



How Scientists Found the Chemistry

The Chronological Unravelling of the Photosynthesis Equation

Sachs

Engelmann

van Niel

The Mid-19th Century Puzzle

Which specific wavelengths of light drive this process?



What exactly is this carbohydrate, and where is it made?

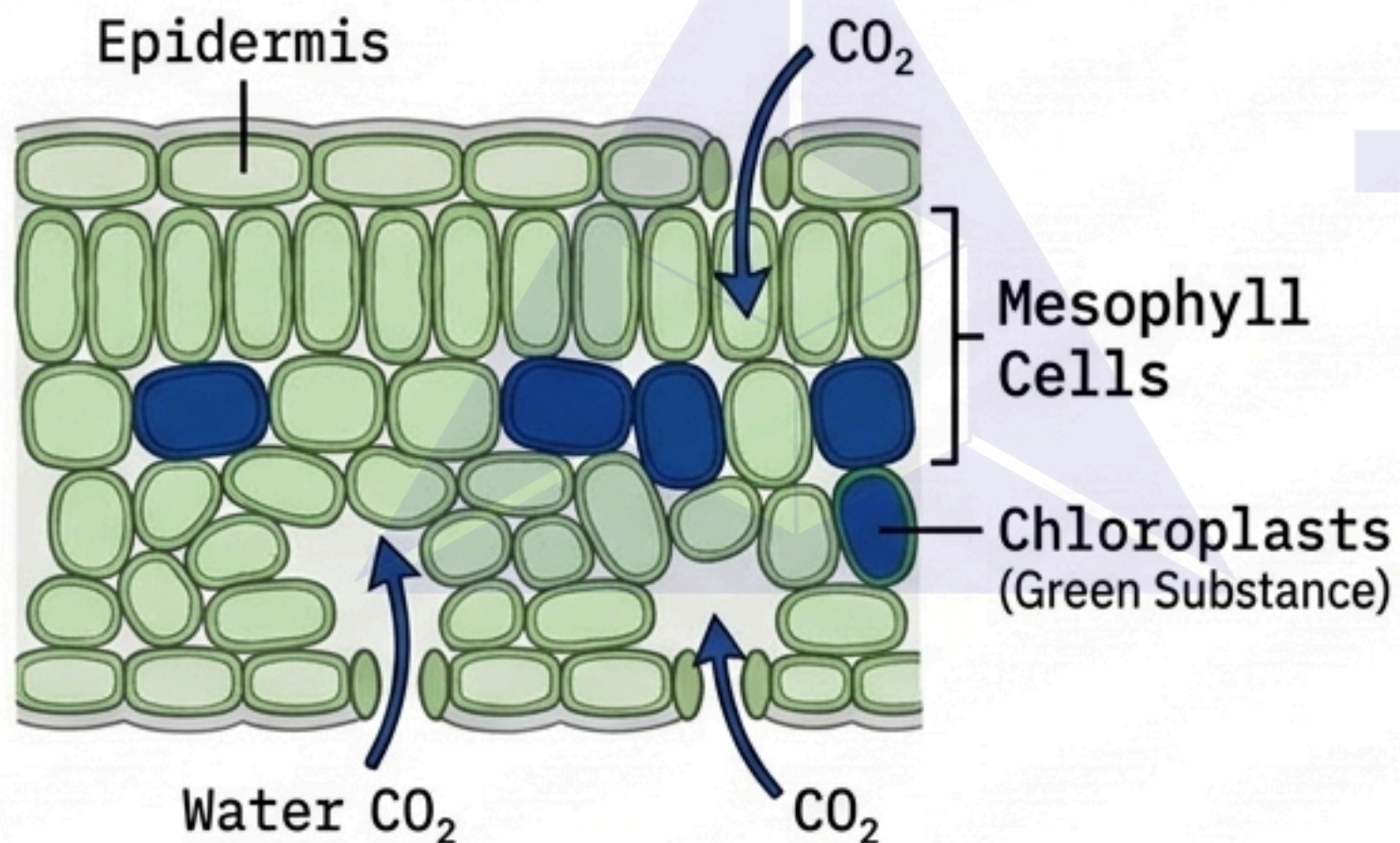
Does this oxygen originate from the carbon dioxide or the water?

By 1850, the inputs and outputs were observed, but the precise chemical mechanisms and anatomical locations remained a black box.

Isolating the Products & Location

Julius von Sachs (1854)

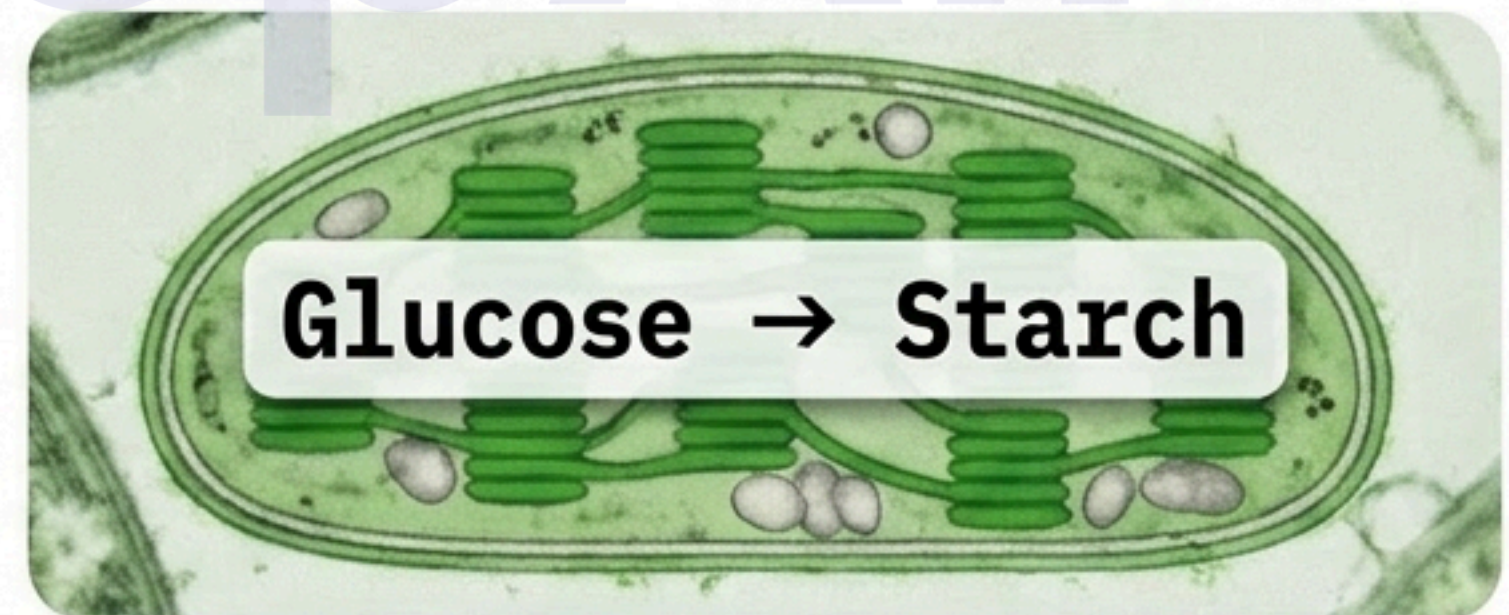
The Setup



As plants grow, they synthesize glucose and produce a green substance.

The Insight

- The green substance (chlorophyll) is not free-floating; it is housed in special cellular bodies (chloroplasts).
- Glucose is produced specifically in these green parts and is stored as starch.





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$$E=mc^2$$



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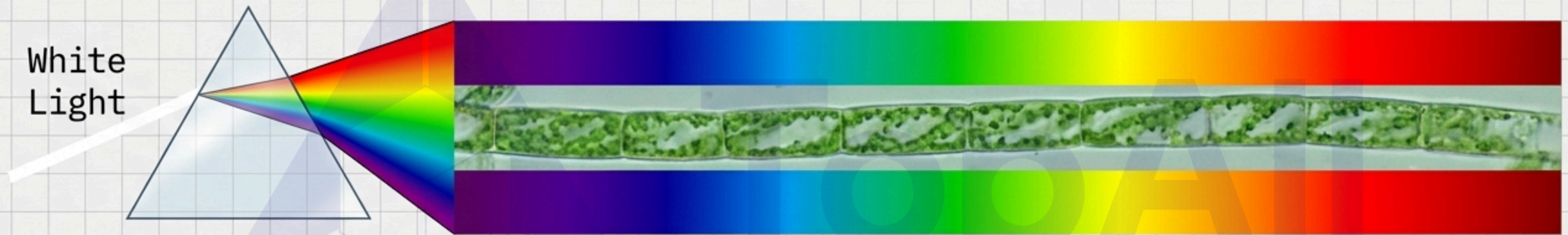
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Discovering the Energy Driver

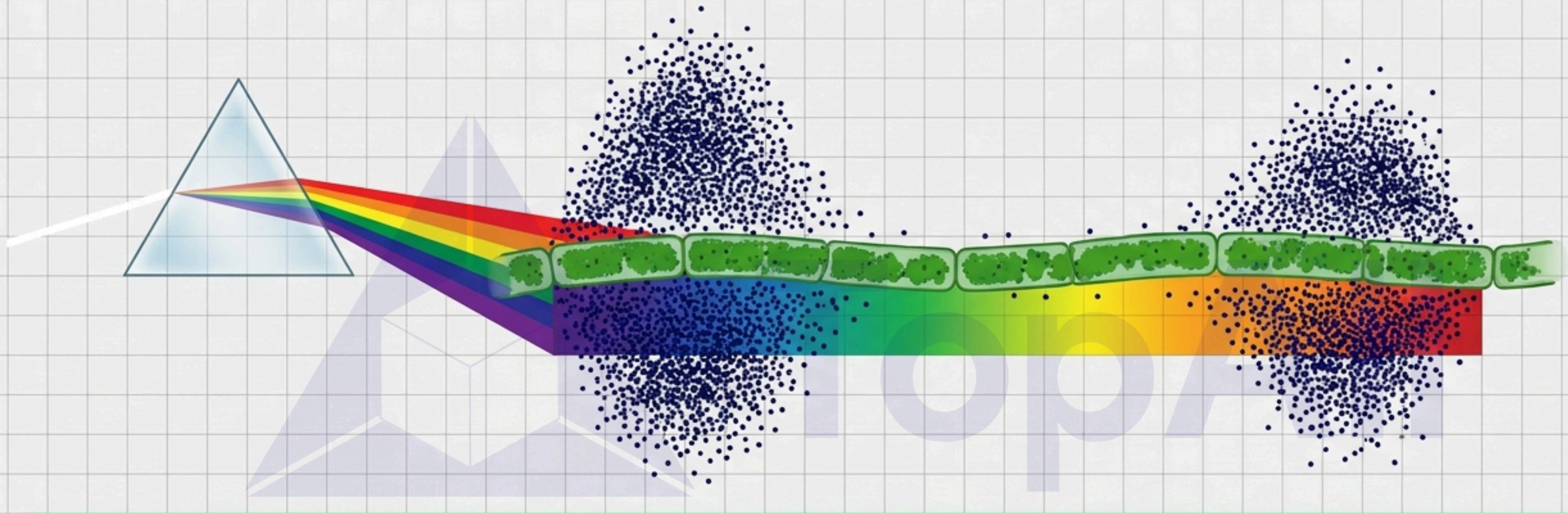
T.W. Engelmann (1843–1909)



Methodology: Engelmann placed the algae in a suspension of aerobic bacteria, using them as living, microscopic oxygen detectors.

Engelmann needed to isolate exactly which wavelengths of light powered photosynthesis. He used bacteria to visually map oxygen evolution across the spectrum.

The First Action Spectrum



Blue/Red Light & Oxygen Evolution

The bacteria accumulated at blue and red wavelengths, proving these specific light energies drive oxygen production. This perfectly mirrors the absorption spectra of chlorophyll *a* and *b*.

The Chemical Breakthrough

Cornelius van Niel (1897–1985)

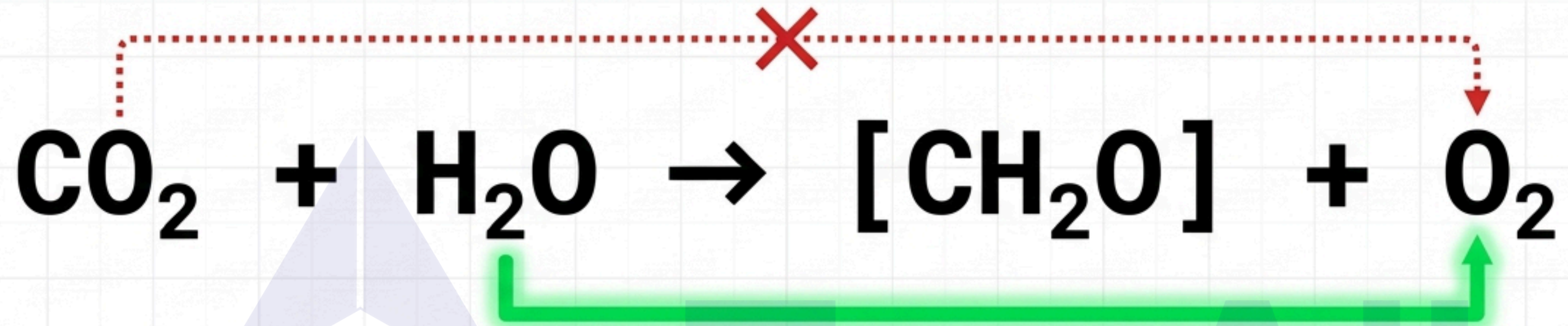


	Green Plants	Purple/Green Sulphur Bacteria
Hydrogen Donor	H_2O	H_2S
Oxidation Product	O_2	Sulphur / Sulphate



By comparing plants to bacteria, van Niel realized photosynthesis is a light-dependent reaction requiring a hydrogen donor (H_2A) to reduce carbon dioxide.

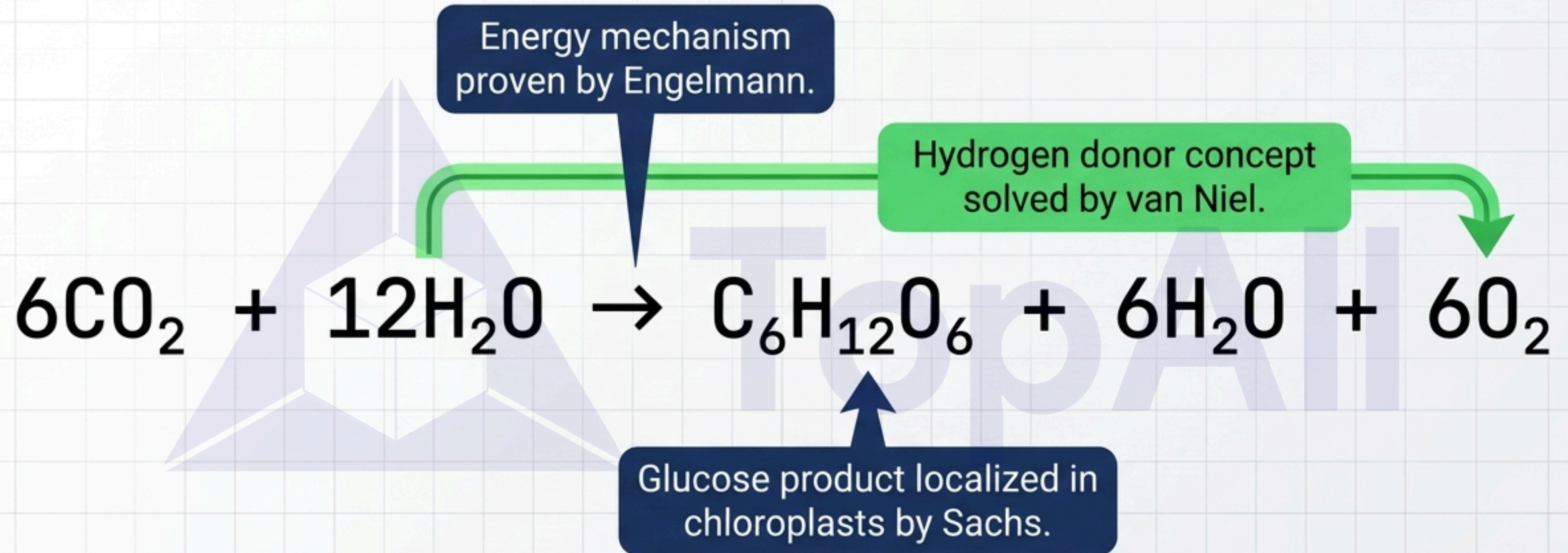
The True Origin of Oxygen



Oxygen comes from water. Van Niel deduced that the O_2 evolved by green plants originates entirely from H_2O , not from Carbon Dioxide.

This hypothesis was later conclusively proven by using radioisotopic tracking techniques.

The Complete Equation



This final equation is not a single reaction, but the blueprint of a complex, multistep biological process pieced together over a century.



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