

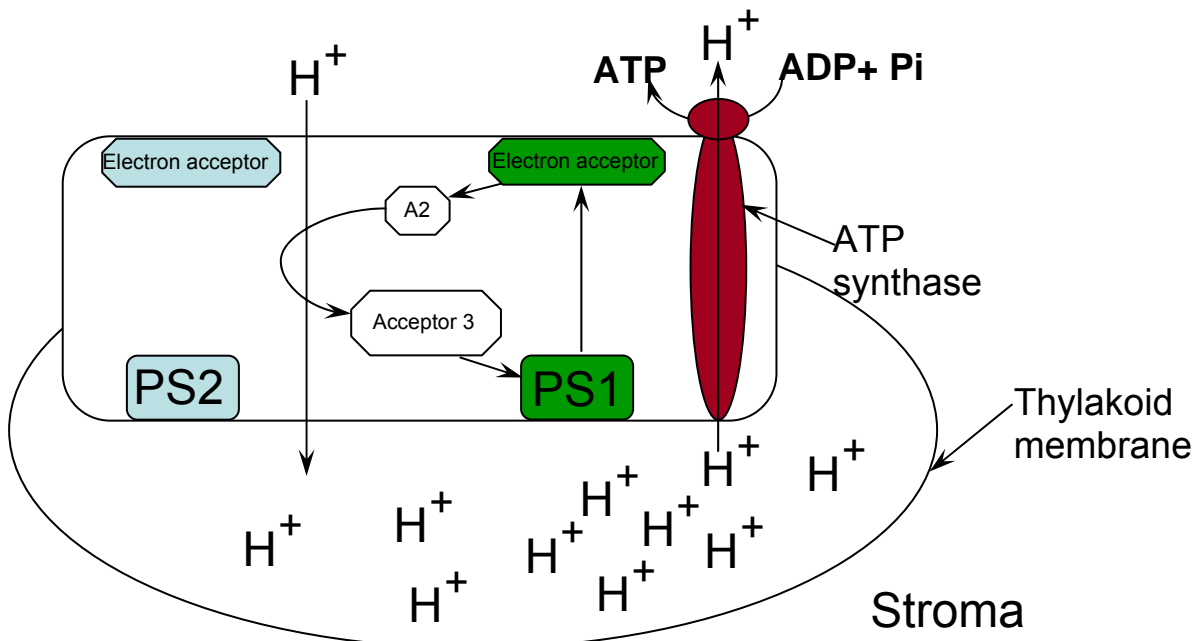
Biochemistry—Photosynthesis and Respiration

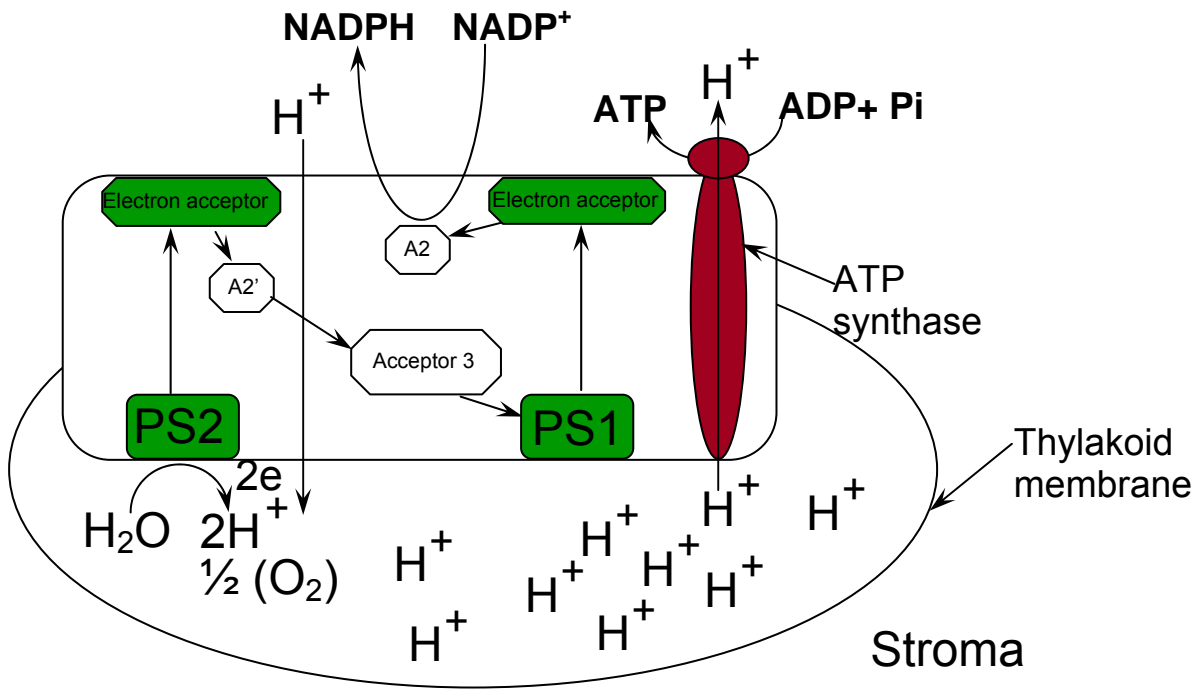
A. Photosynthesis background

1. Why do we consider O_2 a booster of evolution?
2. Why was it advantageous for a cell to develop photosynthesis?
3. Photosynthesis has two phases—light and dark. What does each phase accomplish?

B. Photosynthesis—light reactions

1. Below are the schematics for cyclic and noncyclic photophosphorylation. Identify each schematic and discuss the order of steps in each process.





2. What are the main differences between the two processes?
3. What is the ATP made in photosynthesis used for?
4. In class we learned that cyclic photophosphorylation produces S as waste product. Yet we do not see S created anywhere in the schematic above. Where and how is S released?
5. Why do cells need to make glucose out of ATP? Why not just use the ATP produced in photosynthesis?

C. Aerobic Respiration – Oxidative Phosphorylation

Dark reactions of photosynthesis are expensive, and glycolysis only produces 2 molecules of ATP. This is very inefficient.

1. What process developed to derive energy from glucose more efficiently? Why was it not possible to develop this process before noncyclic photophosphorylation arose?
2. Why was it evolutionarily advantageous for a cell to develop aerobic respiration?

Below is a schematic of the mitochondrial membrane and surrounding compartments.

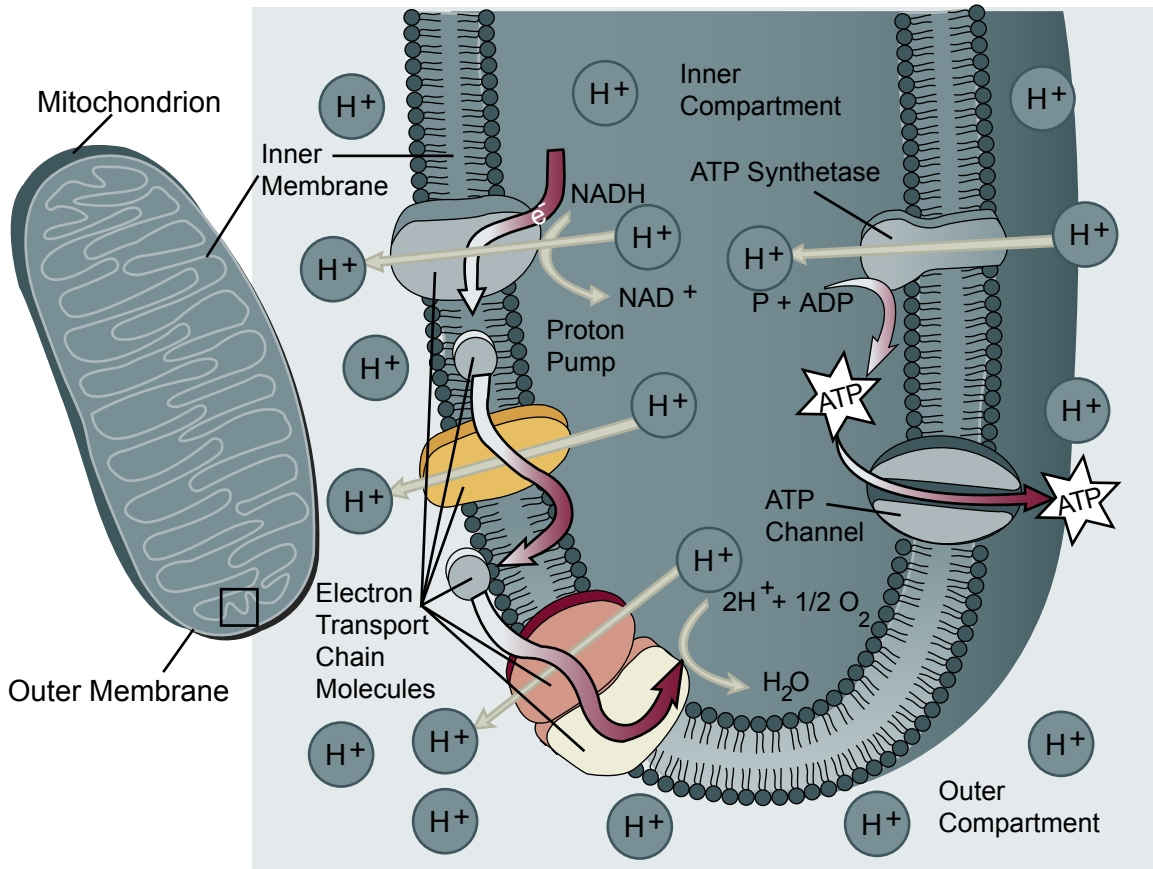


Figure by MIT OCW.

- Using the schematic, explain why an NADH is “worth” 3 ATPs.

On the way to complete oxidation, each pyruvate molecule generates 4 NADH molecules, one FADH₂ molecule, and one ATP molecule. FADH₂ can participate in the proton gradient mechanism as well, but only generates 2 molecules of ATP for each molecule of FADH₂.

- In lecture it was said that 36 molecules of ATP total are derived from a glucose molecule via glycolysis followed by aerobic respiration. Describe where these ATP molecules come from.