

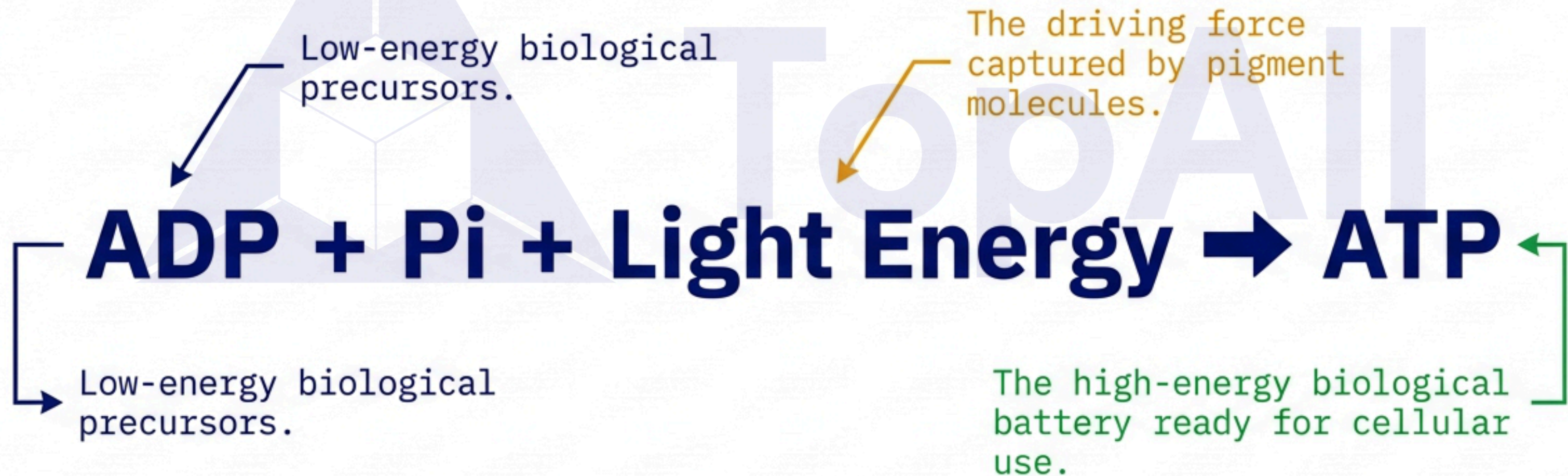
Chapter 11.6.2 Summary

Two Electron Routes

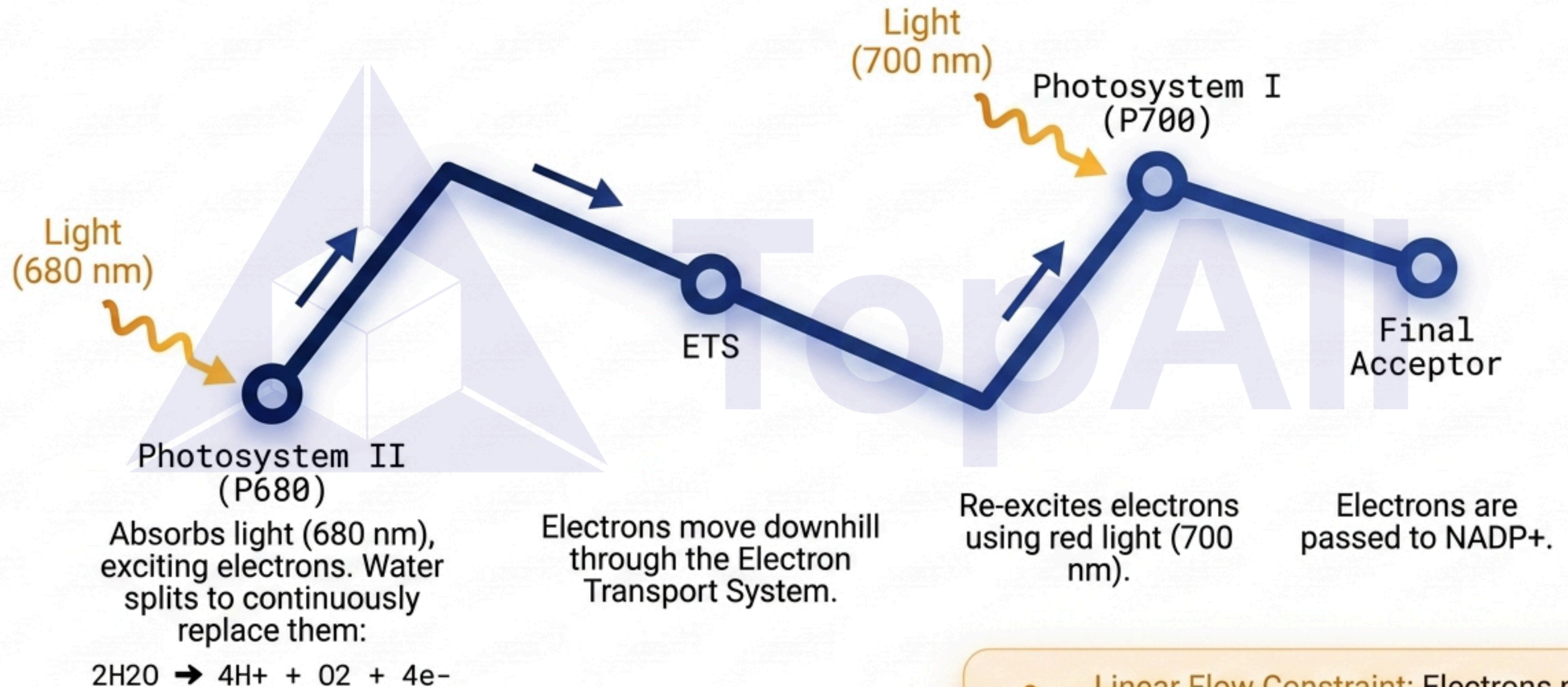
Understanding Cyclic vs. Non-Cyclic
Photophosphorylation

What is Photophosphorylation?

Living organisms extract energy from oxidizable substances and store it in chemical bonds. In chloroplasts, this essential biological process is driven by light.



The Standard Route: Non-Cyclic Flow



Linear Flow Constraint: Electrons move in a strict linear 'Z-scheme' pattern and do not return to their origin.



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$$E=mc^2$$



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The Yield of Non-Cyclic Flow

ATP

Synthesized during the downhill electron transport from Photosystem II to Photosystem I.

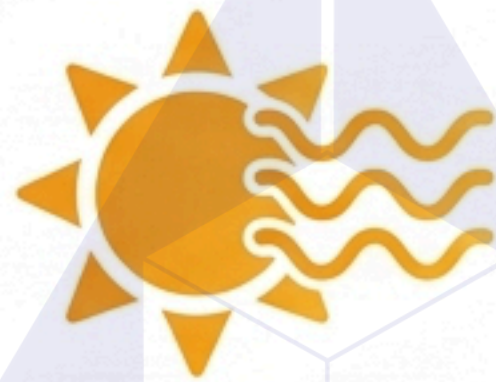
NADPH + H⁺

Created when NADP⁺ receives the finally excited electrons transferred from Photosystem I.

Both products are immediately passed to the stroma to drive the biosynthetic phase (Calvin cycle) for sugar synthesis.

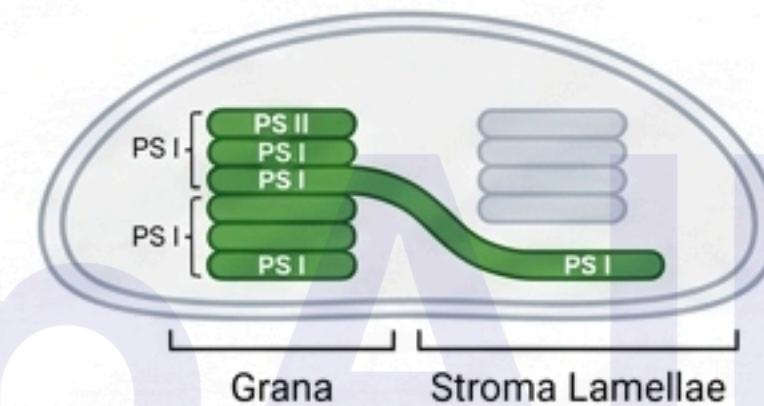
The Alternative Route: Cyclic Flow

Trigger Conditions



- **Condition:** Occurs when only light of wavelengths > 680 nm is available for excitation.
- **Mechanism:** Only Photosystem I (P700) is functional.

Membrane Context

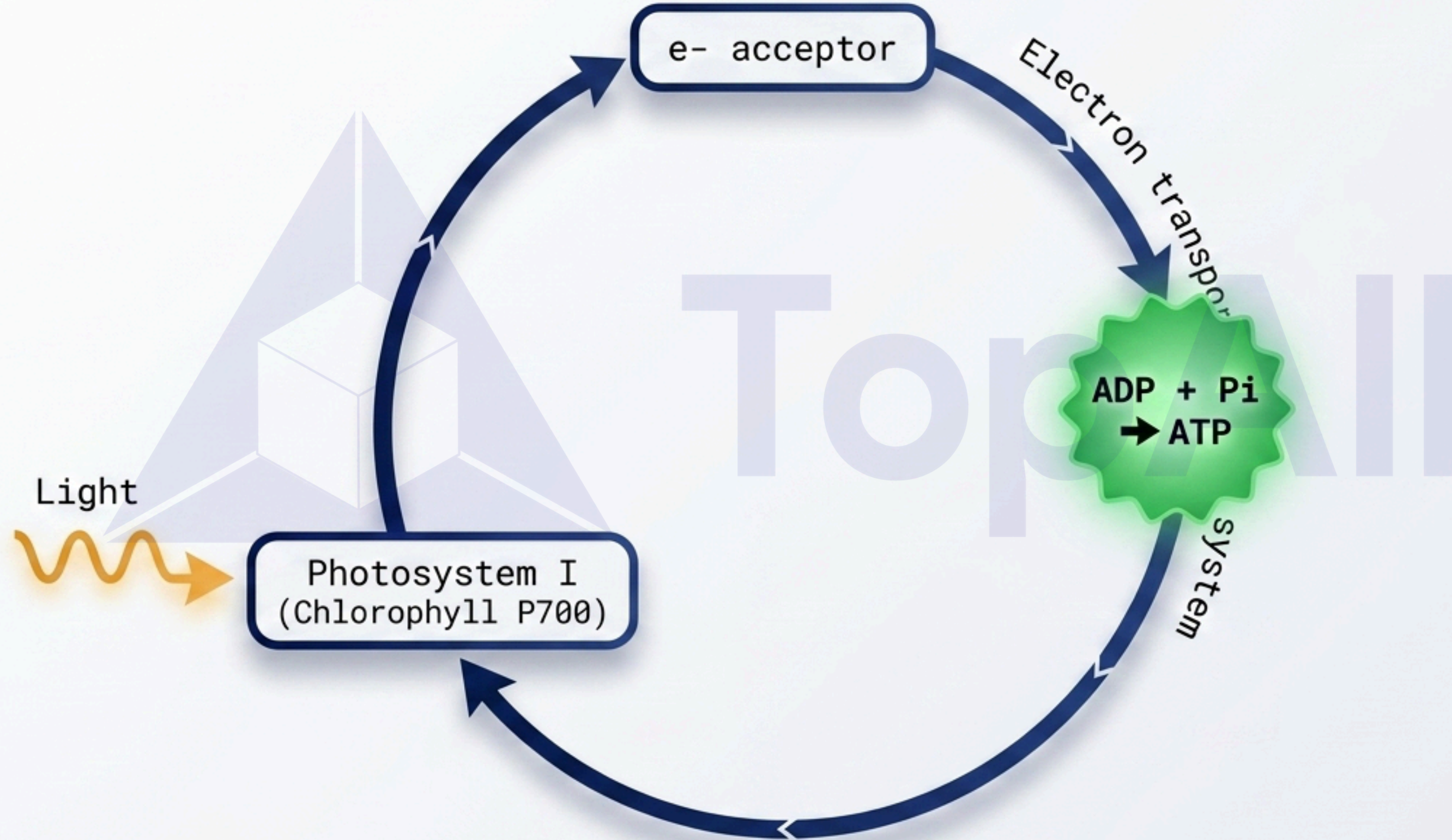


Location: Occurs in the Stroma Lamellae (unlike grana, which possess both systems).



Pathway Blocked: The stroma lamellae lack PS II and the NADP reductase enzyme. Therefore, linear flow to NADP^+ is impossible.

The Cyclic Electron Pathway



The Yield of Cyclic Flow

ATP

Synthesized via the cyclic electron transport chain.

No NADPH



Because the NADP reductase enzyme is absent in the stroma lamellae, the excited electron cannot pass to NADP^+ . It is forced to cycle back to the PS I complex.

Cyclic vs. Non-Cyclic Comparison

Feature	Non-Cyclic Flow	Cyclic Flow
Photosystems	PS II and PS I	PS I only
Electron Flow	Linear (Z-Scheme)	Circular
Products	ATP & NADPH	ATP only
Location	Grana Lamellae	Stroma Lamellae
Photolysis of Water	Yes (O ₂ released)	<u>No</u>

Synthesis: Both pathways harness light to synthesize ATP, but only the non-cyclic route provides the NADPH and the splitting of water necessary to sustain the full biosynthetic dark reactions.



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