

1. **Pick up** Name Folder

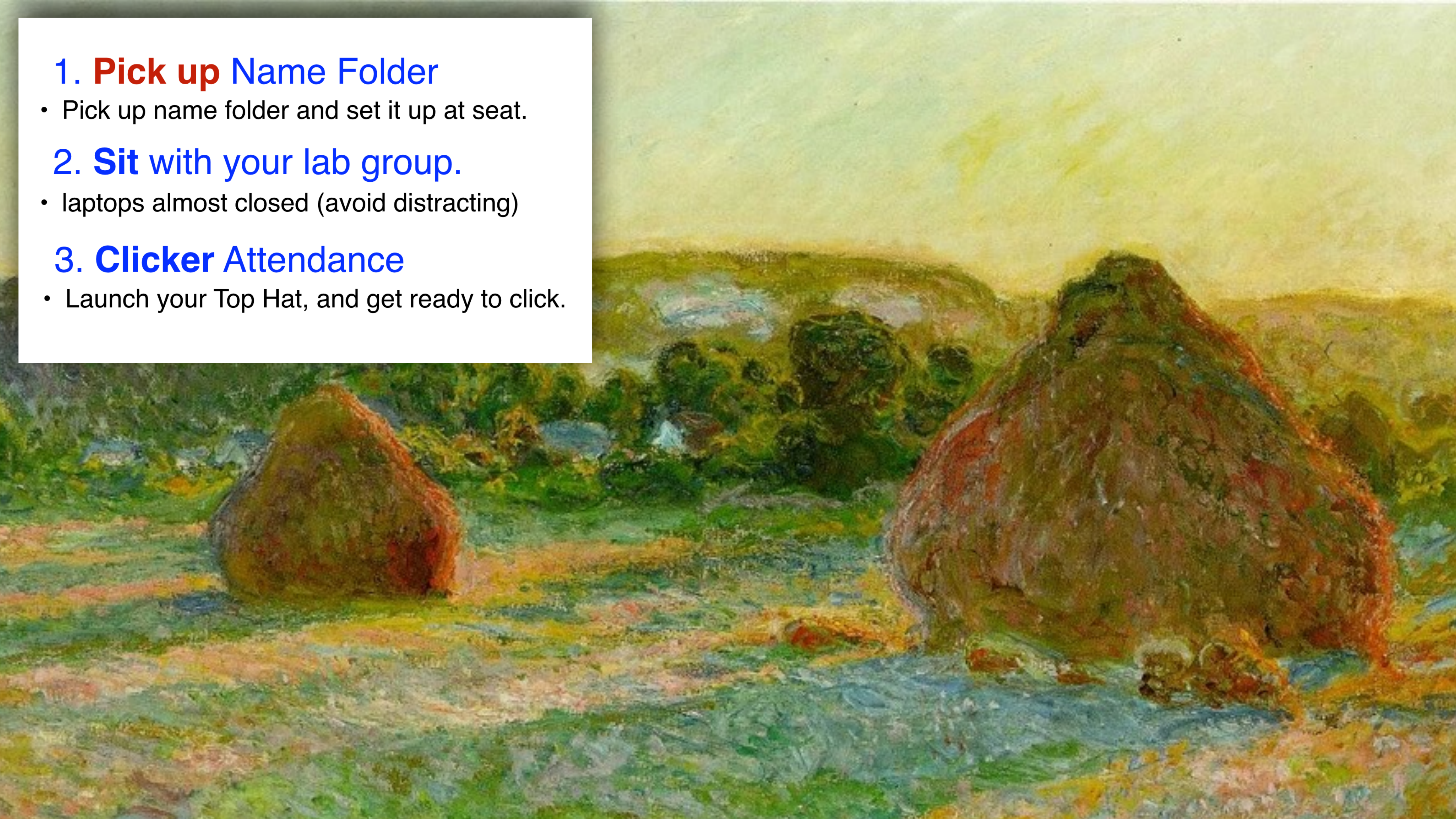
- Pick up name folder and set it up at seat.

2. **Sit** with your lab group.

- laptops almost closed (avoid distracting)

3. **Clicker** Attendance

- Launch your Top Hat, and get ready to click.



“5-minute Pop Quiz”: **Reward** for those who prepared.
(5 questions, 60 seconds each)

Origin of Oxygen Gas



Which experiment will produce $^{18}\text{O}_2$?

- a) experiment 1
- b) experiment 2
- c) both experiment 1 and experiment 2
- d) neither

Experiment 1:
 $\text{H}_2^{18}\text{O} + \text{CO}_2$



Experiment 2:
 $\text{H}_2\text{O} + \text{C}^{18}\text{O}_2$



Which of the following statements is a **correct** distinction between autotrophs and heterotrophs?

- a) Only heterotrophs require chemical compounds from the environment
- b) Cellular respiration is unique to heterotrophs
- c) Only heterotrophs have mitochondria
- d) Autotrophs, but not heterotrophs, can nourish themselves beginning with CO₂
- e) Only heterotrophs require oxygen

Question: Wavelengths of light absorbed by thylakoid pigments are mainly in what range ?

- A. Green, which is why plants are green
- B. The entire spectrum of white light
- C. The range absorbed by carotenoids
- D. Blue violet & red orange
- E. The infrared

Photosynthesis and Biomass



The biomass (dry weight) of a tree comes primarily from

- a) soil.
- b) water.
- c) air.
- d) organic fertilizer (manure, detritus).
- e) light.

Question: Which process is most *directly* driven by light energy?

- A. creation of a pH gradient by pumping protons
- B. carbon fixation in the stroma
- C. reduction of NADP⁺ molecules
- D. removal of electrons from chlorophyll molecules
- E. ATP synthesis

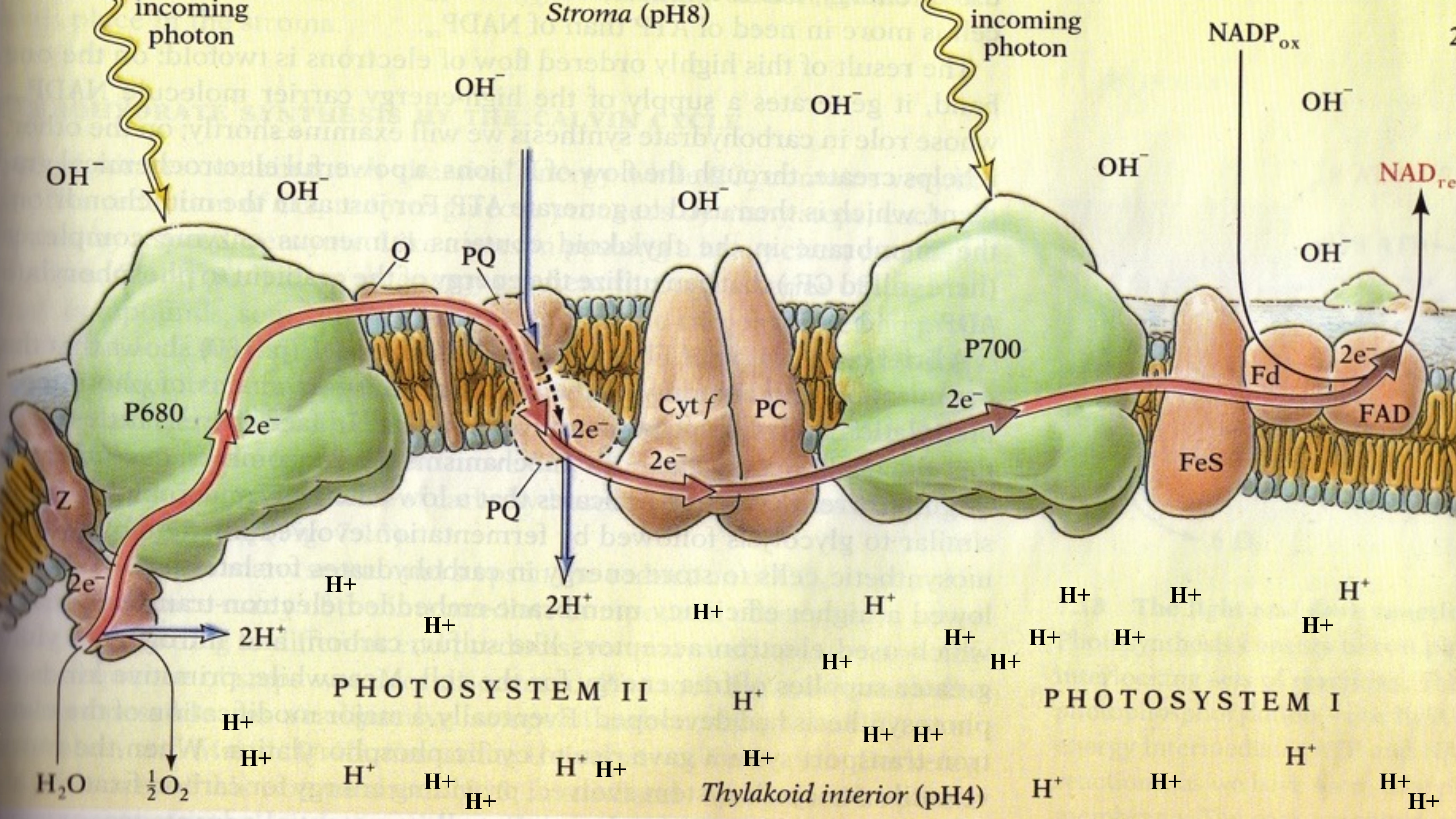
“5-minute Pop Quiz”: **Reward** for those who prepared.
(NOW OVER)

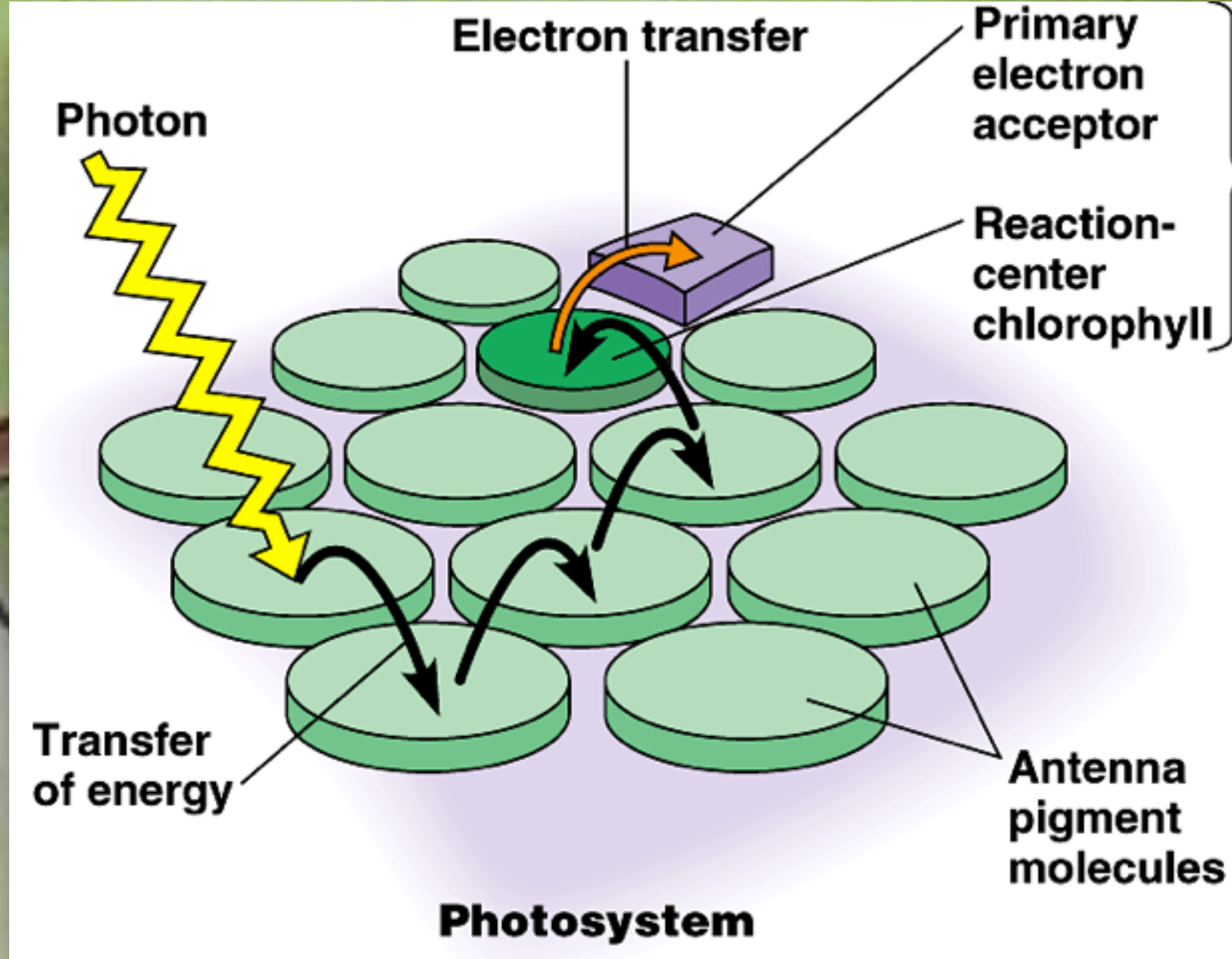
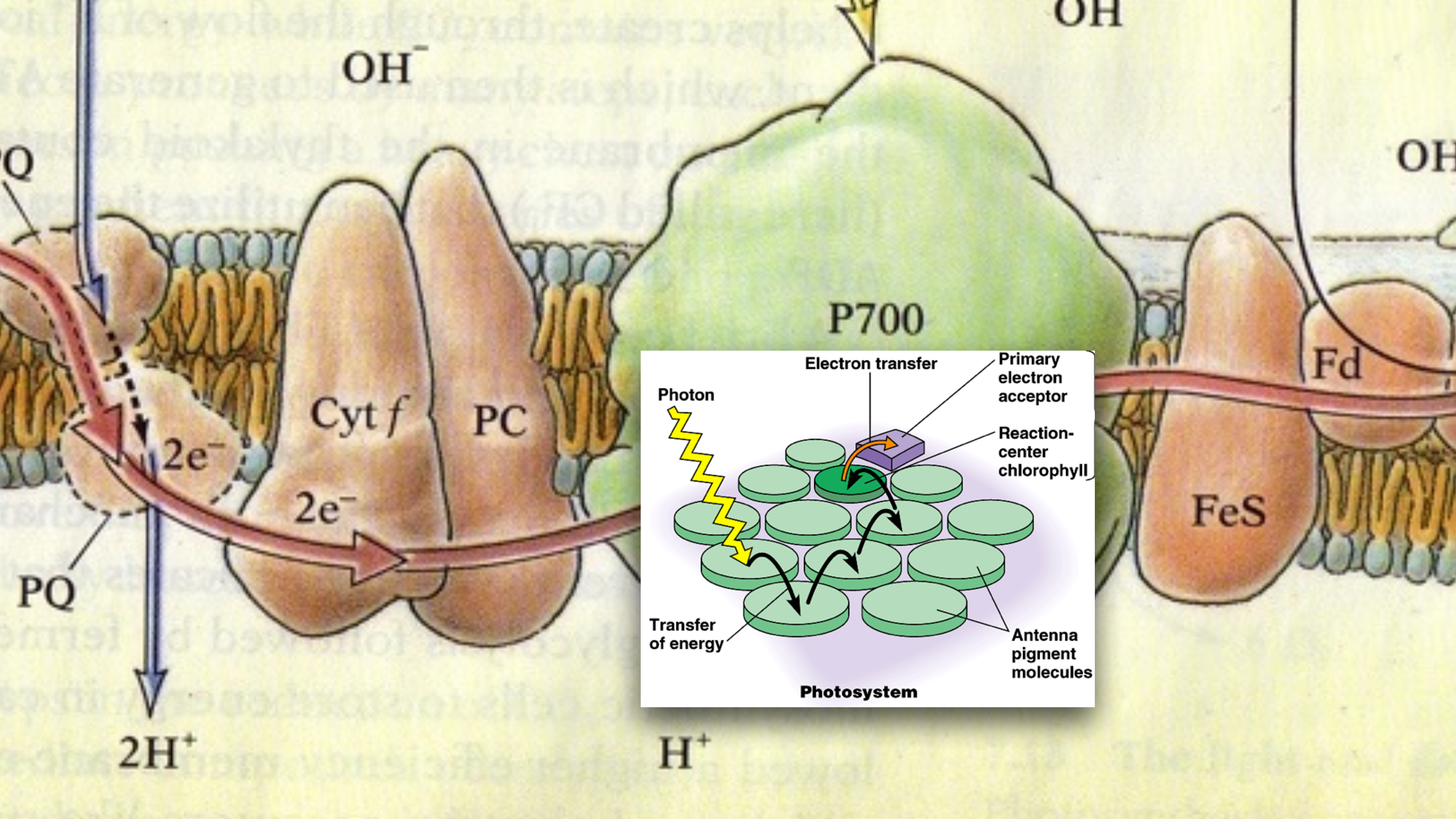
Laptops closed (unless TopHat)

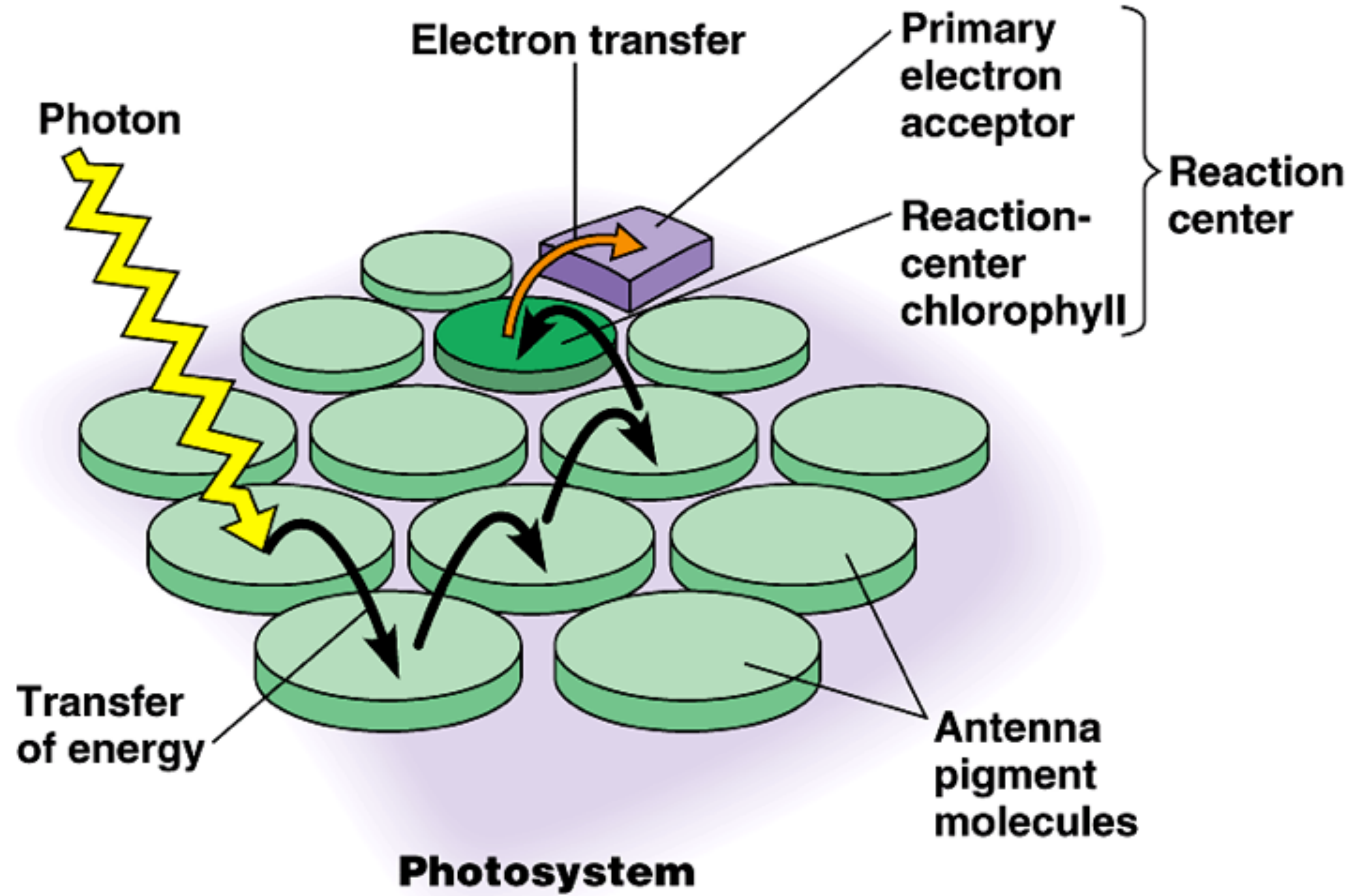


The image is a painting of a landscape. In the foreground, there are two large, rounded, reddish-brown mounds, possibly haystacks or haystacks, one on the left and one on the right. The ground is a mix of green, yellow, and brown, suggesting grass and earth. In the background, there is a hazy, greenish landscape with rolling hills or mountains. The sky is a pale, yellowish-green color. The overall style is impressionistic, with visible brushstrokes and a focus on color and light.

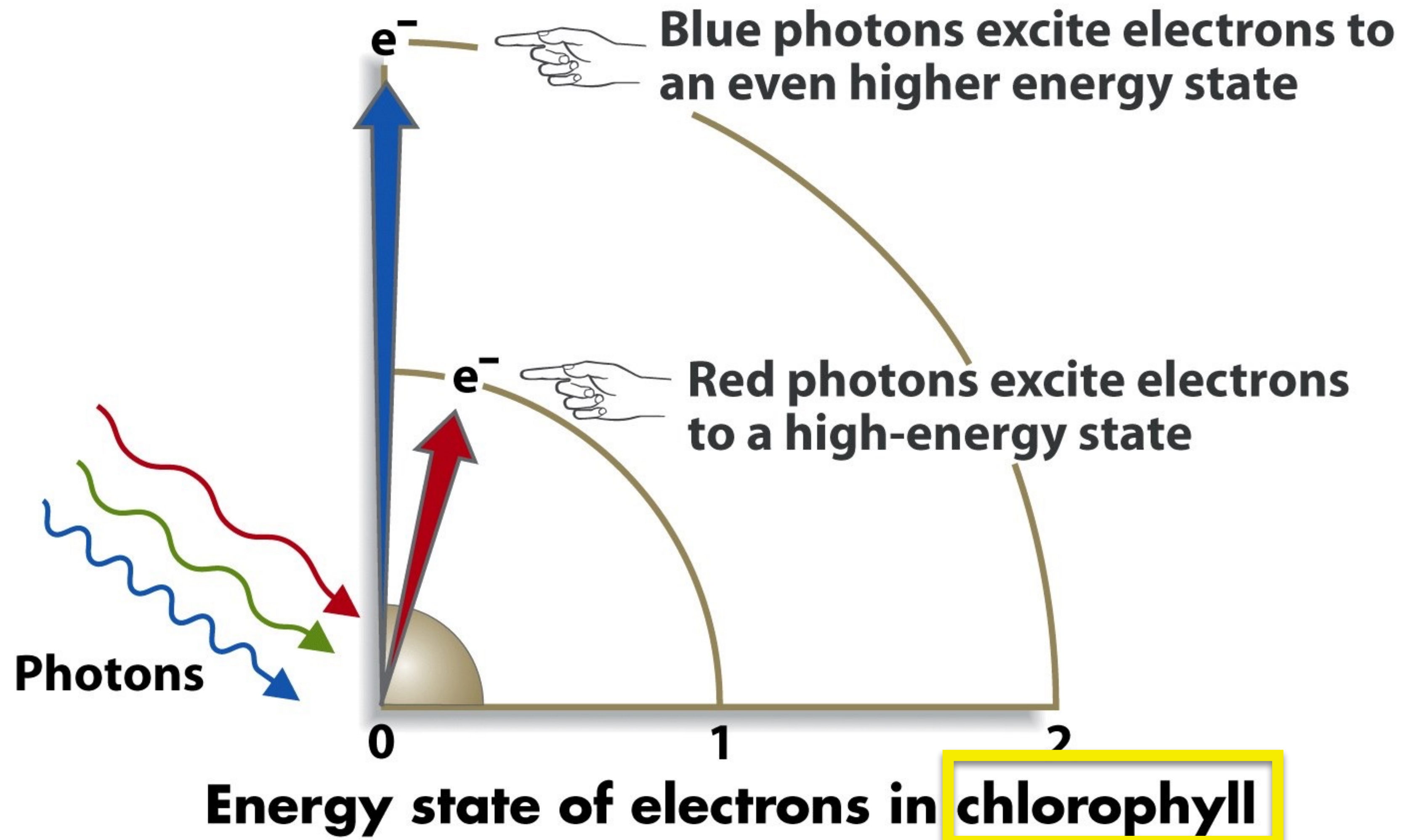
The verbal final



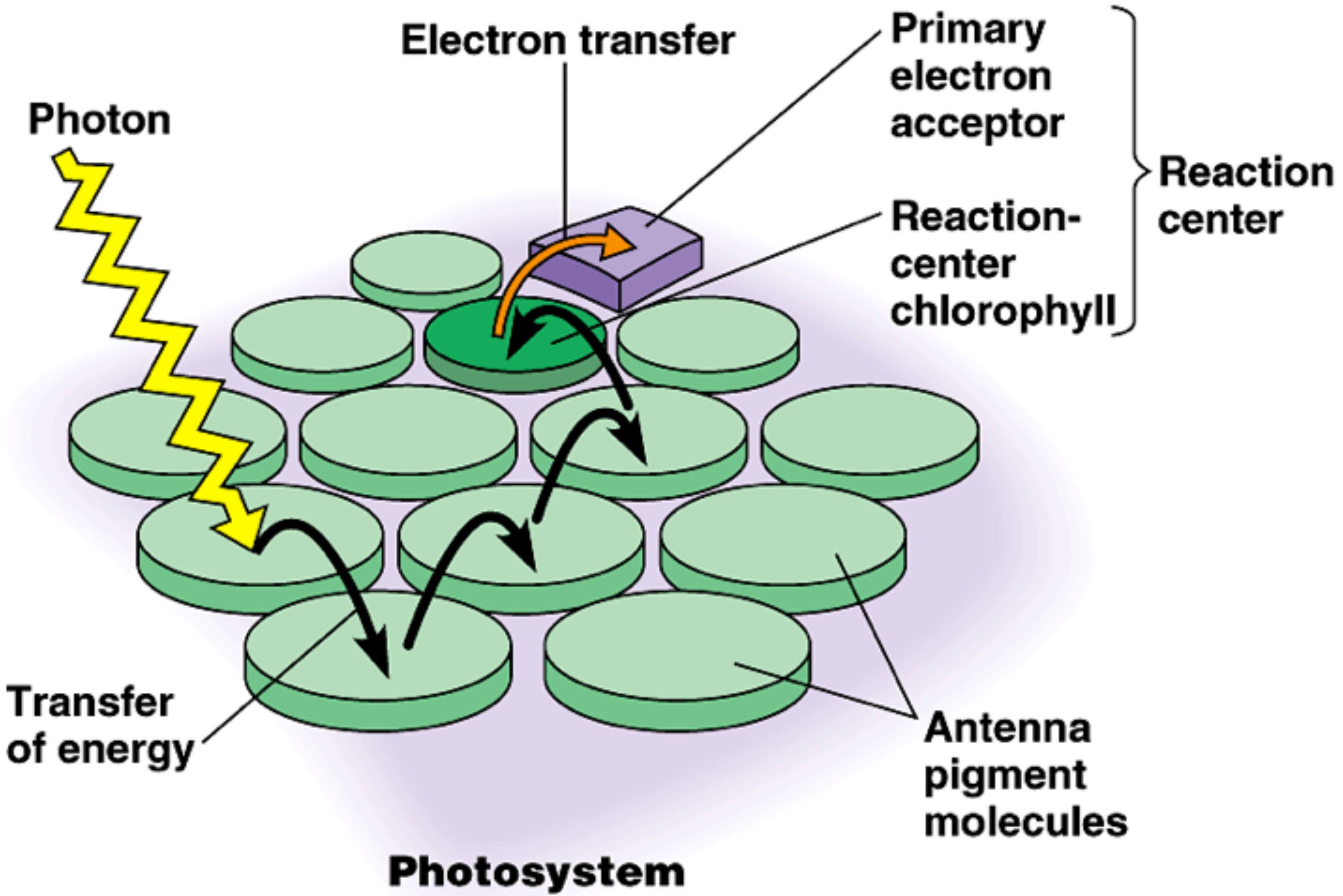




When Light Is Absorbed, Electrons Enter an Excited State



Time to capture photons (photosystem football)





8.2 The Light-Dependent Reactions of Photosynthesis

Summa

- Ex
- De
- Describe how and where photosynthesis takes place within a plant

How do chloroplasts function?
(a deep dive into one organelle)

Biology Learning Objective

How
can
pho

- Build knowledge of the processes used by chloroplasts when functioning (photosynthesis).
- How do photons that depart the sun and strike the earth get converted to chemical energy (ATP, CHO) that is the source of all life.

ght



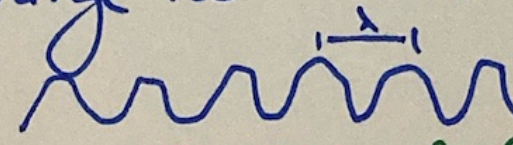
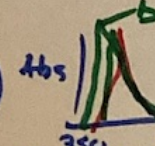
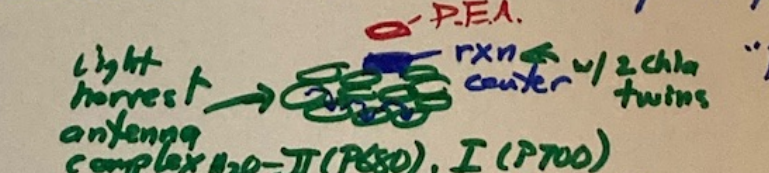
Week 4

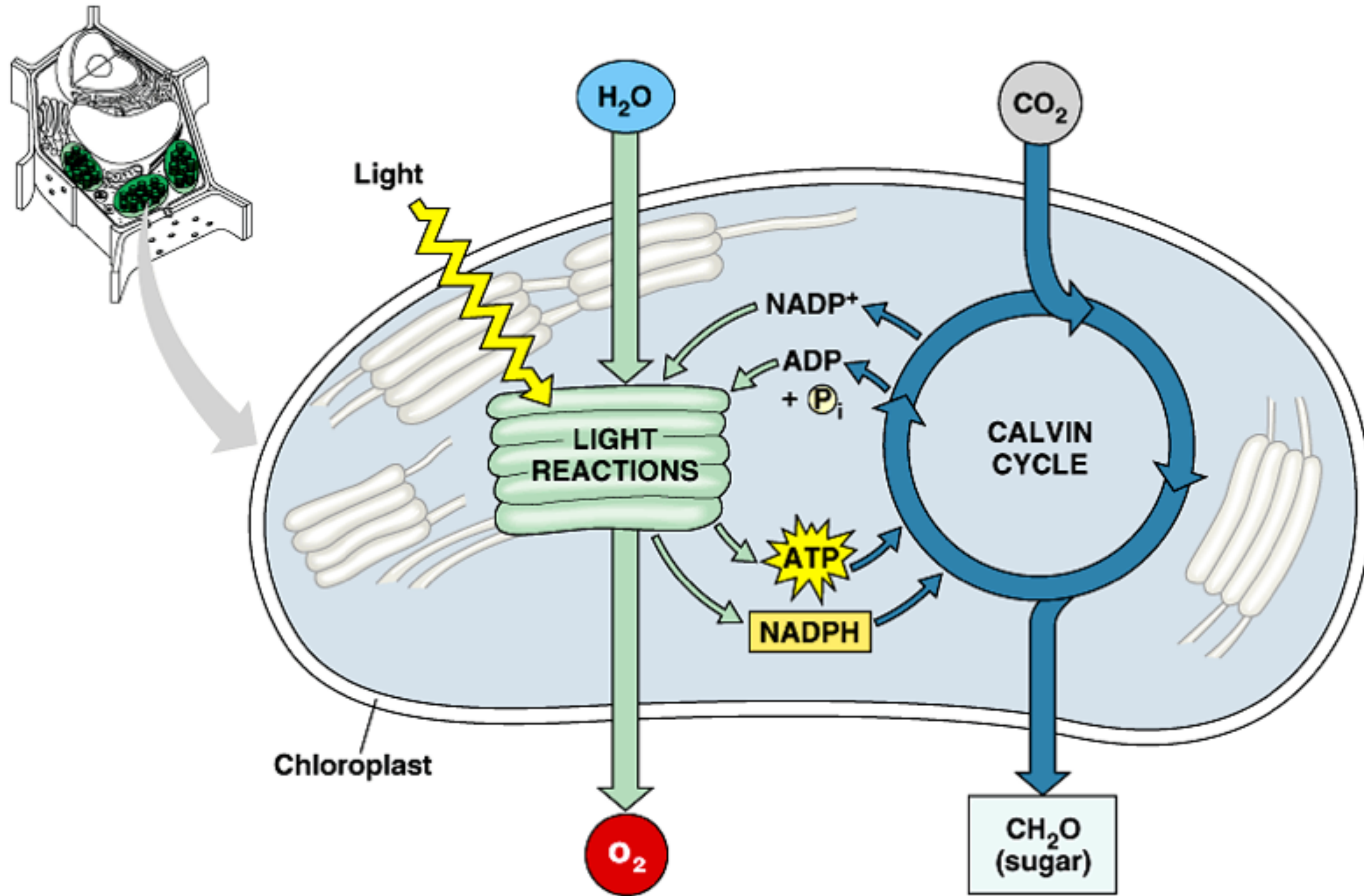
(Preparing for) **Monday's lecture:**

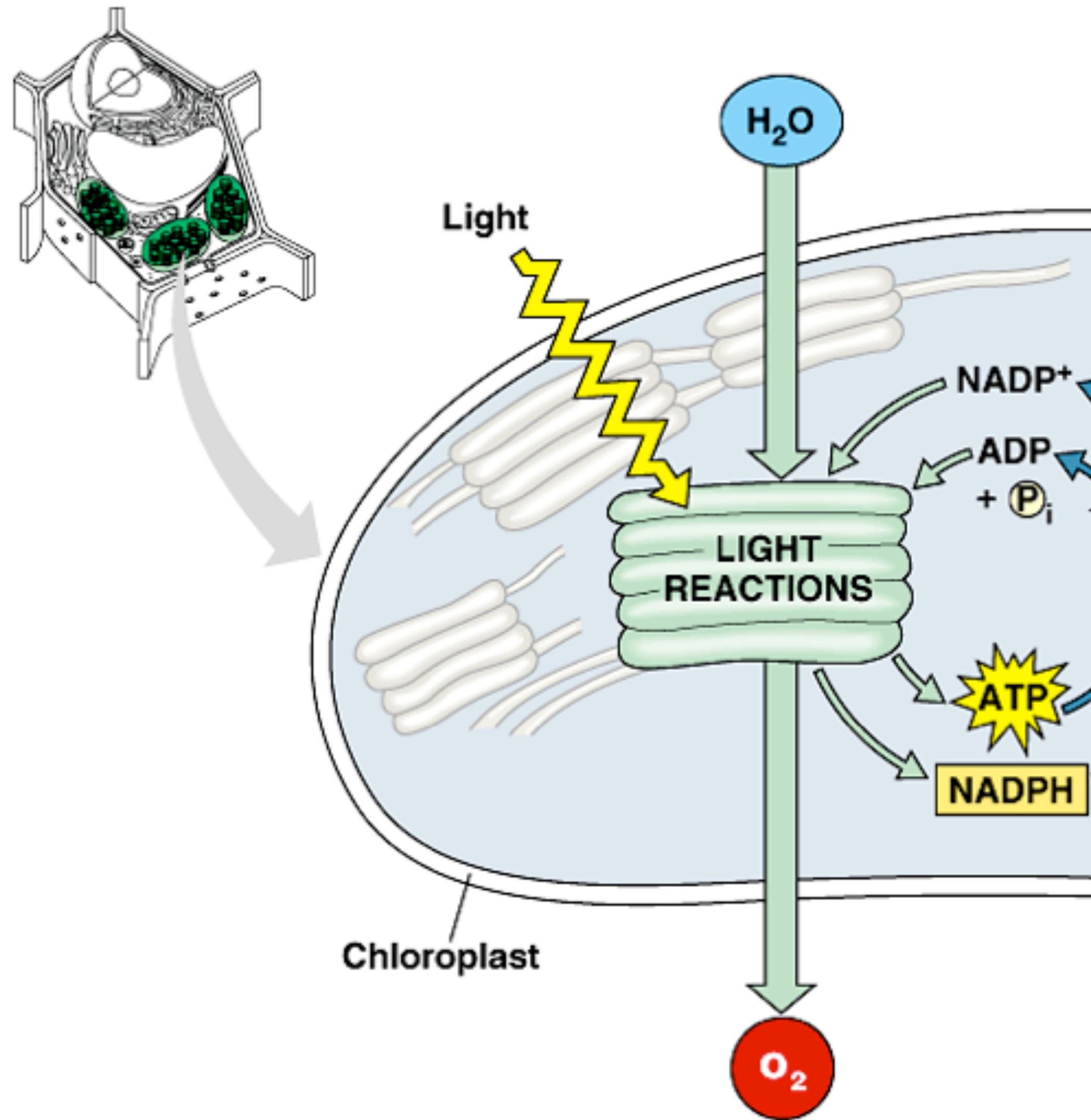
Budgeting homework time (60 min): Photosynthesis (OSB) section 8.2 is 2603 words in length, but has quite a few figures. This should take 13 minutes if you just read it. But when done properly, when you pause to review figures and take careful notes, this assignment should take you more like 60 minutes.

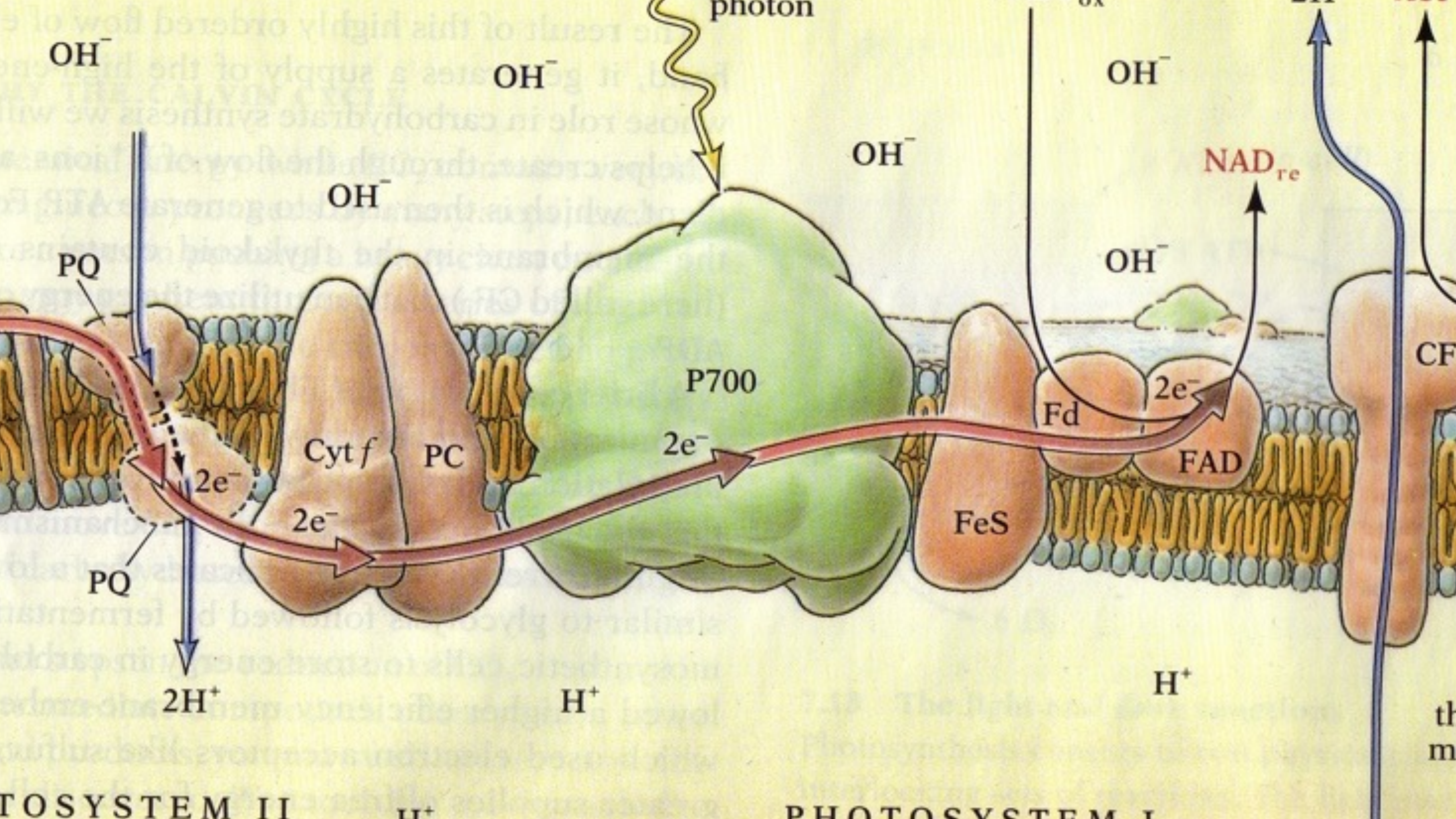
1. _____ **For Monday's lecture**, in the chapter Photosynthesis (OSB) read section 8.2 "The Light-Dependent Reactions of Photosynthesis" and as you read it on your computer be sure to take handwritten notes in your lecture notebook.
2. _____ (Tip): While you are reading focus mostly and take notes regarding **Figures 5, 7, and 8**. We will discuss these in class.
3. _____ **Advanced:** Take a peek at section 8.3, in particular study Figure 1. Take a sneak peek at "Chapter 11: Photosynthesis", section 11.1, study Figures 11.2 and 11.3.

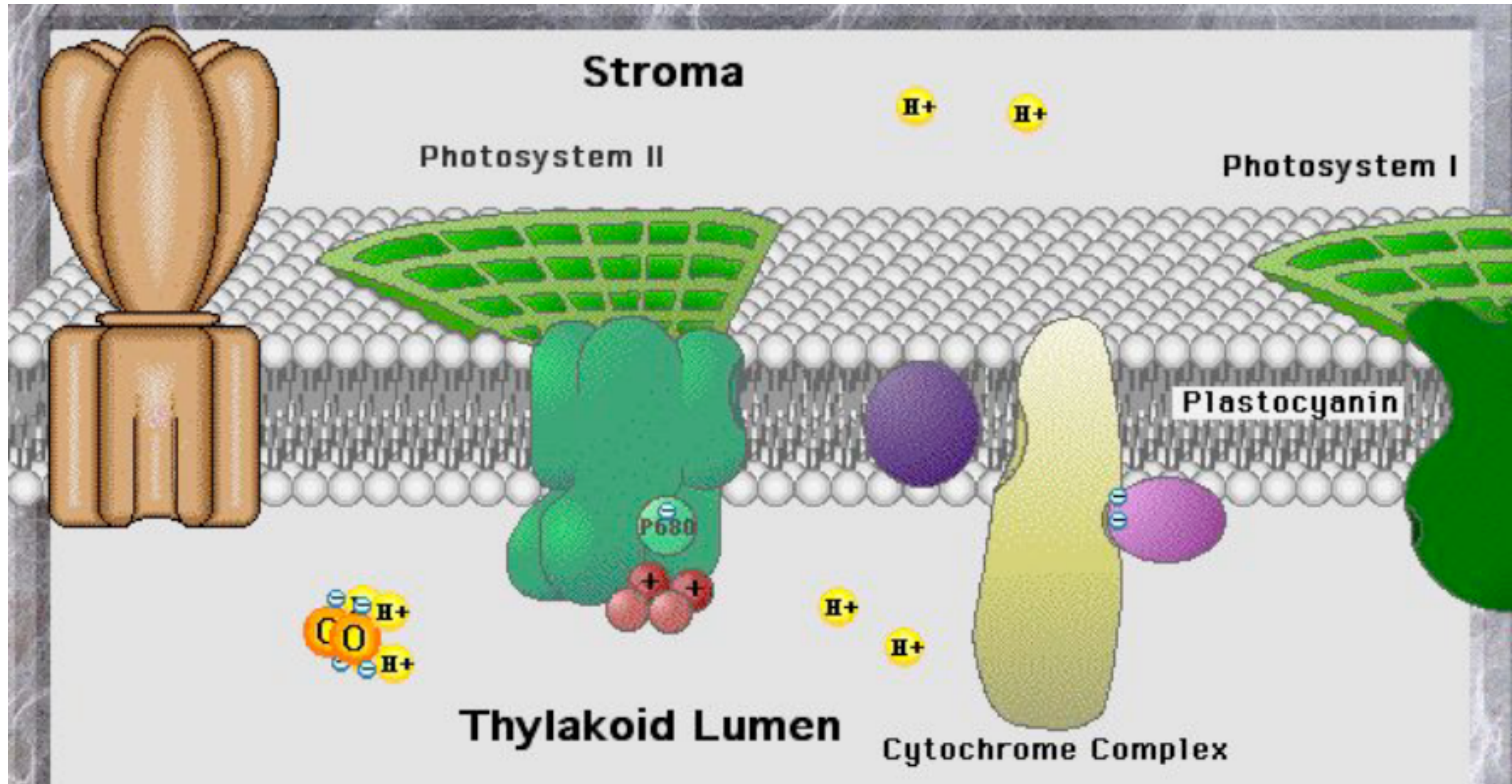
*focus**

4 - lecture 1-30-23 Photosynthesis (OSB)
The Light-dependent rxns of PHS
 by L.O.s textbook says "chloroplast" means
 How Plants absorb energy from sunlight
 be short + long wavelengths of light
 be how + where PHS takes place within a plant.
 light → travel → change form → do work
 converts light E into chemical E. → photoautotrophs b
 yet can only capture narrow range of light/electromagnet
 humans/retina can detect narrow range too "visible" 1
 wavelength anatomy/terminology 
 EM spectrum (tiny most E!) gamma rays → X-rays → UV → Visible → IR → radio
 (Blue, Green, Red) "visible" radiation - for plants
 pigments absorb light (if) E of light photon = distance to av
 ↳ if cannot absorb wavelength/color they reflect it - and it we think
 chlorophylls (a, b, ...) + carotenoids → classes of PHS pigments
 tomato, corn, orange, carrot → help "dispose of excess" ene
 EM spectrum (visible) 
 Pigment structure + absorbance wavelengths (graph) ⁴⁰⁰ ₃₅₀
 → use spectrophotometer to determine wavelengths pigment can a
 rxns work 
 Light harvest → antenna complex → rxn center w/ 2 chl a "photoact" rxn loses it's
 complex II (P680), I (P700) - P.E.A.
 illustration of how each any photo system (green ice berg) we
 300-400 pigments → transfer on energy
 - Photosystems in membrane w/ electron carriers + NADP
 H₂O split to provide e⁻ ETC (electron transport chain) +
 PSI re-energizes the e⁻ and sends it to NADPH.
 Also H⁺'s are consumed + moved creating BIG gradient → A



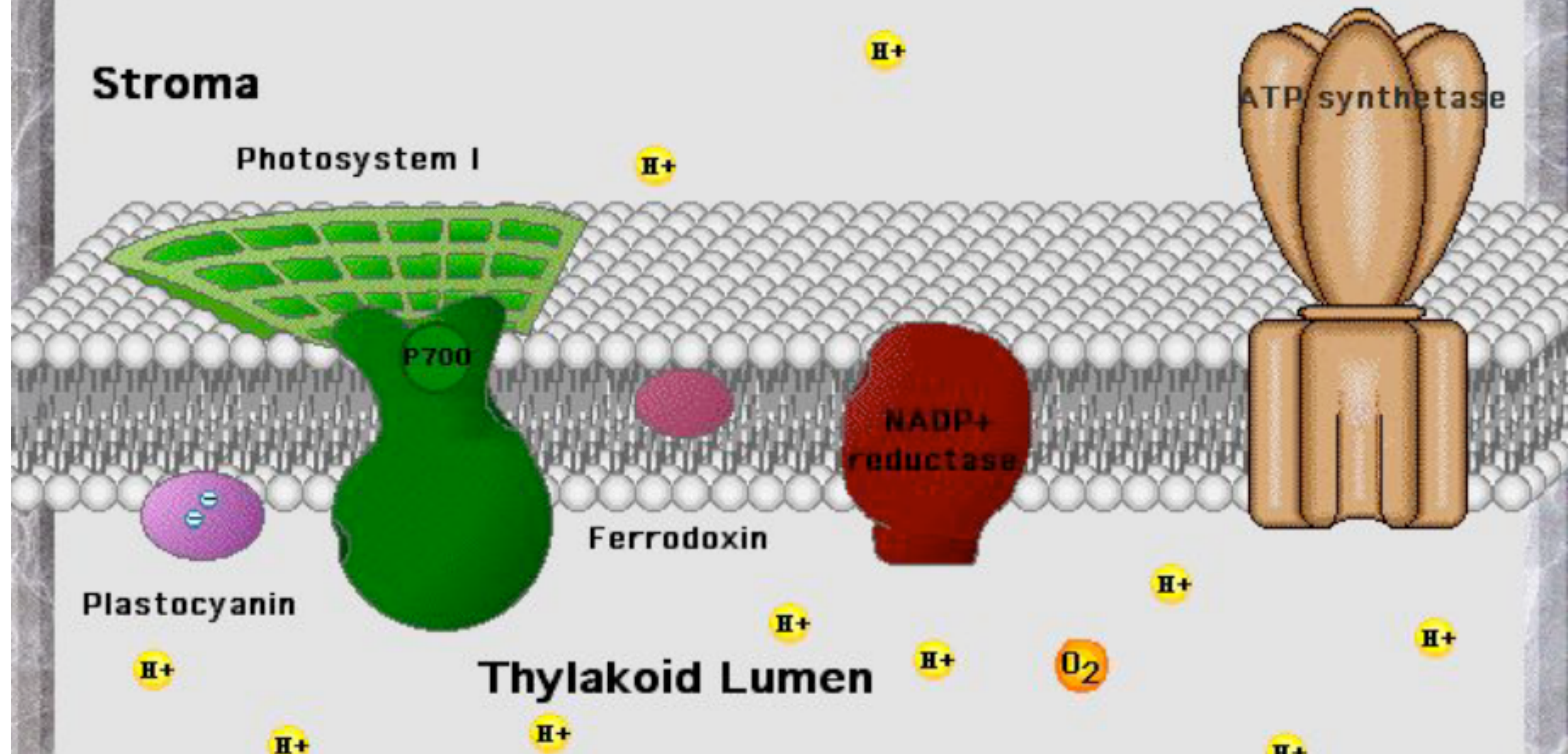


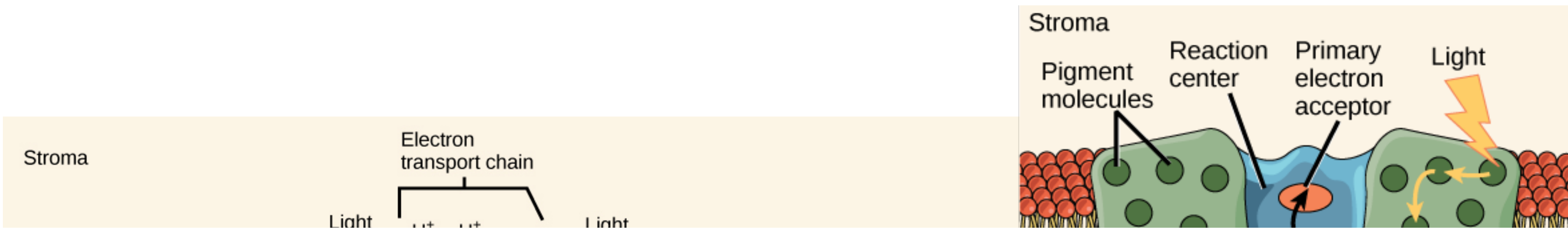




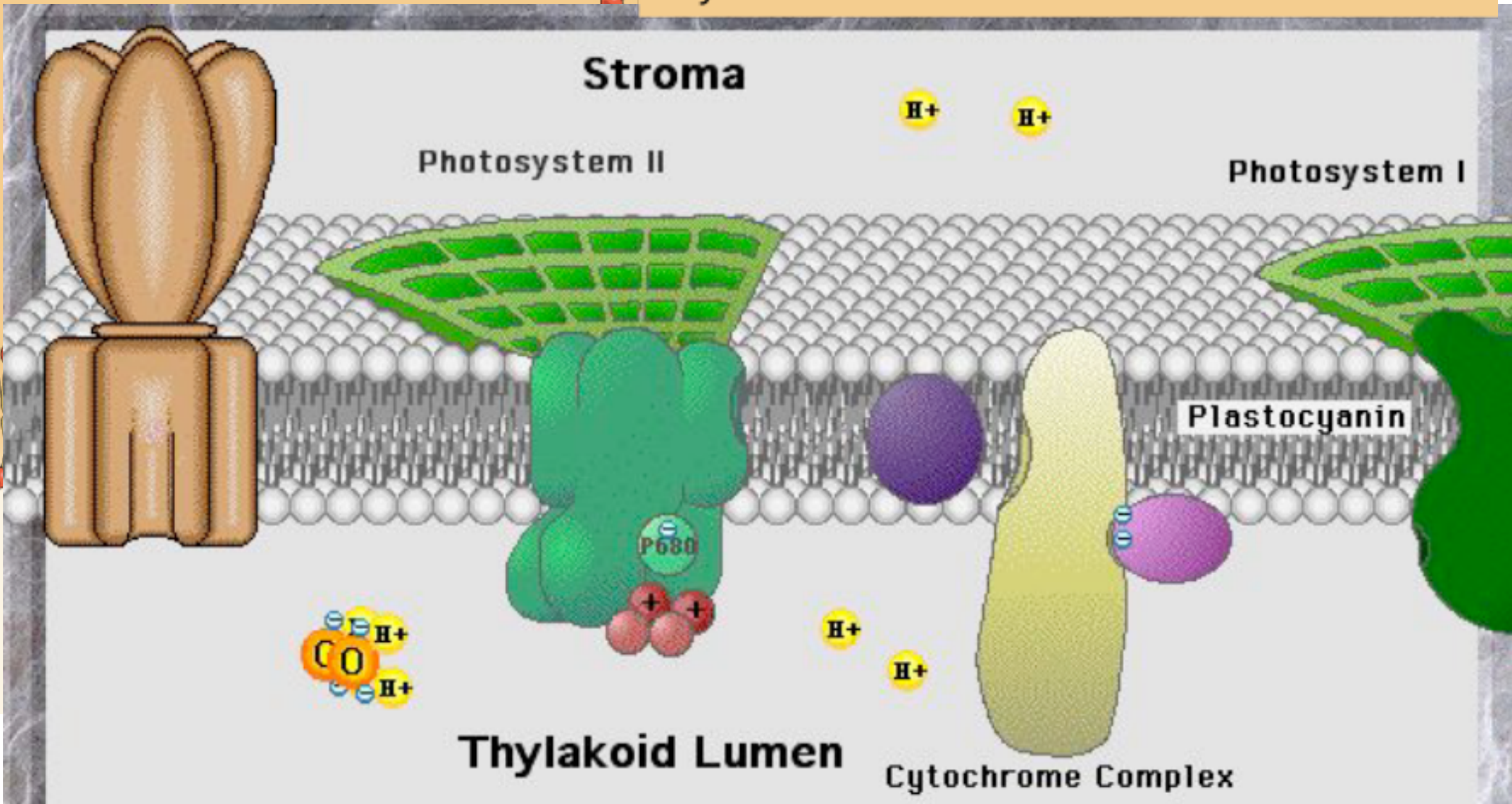
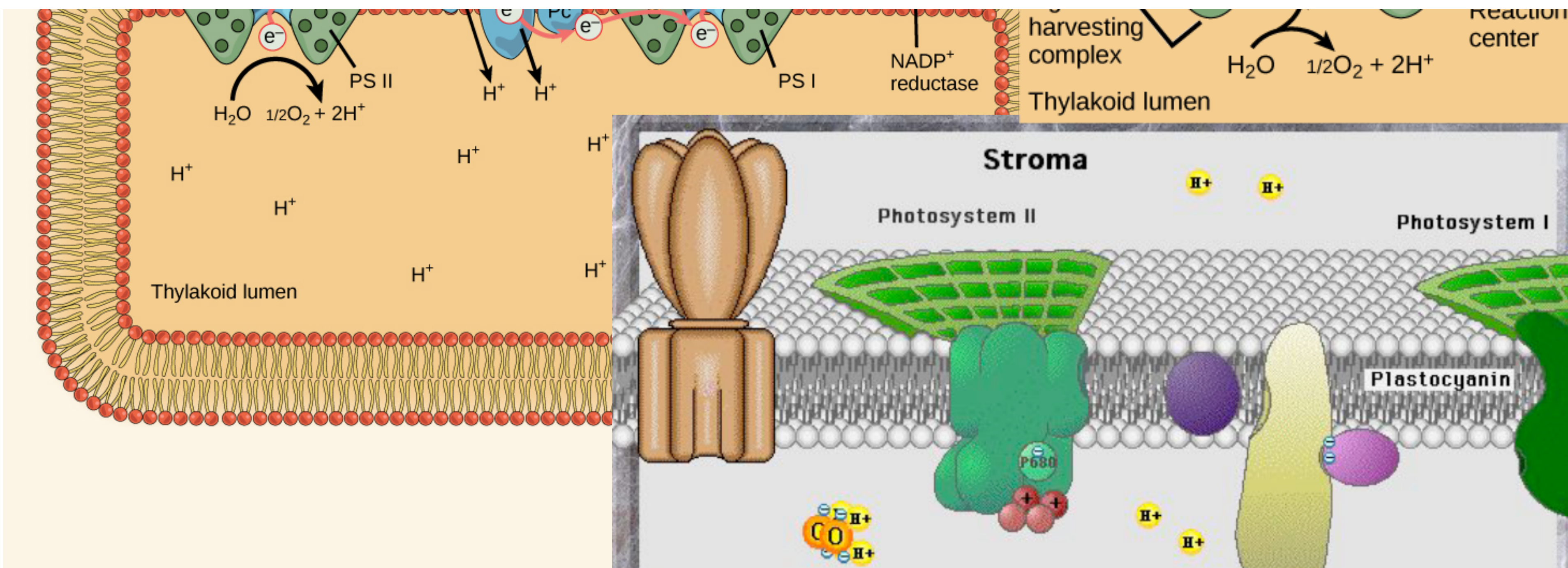
The electrons donated to the cytochrome complex are then carried to the next electron transporter, plastocyanin, which is downhill in energy from the cytochrome complex. The electron pair then goes down in energy still further by being donated to the reaction center of [photosystem-I](#). We will return to the electrons at photosystem I later, but for now things are still happening at [photosystem-II](#).

At this point, four electrons (originally from water) have been donated to **photosystem-I** (P700) via **photosystem-II**. Photosystem I absorbs additional light energy to excite the electrons again and send them on their way down another leg of the electron transport chain, ultimately reducing **NADP** to **NADPH**. That is, the four electrons stripped from the two water molecules are eventually donated to two molecules of oxidized coenzyme, NADP, to produce reduced, high energy coenzyme, NADPH.



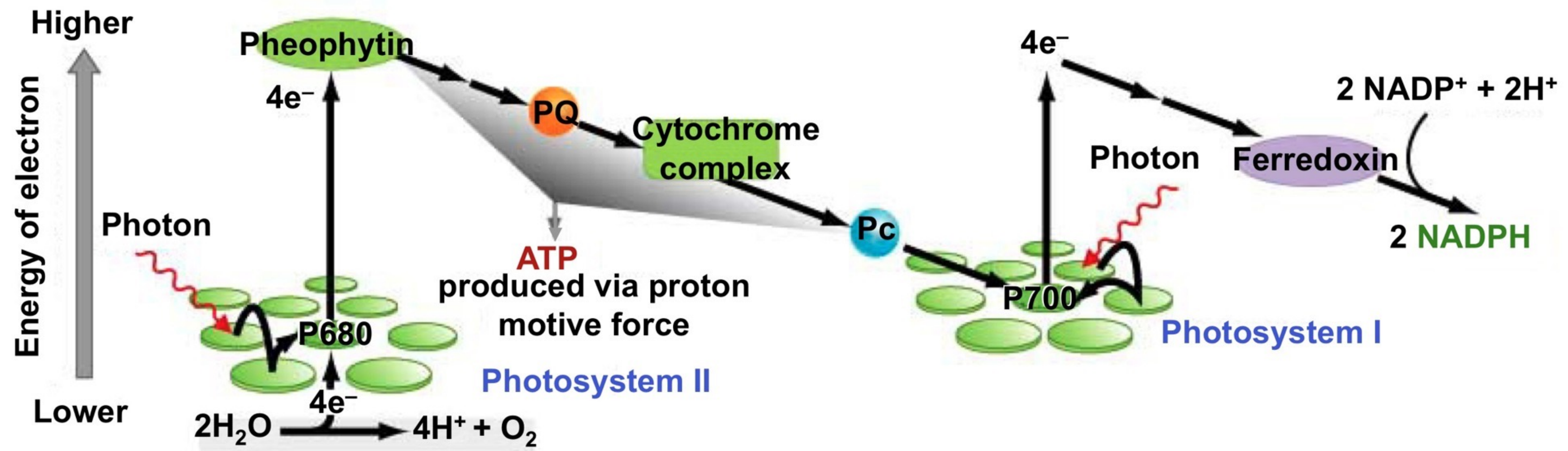


- *We will anoint the PHS animation on course website as our working model and the “correct” one.*



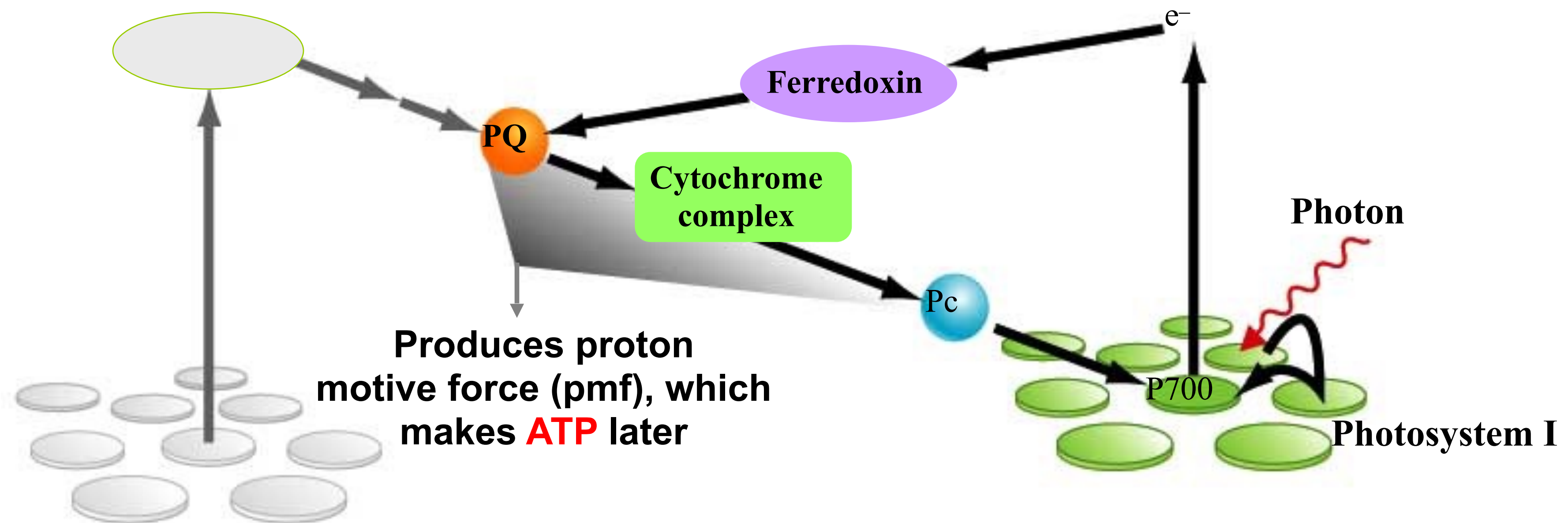
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In the linear scheme of Photosynthesis, electrons flow from water to NADPH.

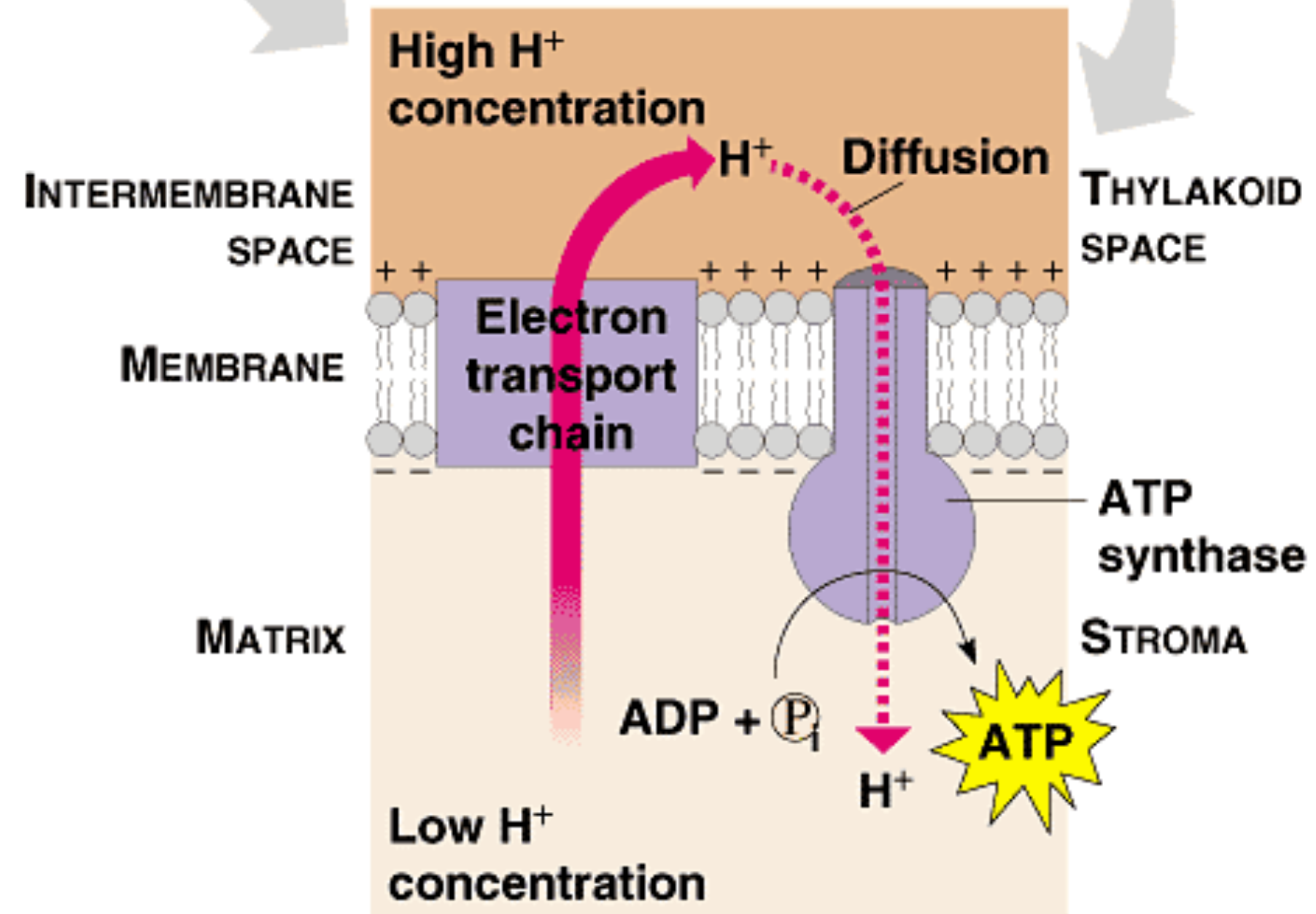
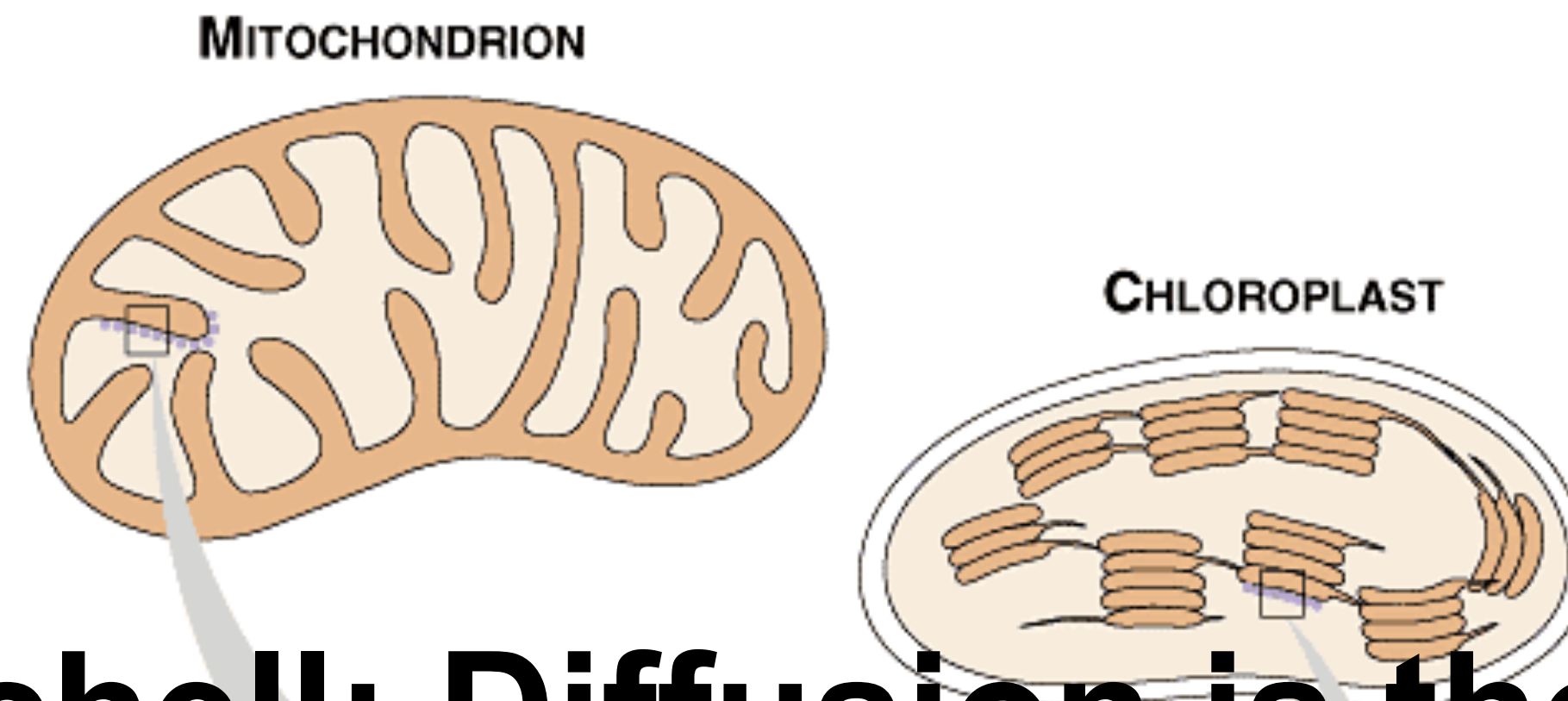


Cyclic Photosynthesis

In cyclic electron transport, photosystem I transfers electrons to plastoquinone (PQ)

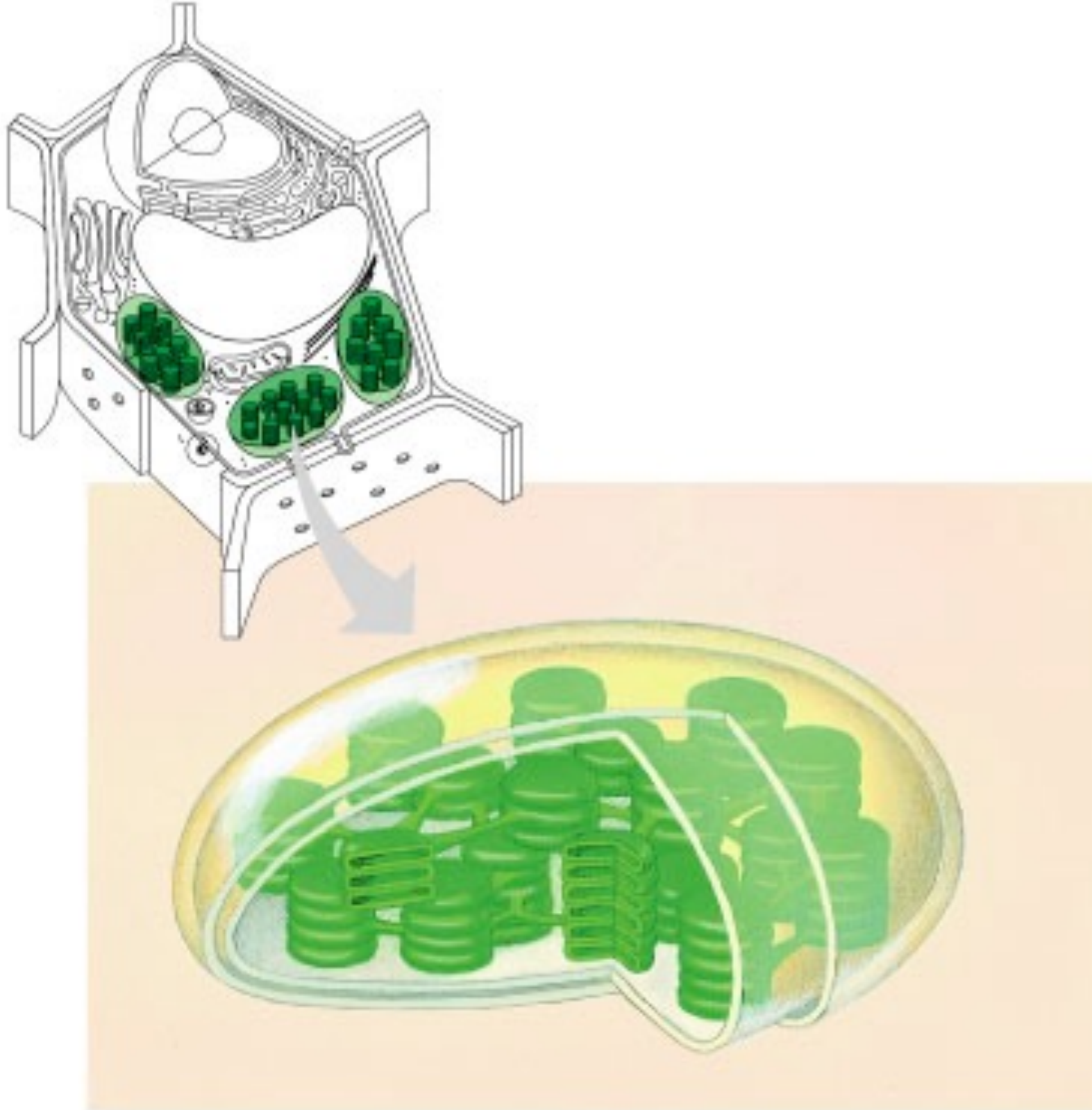


Peter Mitchell: Diffusion is the answer!

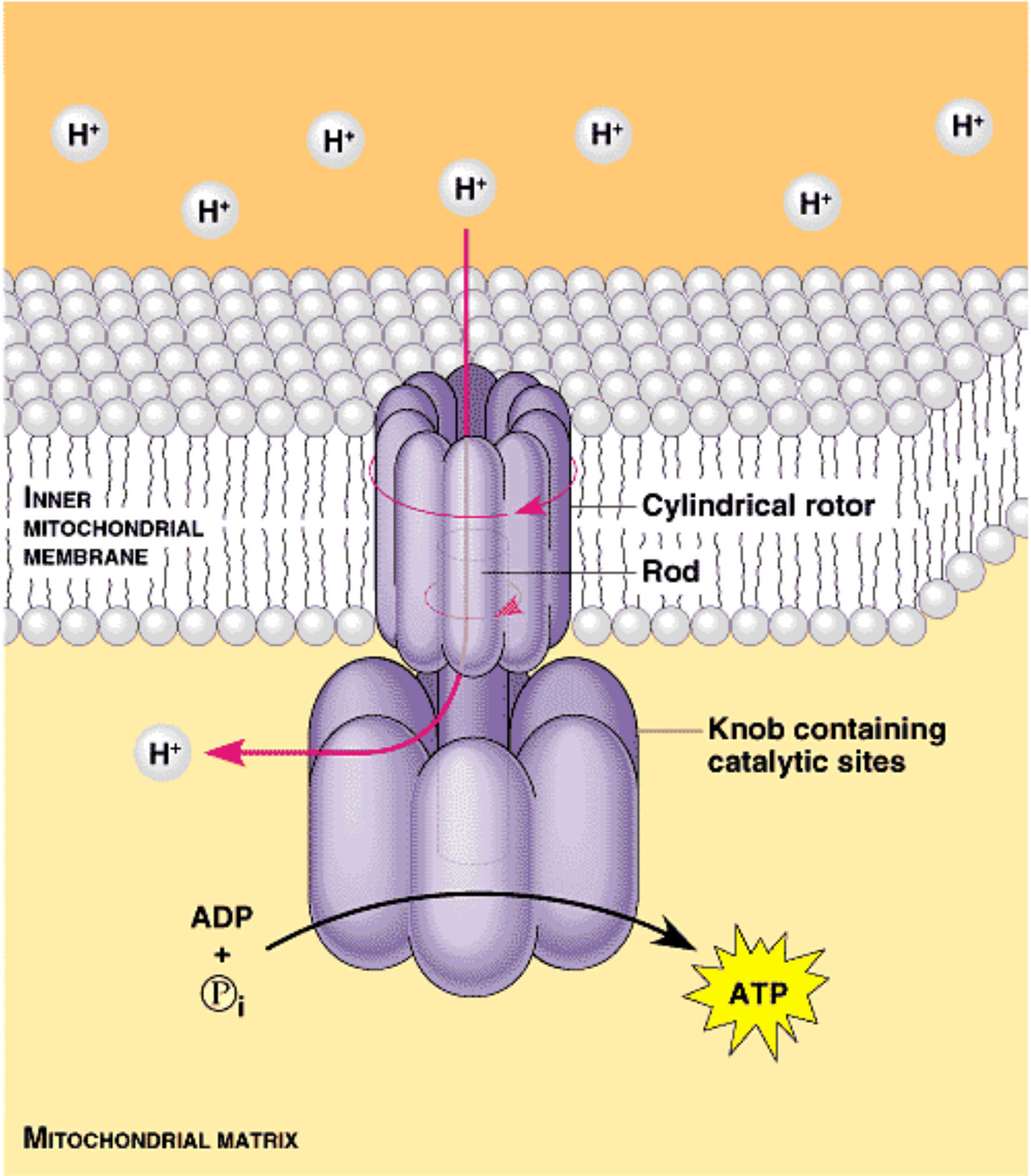


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Paul Boyer: I think it actually twists!

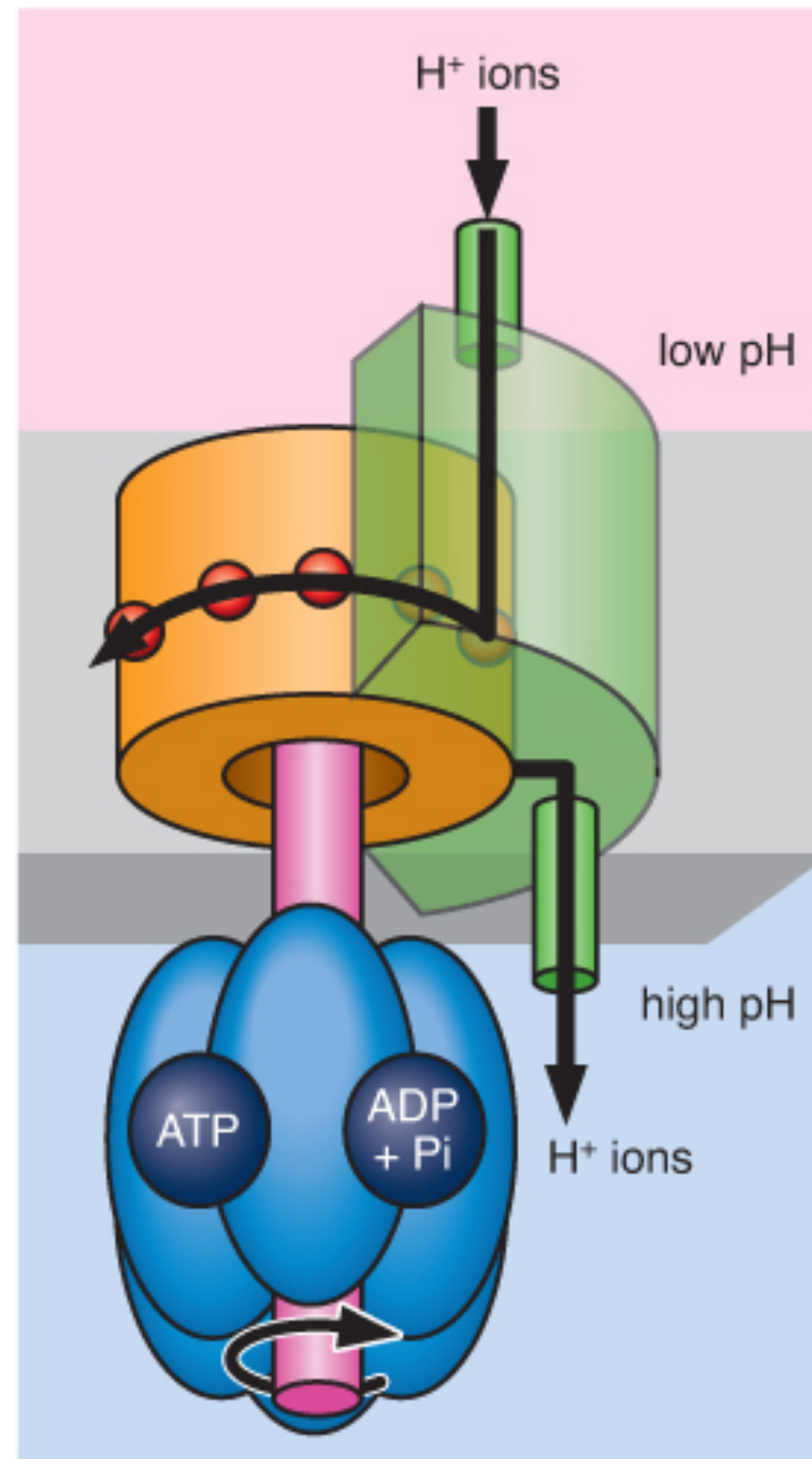


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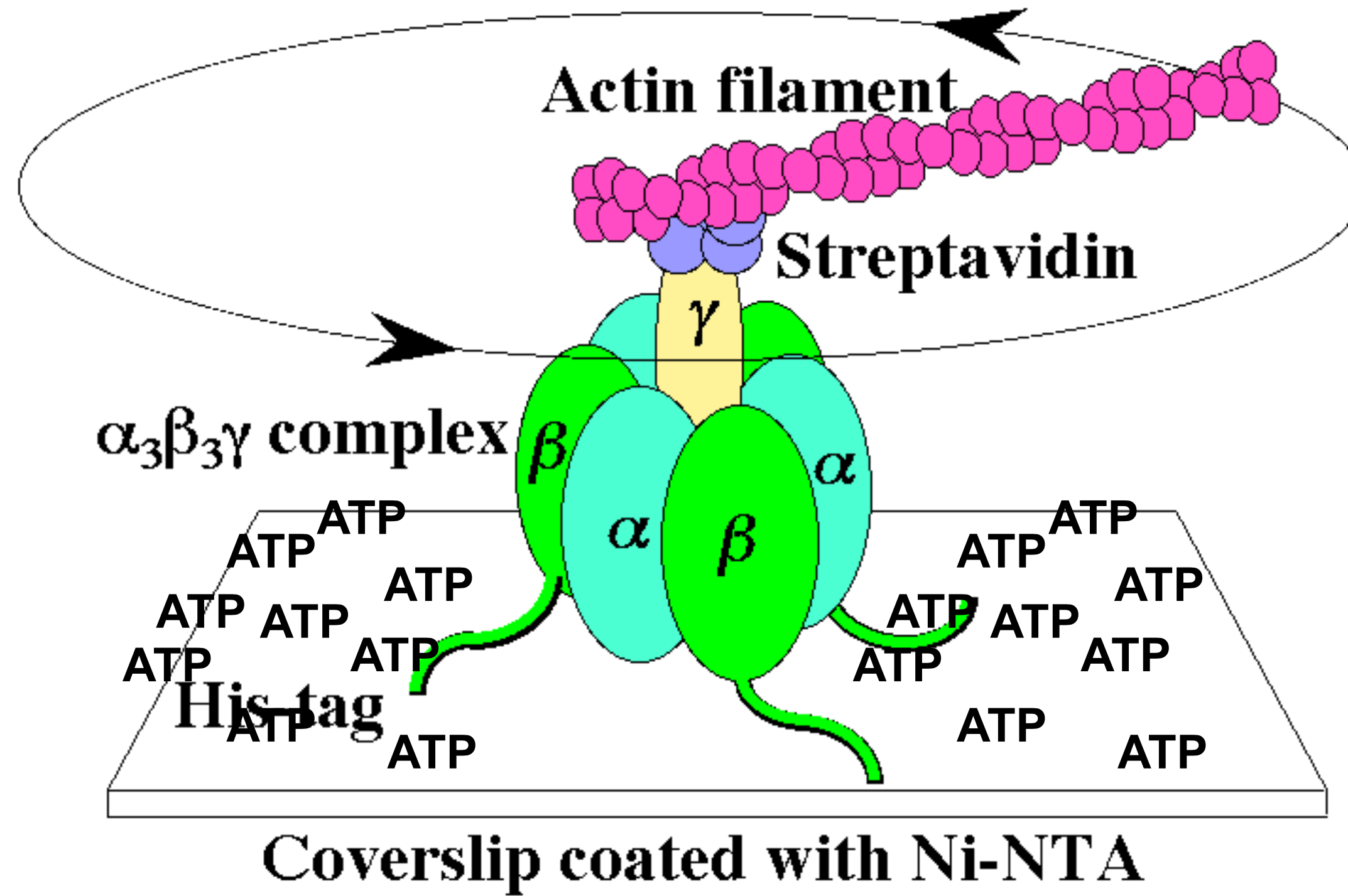


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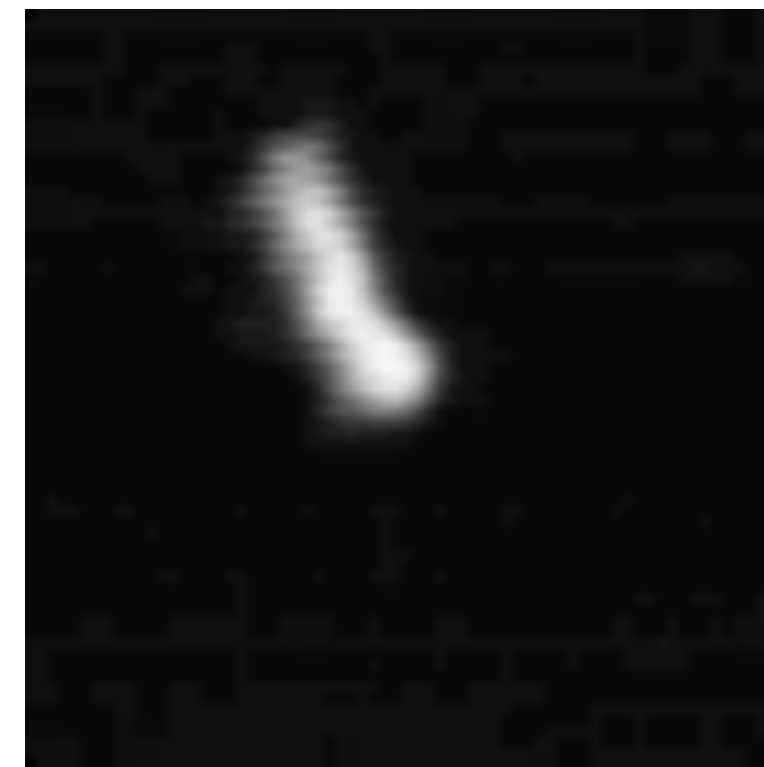
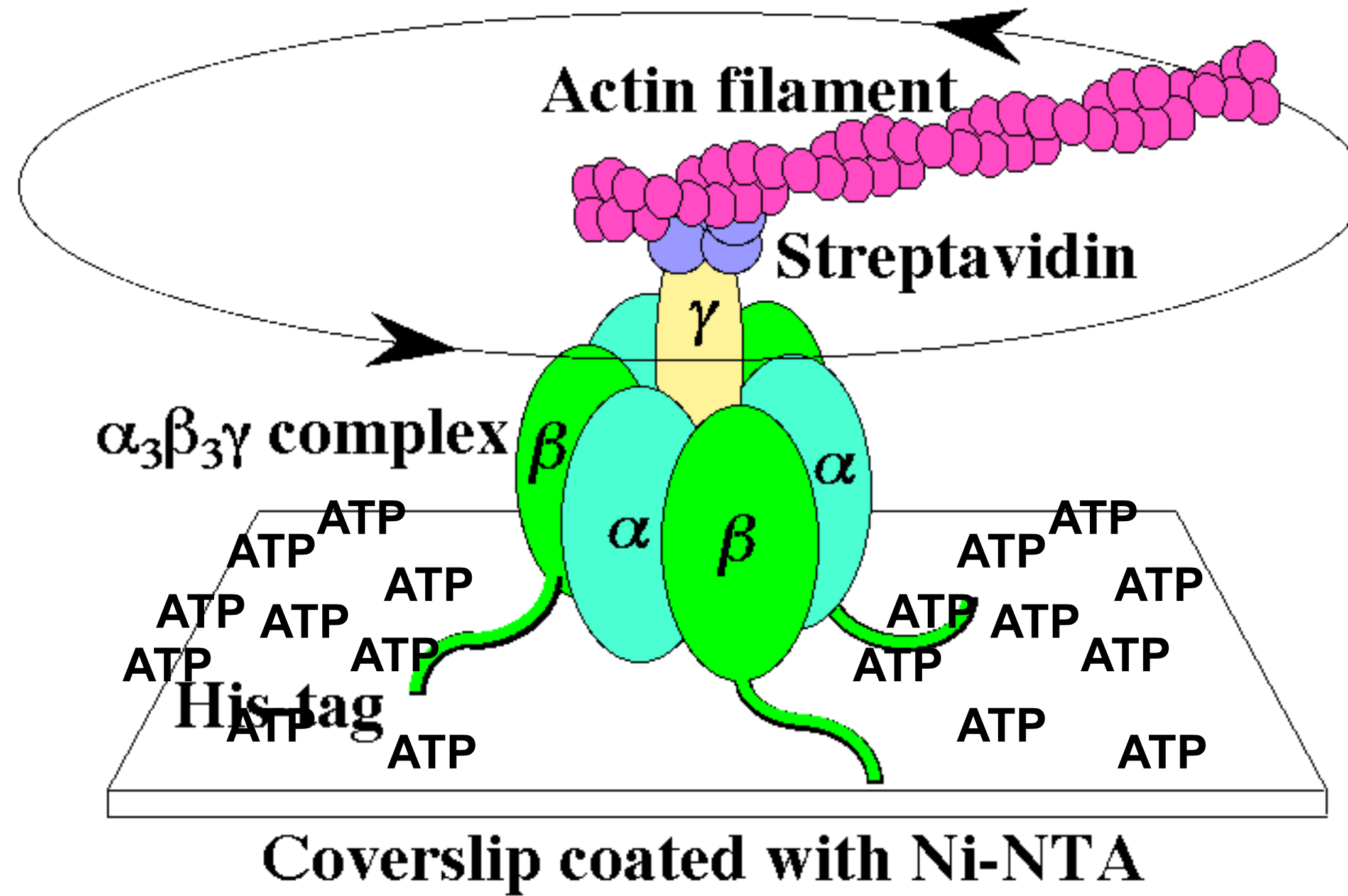
**Paul
Boyer:**
I think it is
*Rotational
Catalysis*



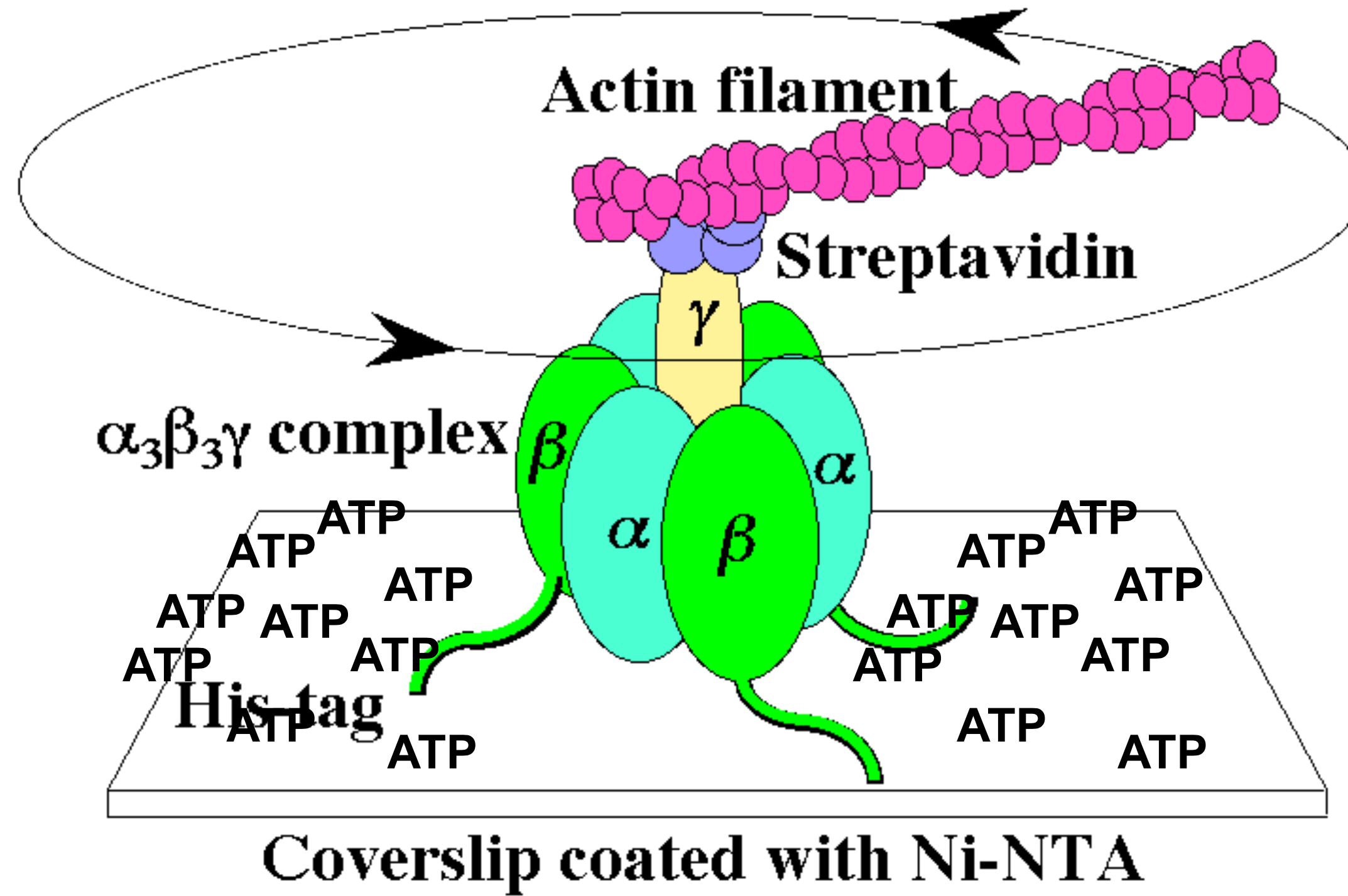
Masasuke Yoshida “check this out.”



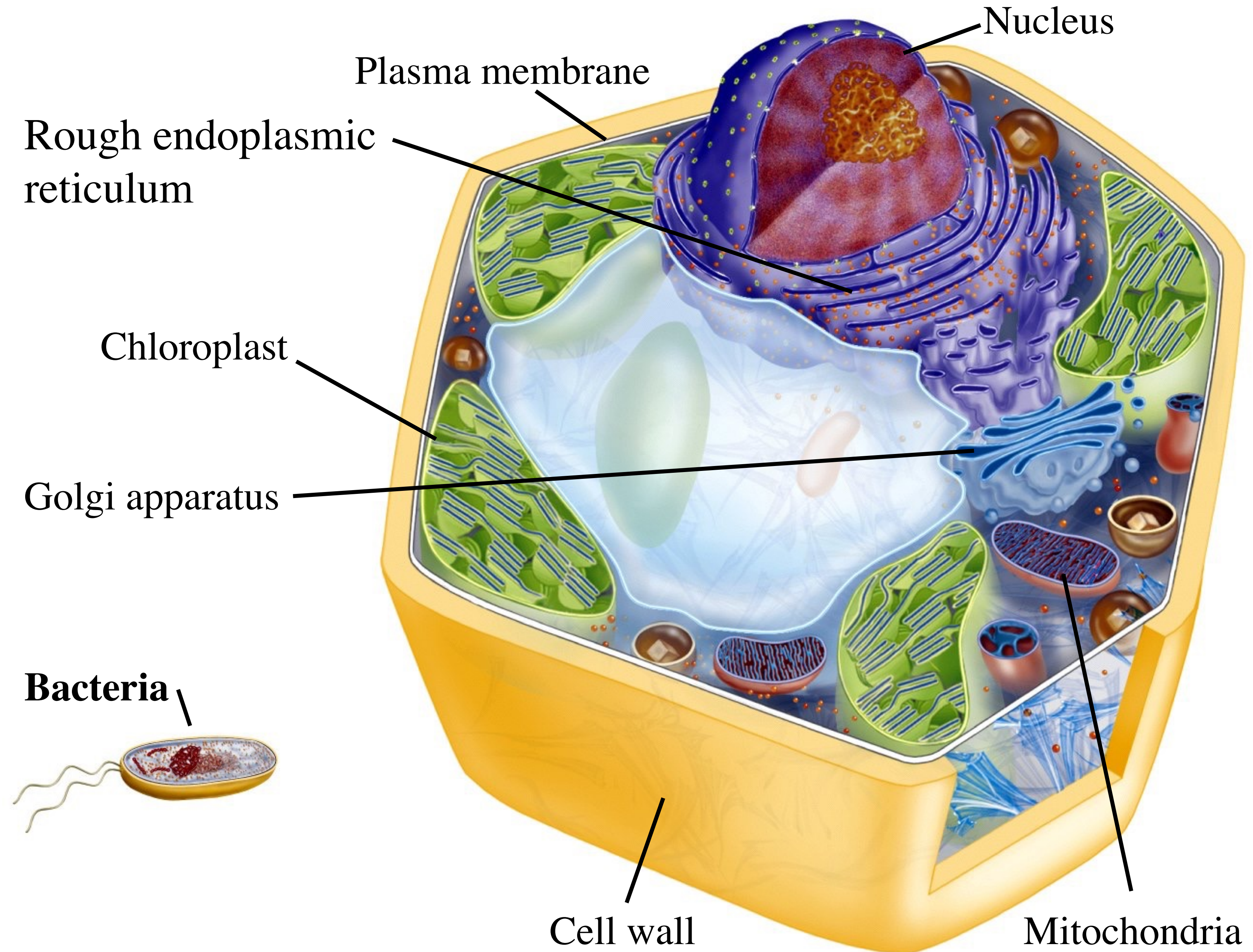
Masasuke Yoshida “check this out.”



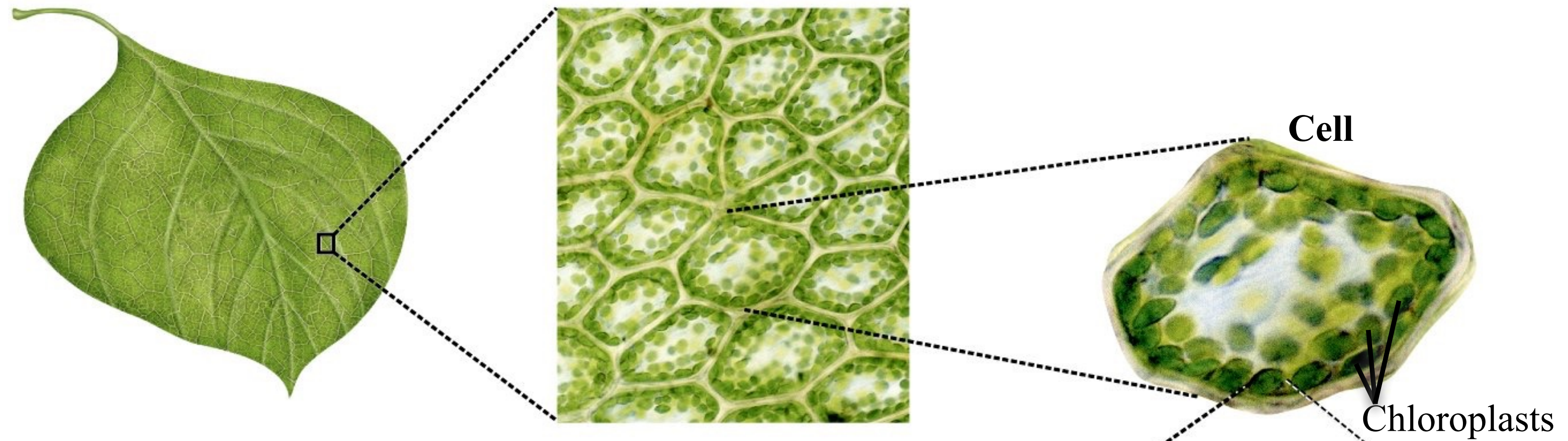
Masasuke Yoshida “check this out.”



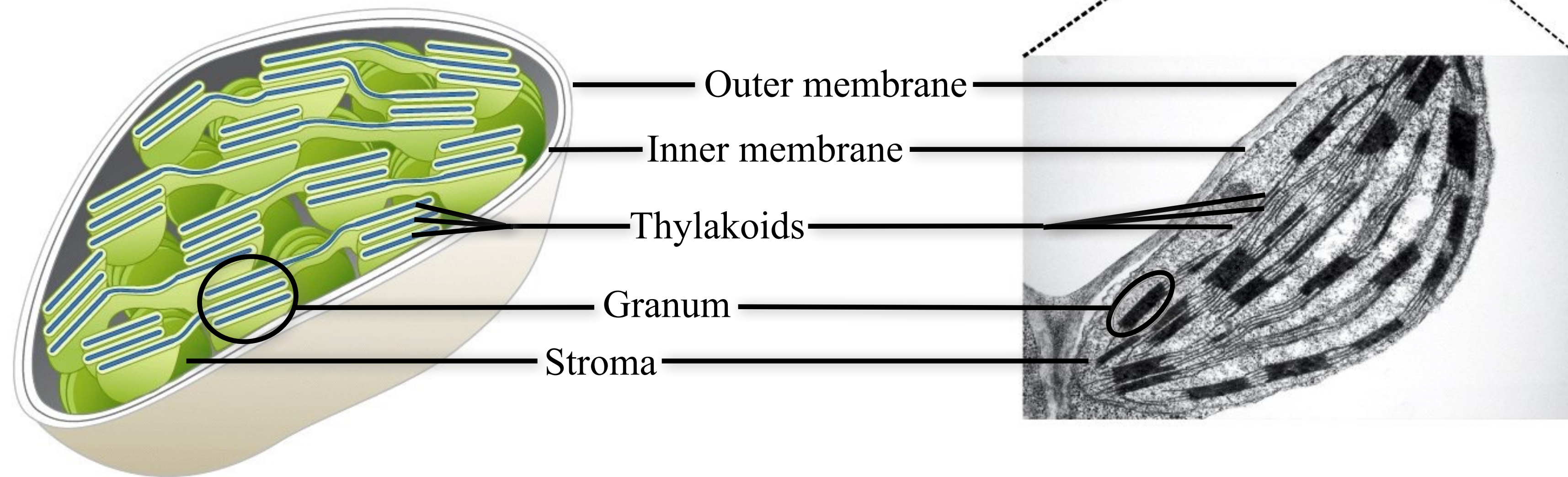
What eukaryotic cell has that prok. doesn't?



Leaves contain millions of chloroplasts.



Chloroplasts are highly structured, membrane-rich organelles.



Announcements

1. **8 red photons make how much ATP?**: few people completed the homework question for today, good job, some were brief others far more impressive...verbal final is like this.
2. **DRAFT2 is next, so what part are you writing?**
3. **Write to scientist for CF DNA with your mutation yet?**
4. **Advice: Today is “comfort food”, is not an ICB reading with trifecta etc, it’s an old fashioned traditional lecture so take new notes** to add to those from the reading.