

How Blood Carries O_2 and CO_2

The physiological mechanisms of respiratory gas transport.

The Dual-Lane Logistics Network



RED BLOOD CELLS (RBCs)

The primary transporters. Packed with a red-coloured, iron-containing pigment (haemoglobin) that binds gases reversibly for rapid, high-volume transit.



BLOOD PLASMA

The liquid medium. Gases dissolve directly into this water-based fluid for transport, though capacity is heavily limited by the physical solubility of the gas.

Delivering Oxygen to Tissues



Dissolved in Plasma

Bound to RBCs

97%

O_2 binds reversibly to haemoglobin to form oxyhaemoglobin. Each haemoglobin molecule can carry up to 4 molecules of O_2 .

5 mL

Amount of O_2 delivered to tissues by every 100 mL of oxygenated blood under normal physiological conditions.



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$$E=mc^2$$



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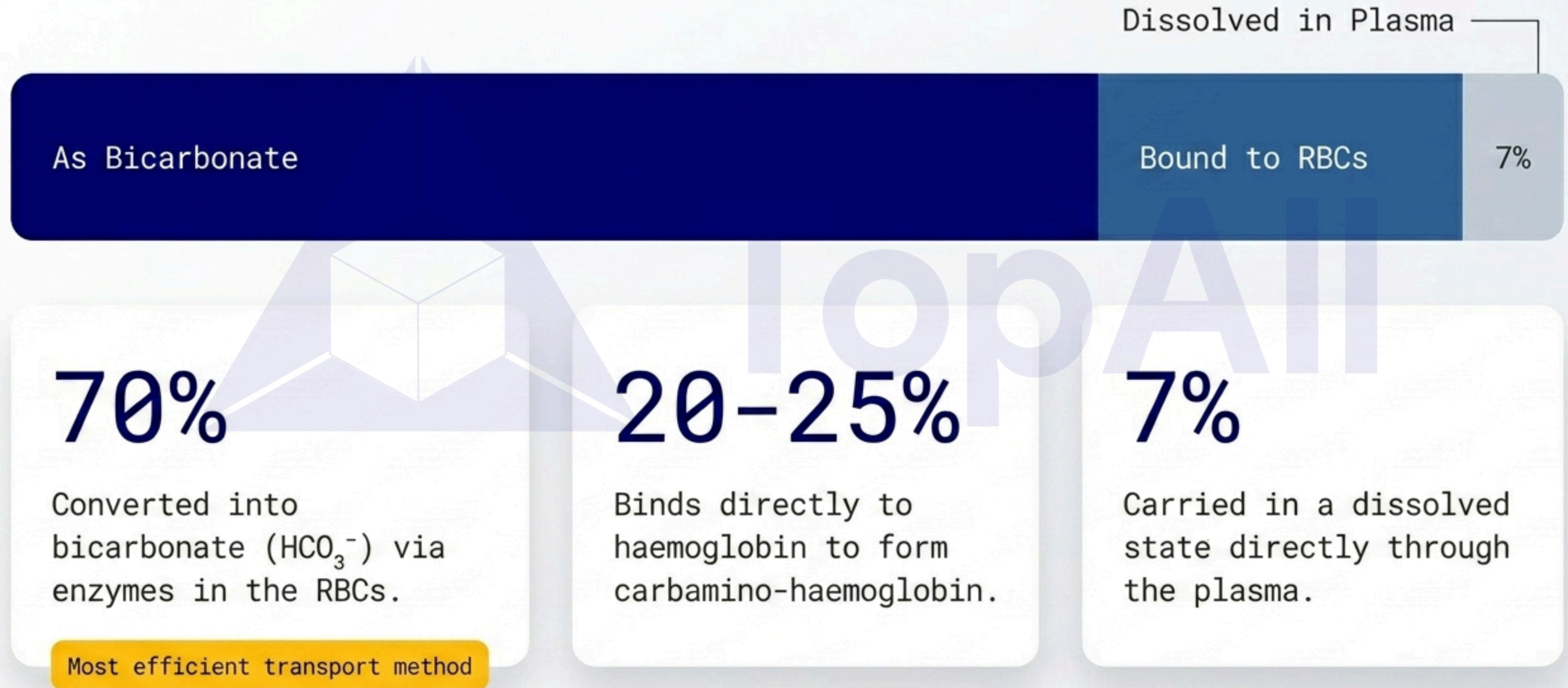
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Removing Carbon Dioxide



The Carbonic Anhydrase Engine



The Catalyst

The enzyme carbonic anhydrase (highly concentrated in RBCs, minute amounts in plasma) drives this reaction in both directions.

The Yield

Every 100 mL of deoxygenated blood delivers 4 mL of CO₂ to the alveoli.

Carbonic anhydrase



At the Tissues

High pCO₂ pushes the reaction to the right, trapping CO₂ as bicarbonate (HCO₃⁻) for safe transport.

At the Alveoli

Low pCO₂ pushes the reaction to the left, releasing CO₂ gas to be exhaled.

Transport Mechanics Compared

Feature	O ₂ (Oxygen)	CO ₂ (Carbon Dioxide)
Primary Carrier	RBCs (97%)	Bicarbonate (70%)
Haemoglobin Form	Oxyhaemoglobin	Carbamino-haemoglobin
Loading Trigger	High pO ₂ , Low pCO ₂ (Alveoli)	High pCO ₂ , Low pO ₂ (Tissues)
Unloading Trigger	Low pO ₂ , High pCO ₂ , High H ⁺ (Tissues)	Low pCO ₂ , High pO ₂ (Alveoli)

KEY TAKEAWAY

Blood acts as a highly specialized, dual-lane transit system. While nearly all **oxygen** relies on the direct binding power of red blood cells, the majority of **carbon dioxide** is converted into a chemical disguise—bicarbonate—to safely back to the lungs.

Yield: 5mL O_2 delivered / 4mL CO_2 removed per 100mL of blood



You've Learned the Theory.

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