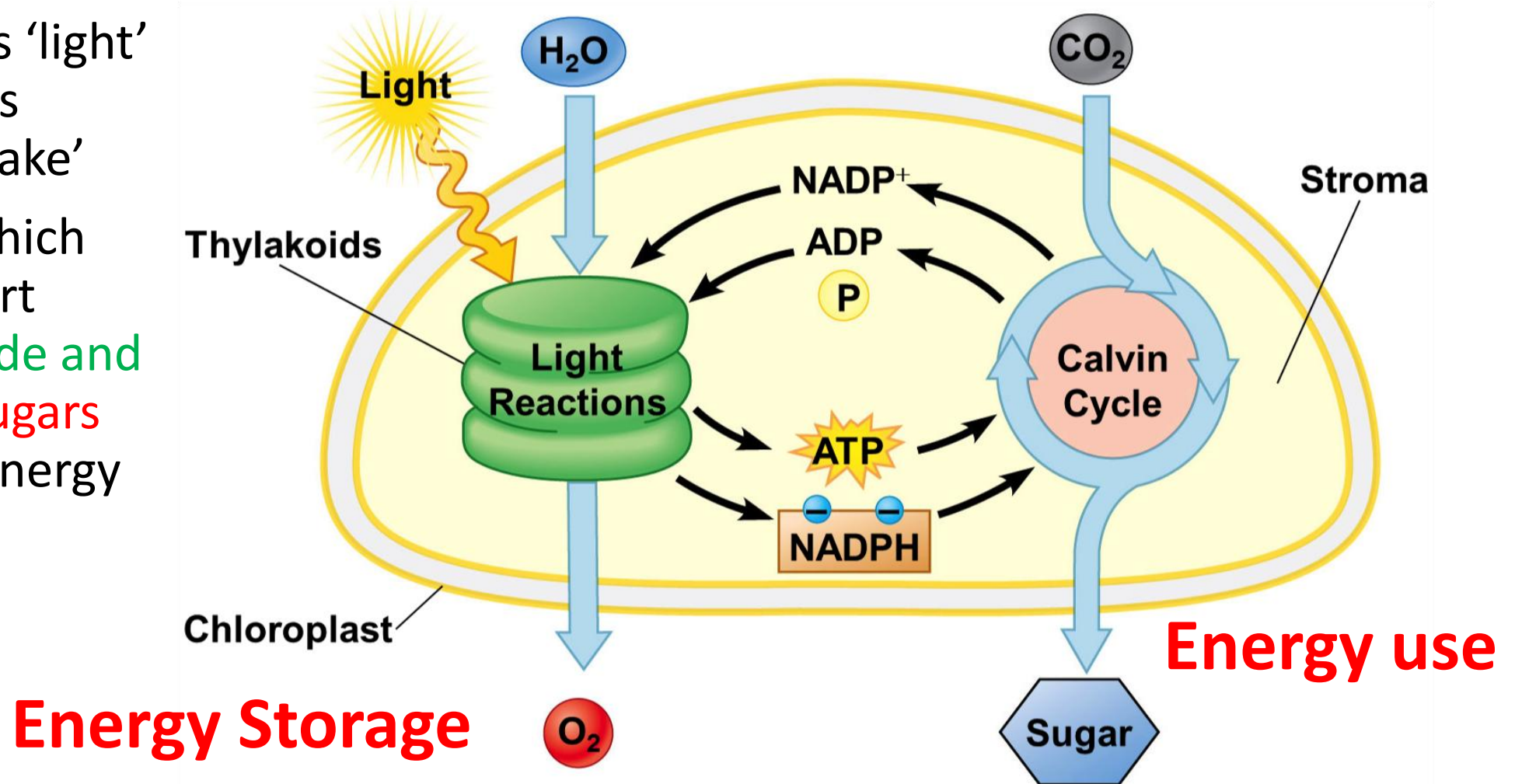
Photosynthesis

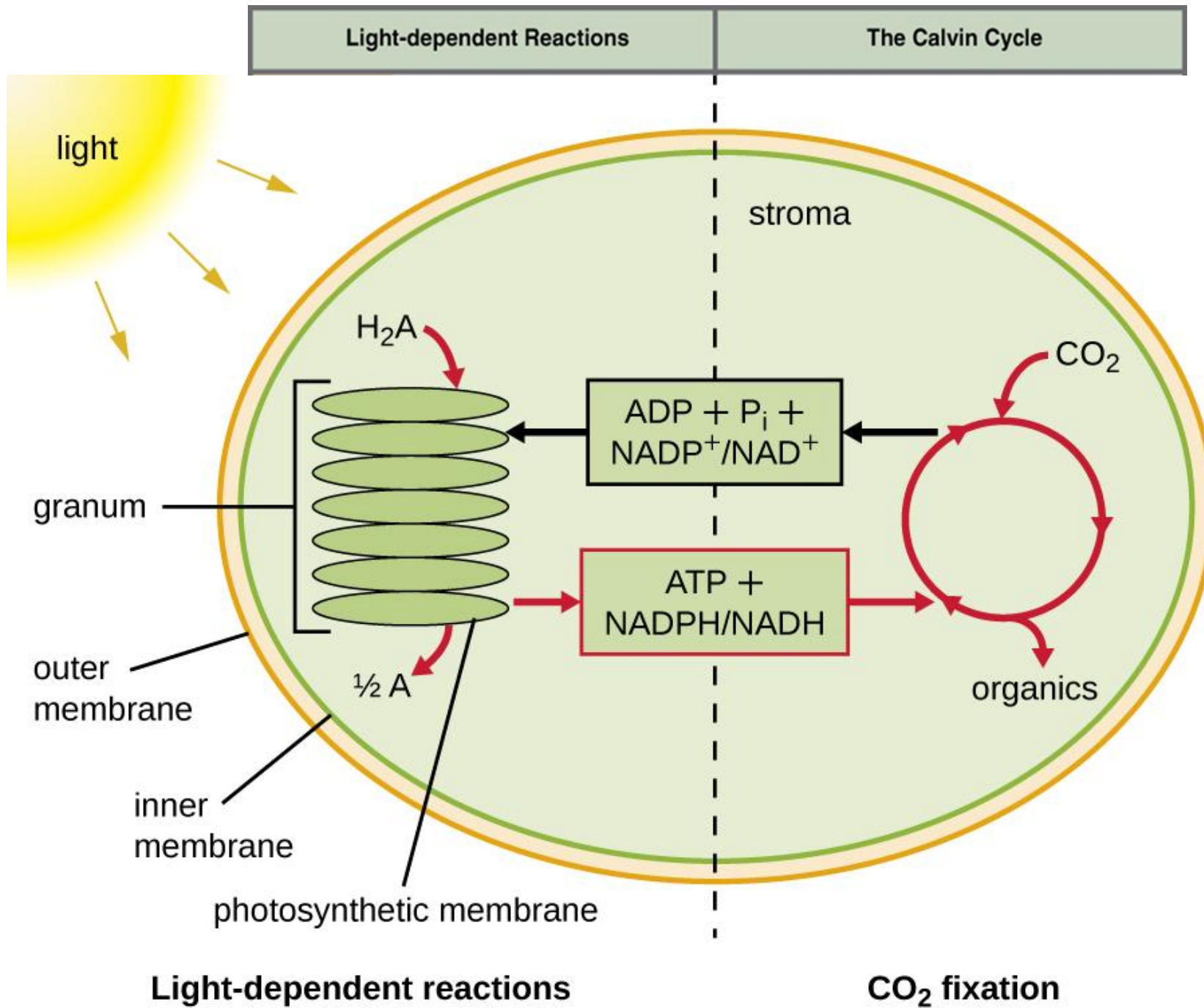
Me studying
Biology for the
first Time

Calvin And krebs Cycle

Photosynthesis

- Photo means 'light' and synthesis means 'to make'
- Process in which plants convert carbon dioxide and water into sugars using solar energy
- Occurs in chloroplast





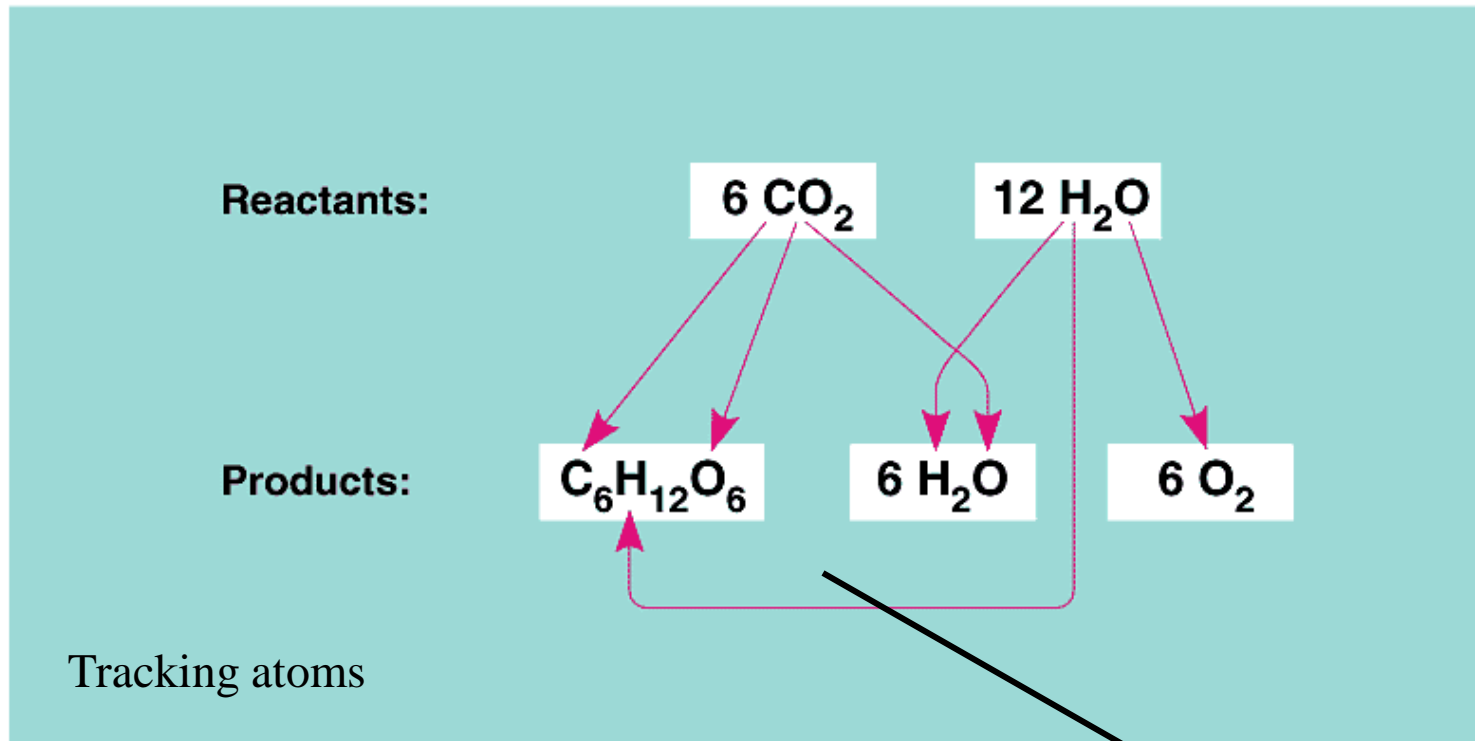
Light-dependent reactions

CO_2 fixation

Photosynthesis:



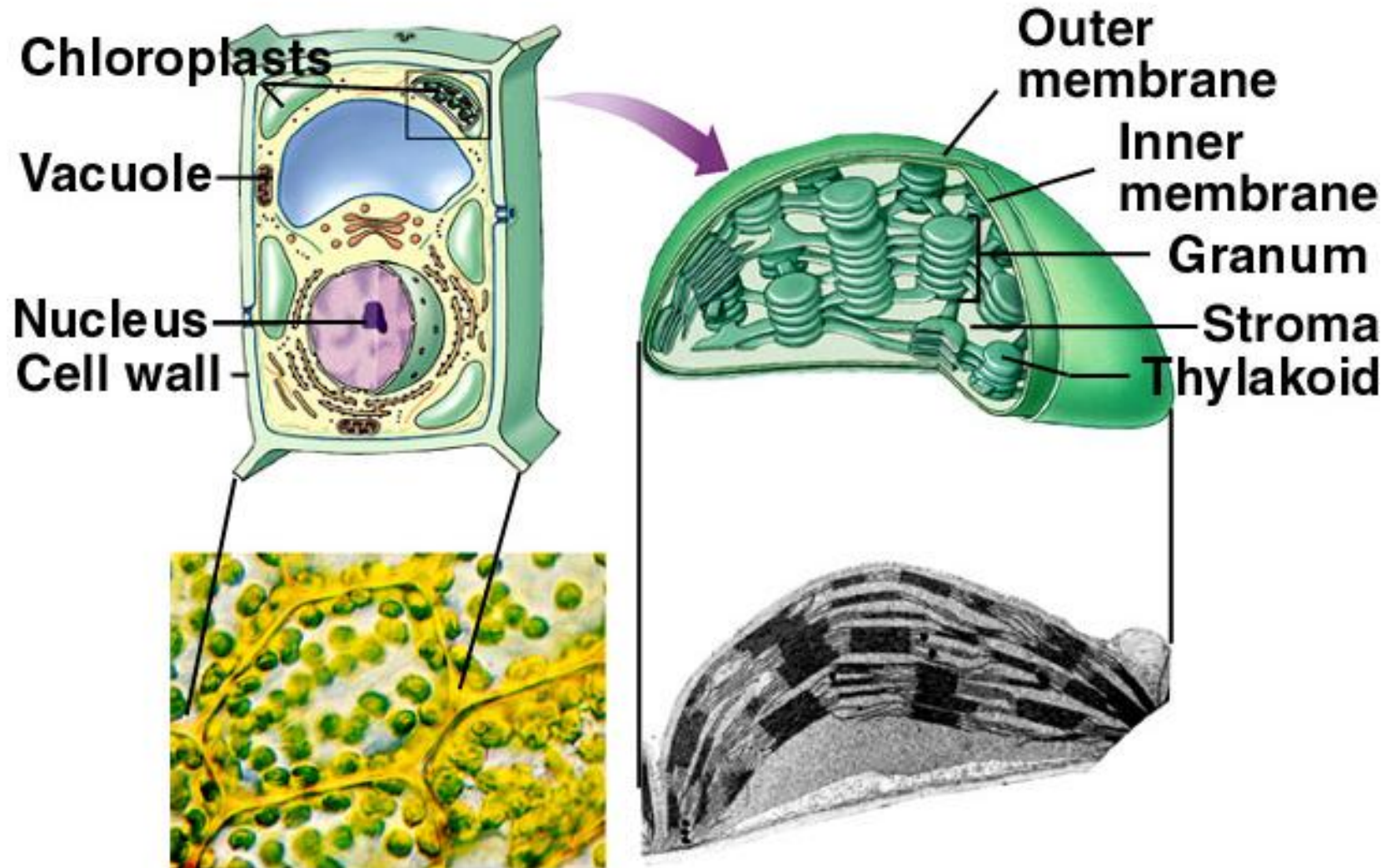
carbon dioxide + water = sugar + oxygen

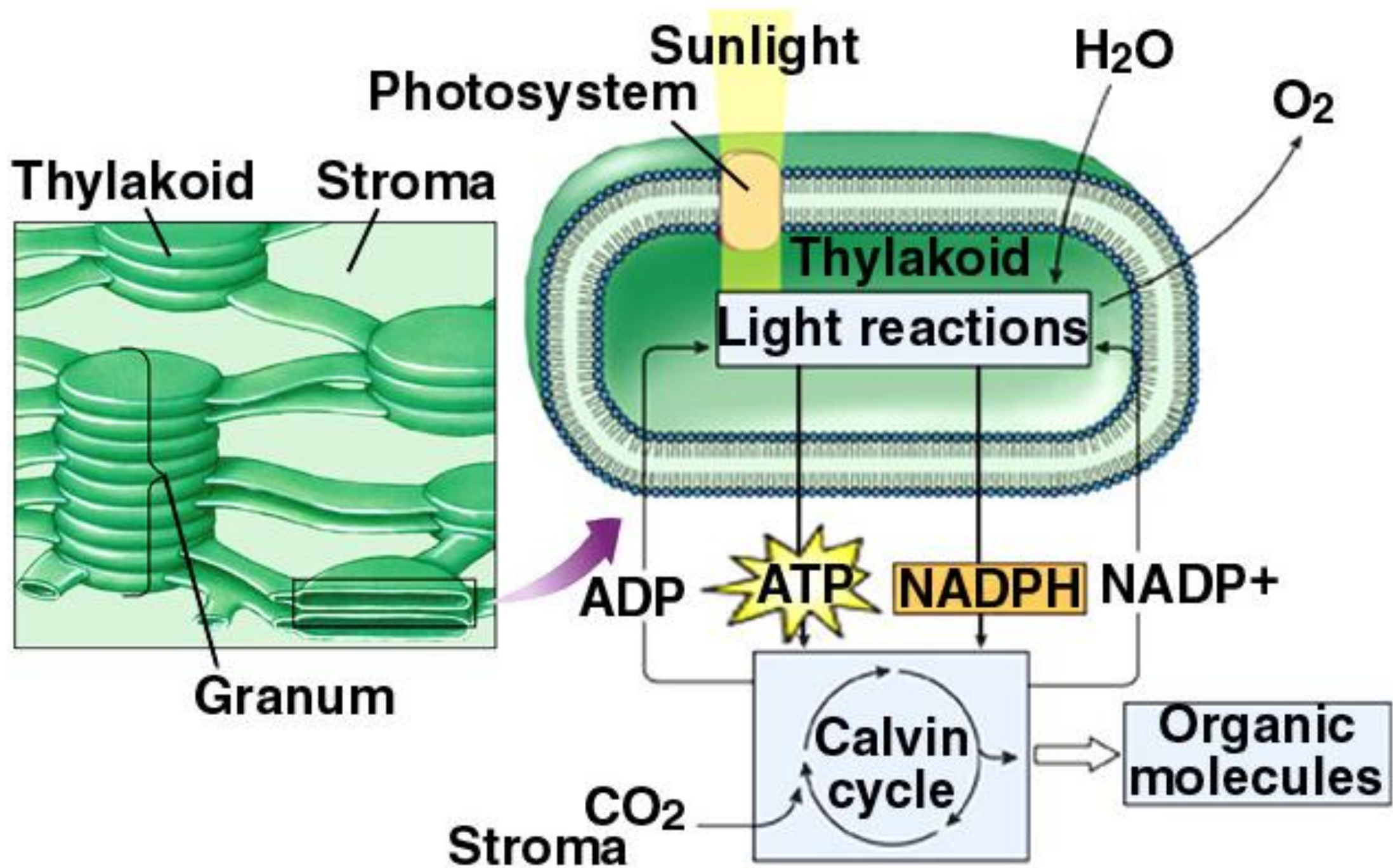


photosynthetic products often stored as starch

- Starch = glucose polymer

Physiological structure





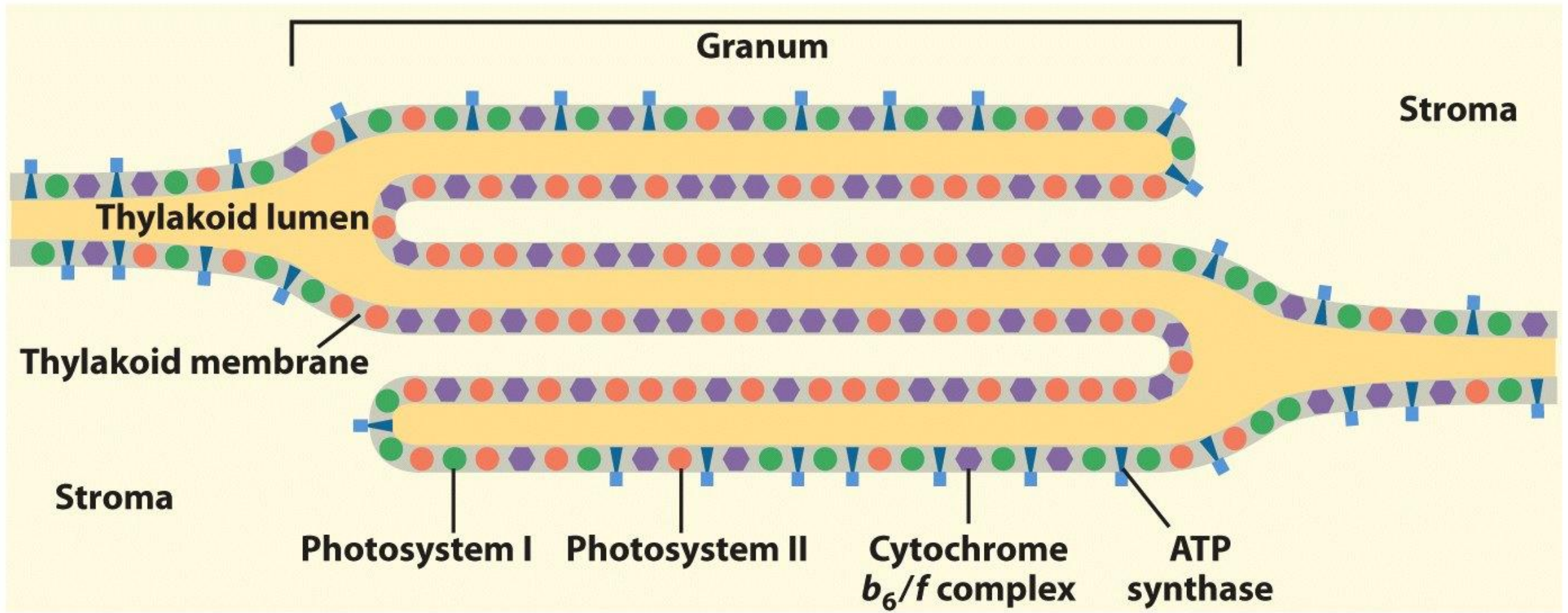


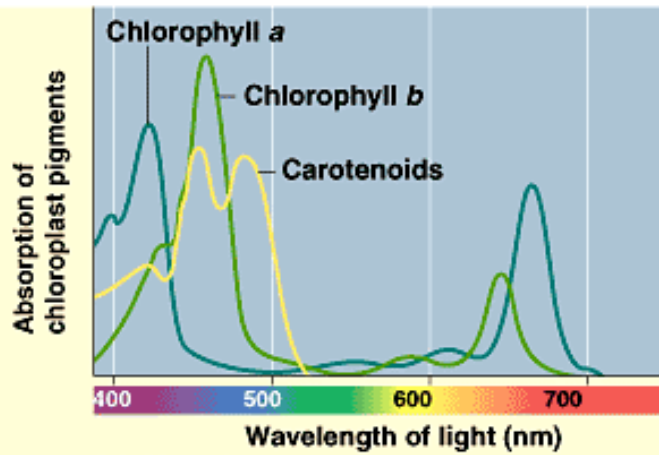
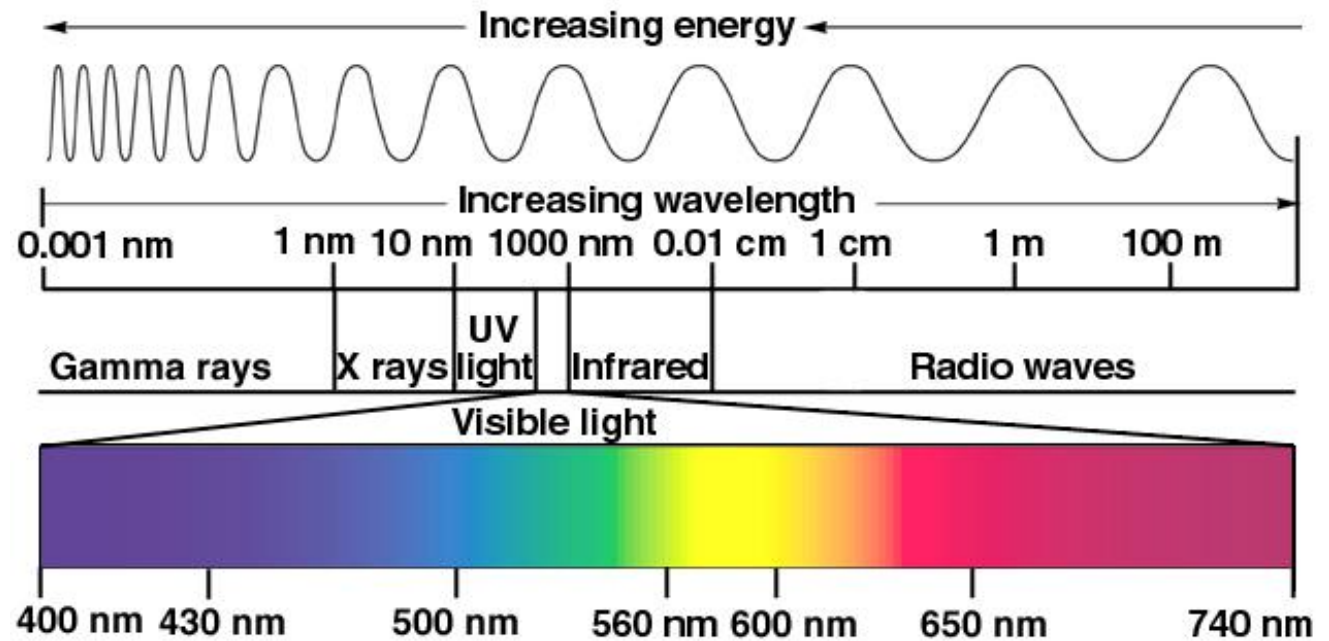
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Chlorophyll

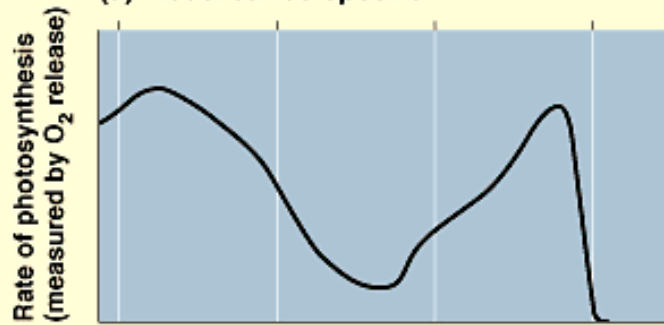
- Absorbs red & blue light
- Reflects green light

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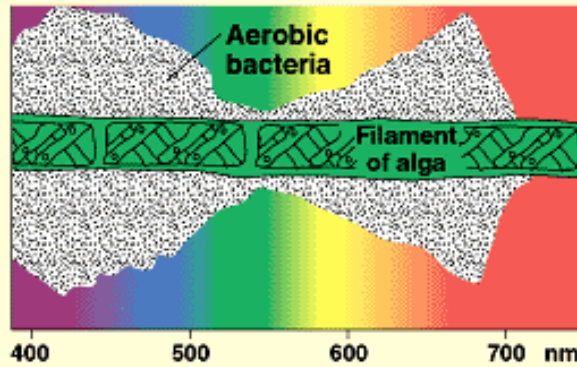
Electromagnetic Spectrum



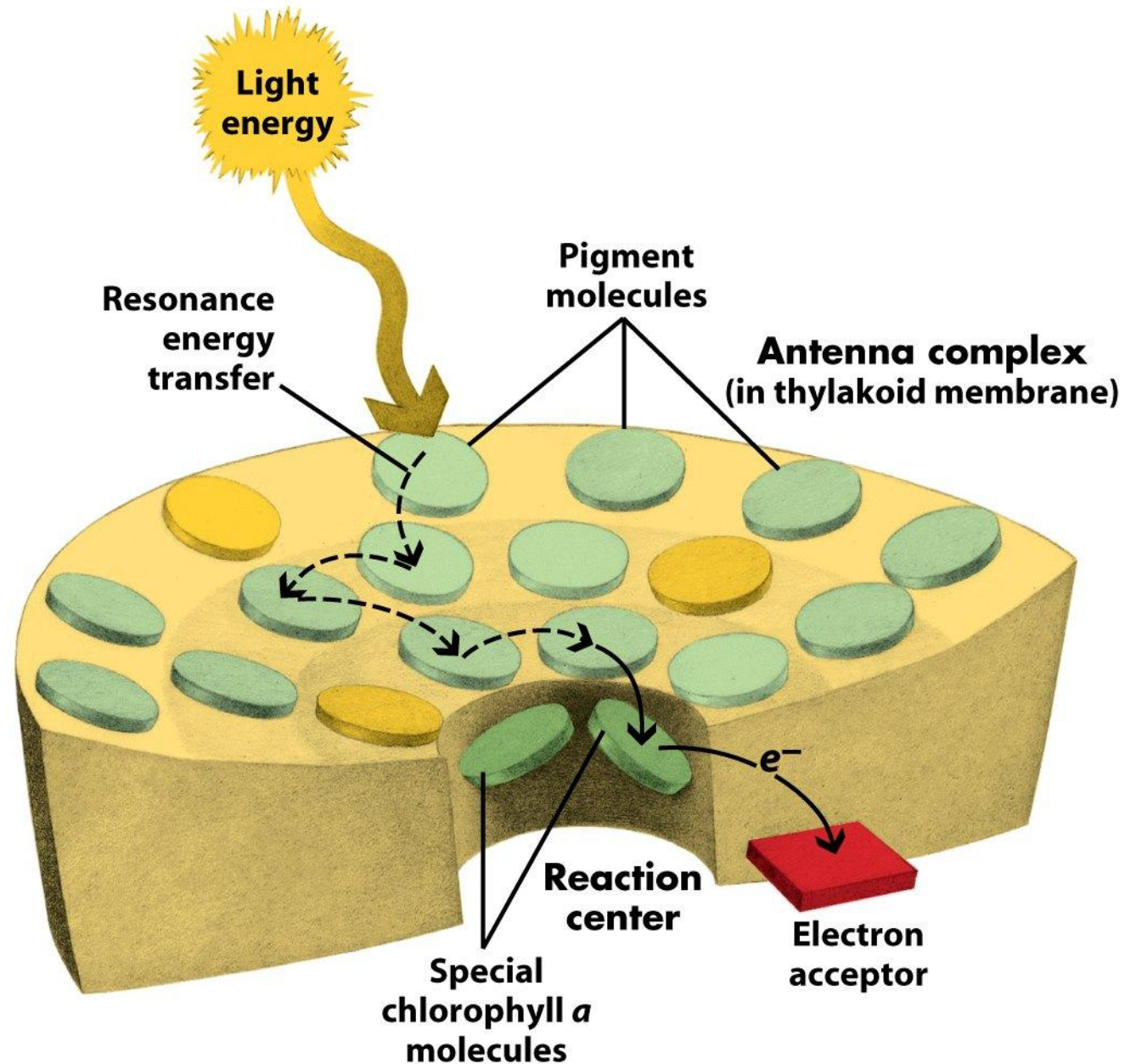
(a) Absorbance spectra



(b) Action spectrum



(c) Engelmann's experiment



Resonance energy transfer to the Reaction center

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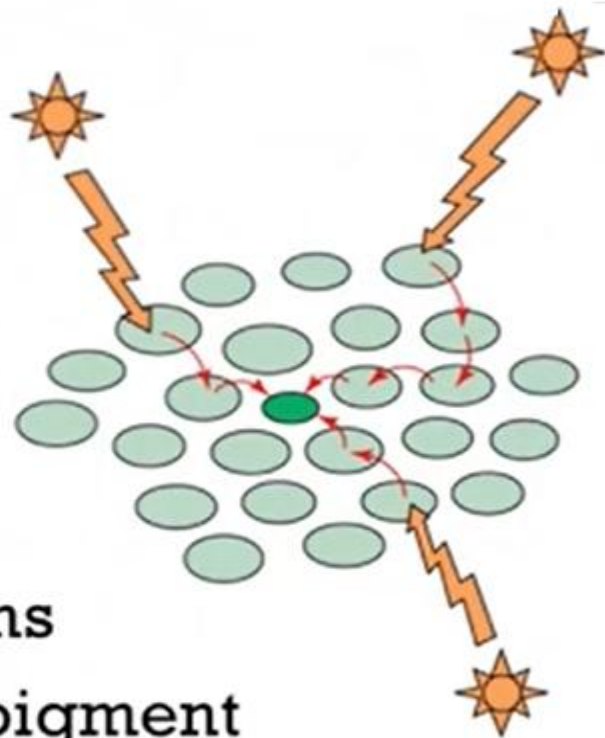
+ Light-Harvesting Complexes

■ Reaction centers

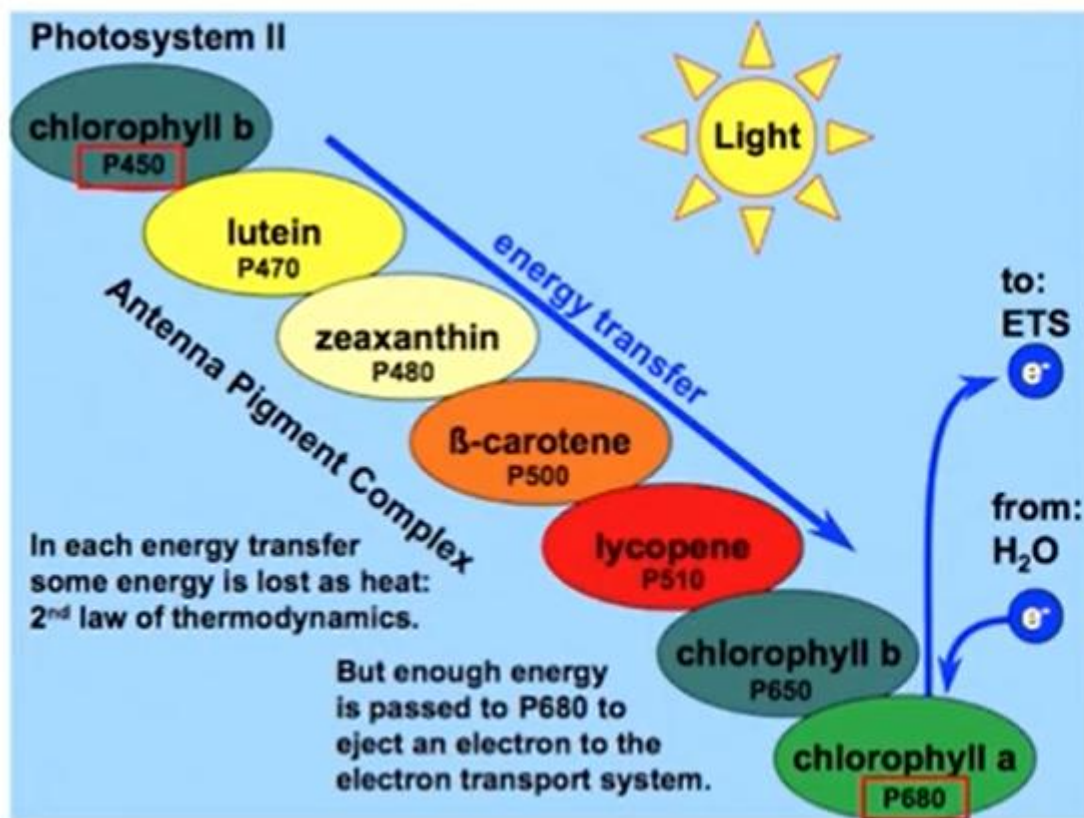
- Where photosynthesis takes place
- Contain chlorophyll molecules

■ Light-harvesting complexes

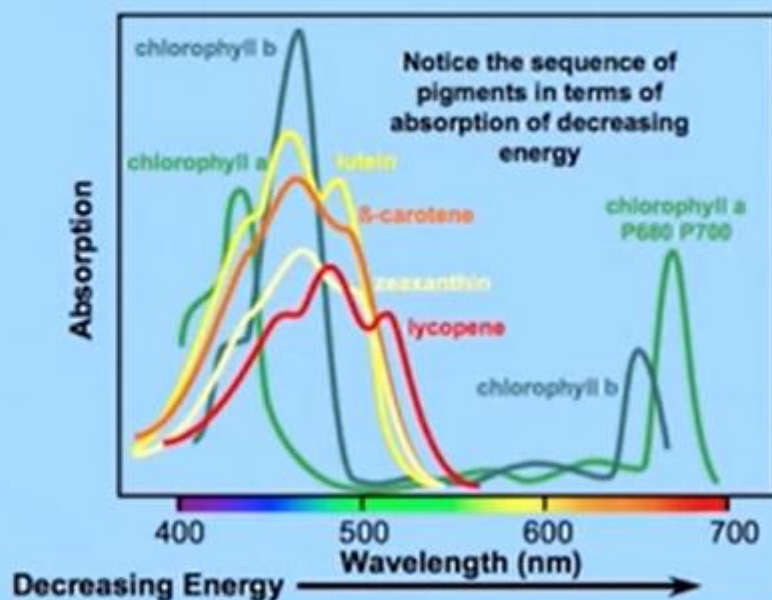
- Antenna pigments in membrane proteins
- Proteins in complex act as scaffold for pigment molecules
- Many different pigment types – absorb different λ of light
- Exciton transfer (\rightarrow) brings energy to chlorophyll at reaction center



Harvesting Light*



The photosynthetic pigments absorb much of the spectrum



Photoreceptor that absorbs higher energy (shorter) λ , transfers energy to one that absorbs lower energy (longer) λ

ATP Synthesis

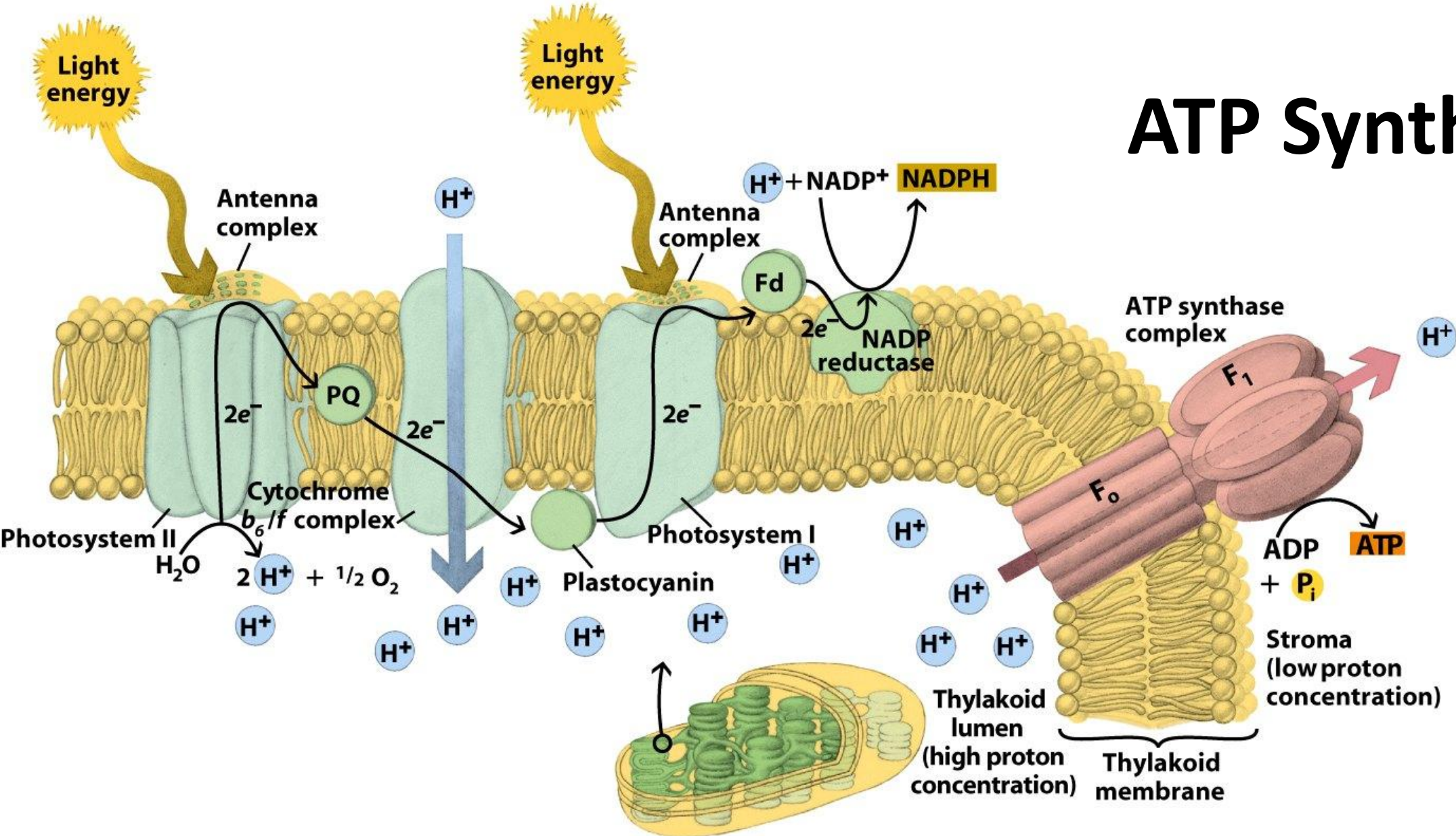
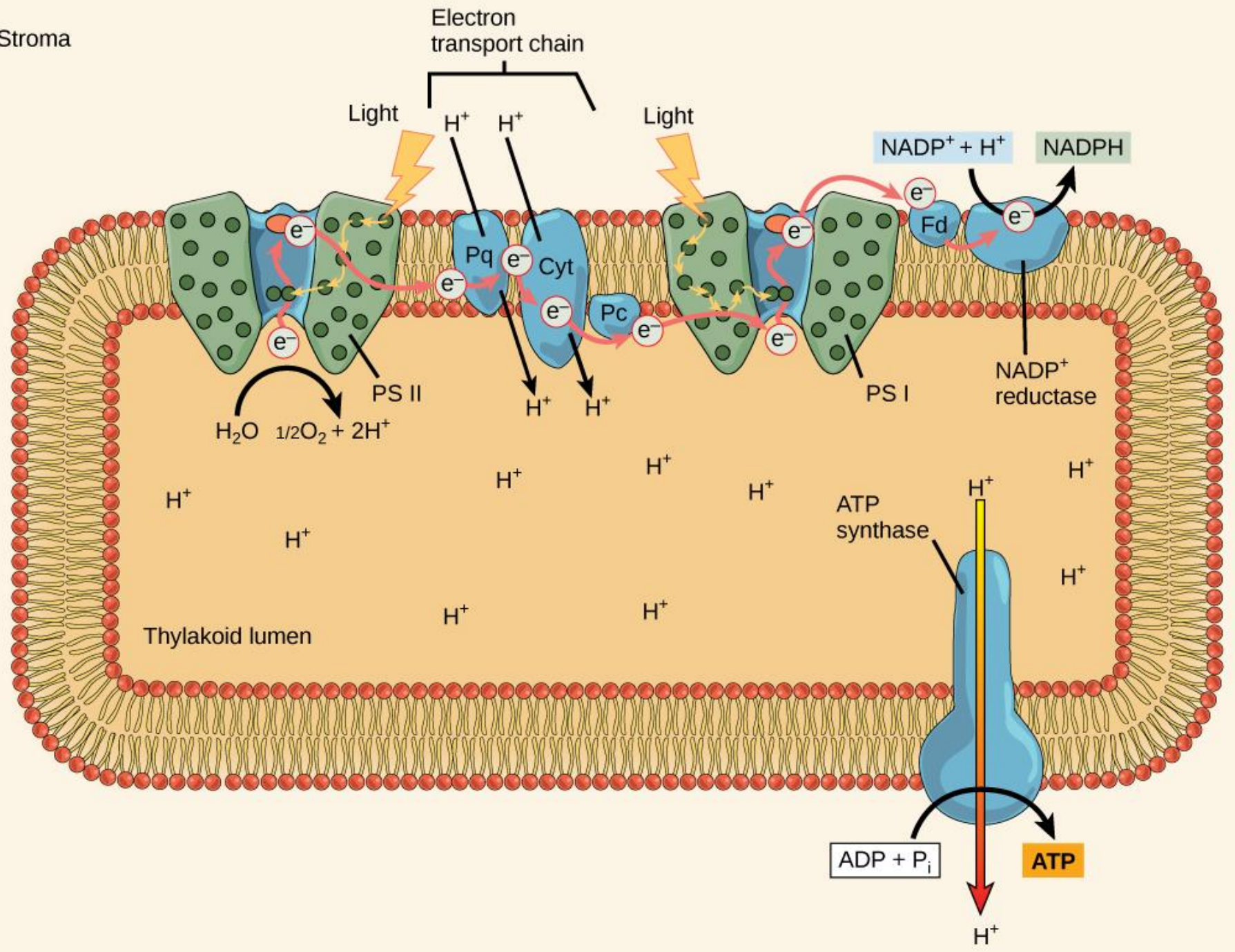
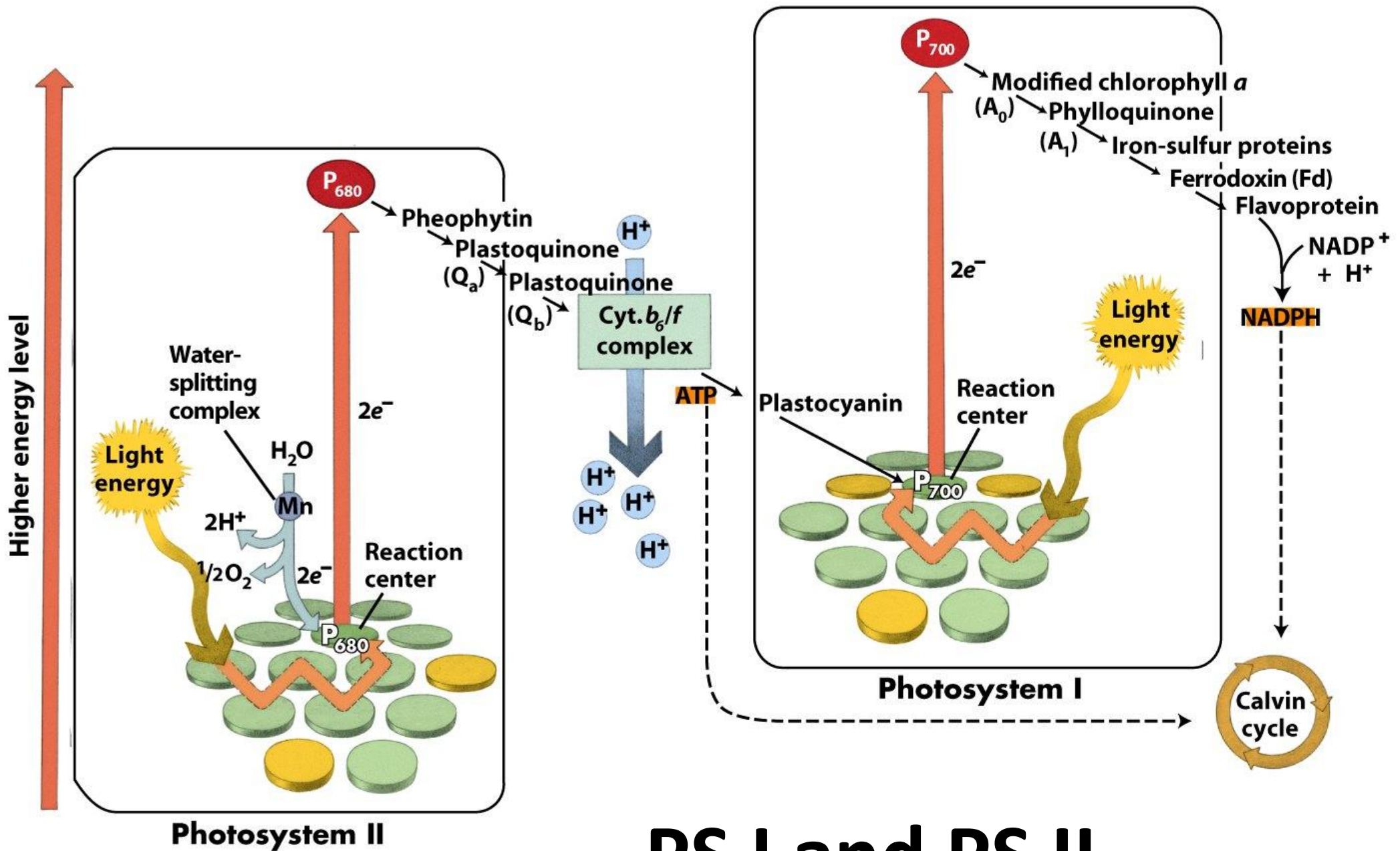


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Stroma





PS I and PS II

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Photosystem I	Photosystem II
Photolysis of water is not occurred.	It is related with photolysis of water.
Reaction center is P700.	Its reaction center is P680.
It is rich in chlorophyll A then Chlorophyll B	It is rich in chlorophyll B then Chlorophyll A
Molecular oxygen is not evolved.	Photosystem II, as a result of photolysis of water molecular oxygen is evolved.
Receive electrons from photosystem II.	Receive electrons from photolytic dissociation of water.
Pigments absorbs longer (>680nm) wavelengths of light	Pigments absorbs shorter (<680nm) wavelengths of light
In this reaction, NADPH is formed.	While in this reaction, NADPH is not formed.
It can participate in both cyclic and non-cyclic photophosphorylation.	Just participates in non-cyclic photophosphorylation.
The core complex is composed by a smaller number of protein.	The core complex is composed multi-subunit of about 25-30 sub-units.
Lies on the outer surface of thylakoid membrane	Lies on the inner surface of the thylakoids.
PS I has iron sulphur type reaction center.	PS II is a Quinone type reaction center
<u>Major function</u> is NADPH synthesis.	Its main function is hydrolysis of water and ATP synthesis.

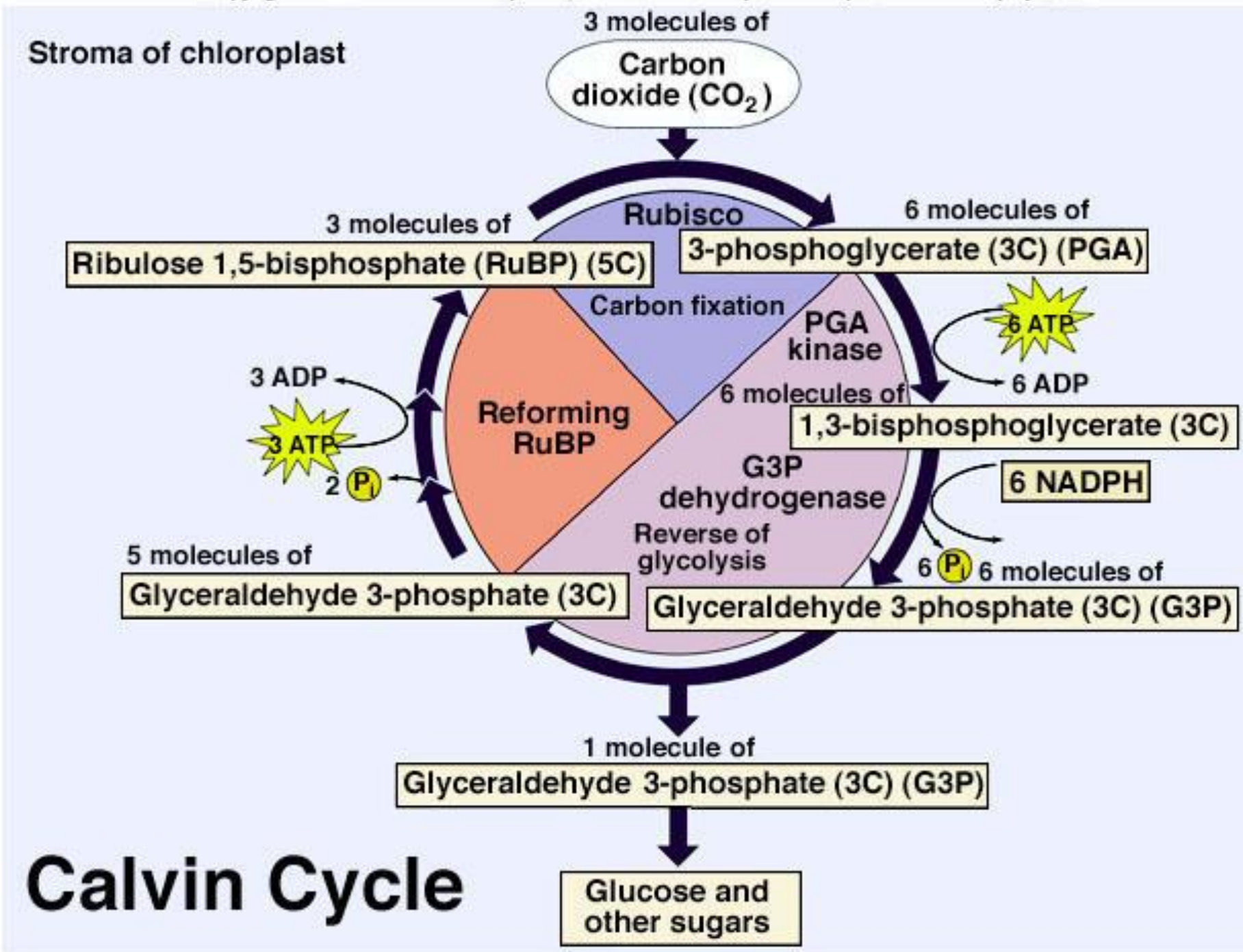
Key products of Light reaction

ATP and NADPH

ADP

Fig. 10.20

Carbon Fixation



Types of photosynthesis

- C3
 - The majority of plants
- C4
 - CO₂ temporarily stored as 4-C organic acids resulting in more efficient C exchange rate
 - **Advantage in high light, high temperature, low CO₂, low nitrogen**
 - Many grasses and crops (e.g., corn, sorghum, millet, sugar cane)
- CAM
 - Stomata open during night
 - **Advantage in arid climates**
 - Many succulents (e.g., cacti, euphorbs, bromeliades, agaves)