ADVANCED PHOTOSYNTHESIS MECHANISM

Biochemical Pathway Reference Guide

I. Light-Dependent Reactions *Thylakoid Membrane*

- **Photoactivation:** Chlorophyll a (P680) absorbs photons, elevating electrons to excited states.
- **Photolysis:** Hâ‚‚O is split by the Oxygen Evolving Complex (OEC) into Â½Oâ‚‚, $2H^+$, and $2e^-$.
- **Electron Transport:** Linear flow via Plastoquinone (PQ), Cytochrome b6f, and Plastocyanin (PC).
- **Photophosphorylation:** Chemiosmotic gradient drives ATP Synthase to generate ATP from ADP.
- **Reduction:** Photosystem I (P700) facilitates the reduction of $NADP^+$ to NADPH.

II. Light-Independent Reactions *Stroma*

- **Carbon Fixation:** CO_2 is attached to RuBP (5C) by the enzyme RuBisCO, forming 3-PGA.
- **Reduction Phase:** 3-PGA is phosphorylated by ATP and reduced by NADPH to form G3P (GALP).
- **Carbohydrate Exit:** One G3P molecule exits the cycle for synthesis of glucose and starch.
- **Regeneration:** Remaining G3P molecules are rearranged using ATP to regenerate RuBP.
- **Stoichiometry:** 3 CO_2 cycles required for 1 net G3P; 6 cycles for 1 Glucose.

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Net Equation: 6COâ‚‚ + 12Hâ‚‚O + Light Energy â†’
        Câ‚†Hâ‚â‚‚Oâ‚† + 6Oâ‚‚ + 6Hâ‚‚O
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Key Enzymes
RuBisCO, ATP Synthase, NADP+ Reductase
Inputs
Photons, Hâ‚‚O, COâ‚‚, ADP, $NADP^+$
Outputs
Glucose, Oâ‚‚, ATP, NADPH