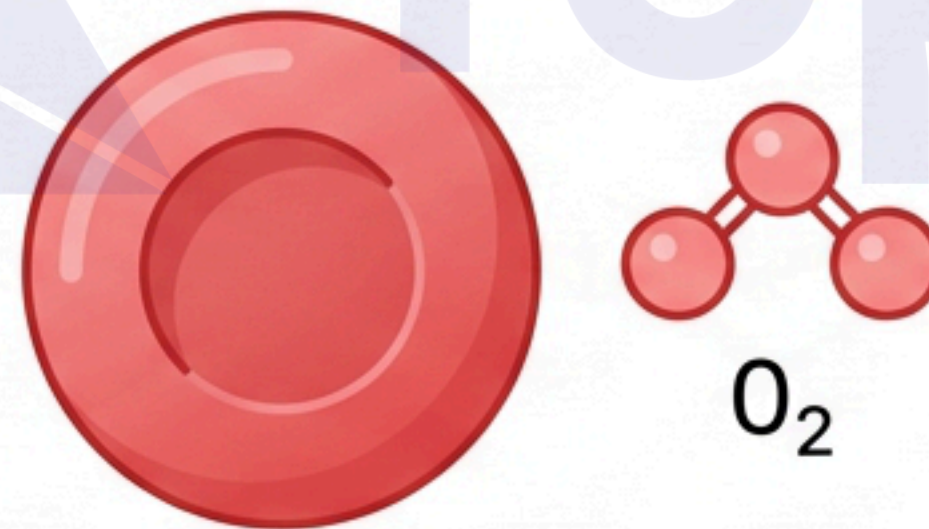


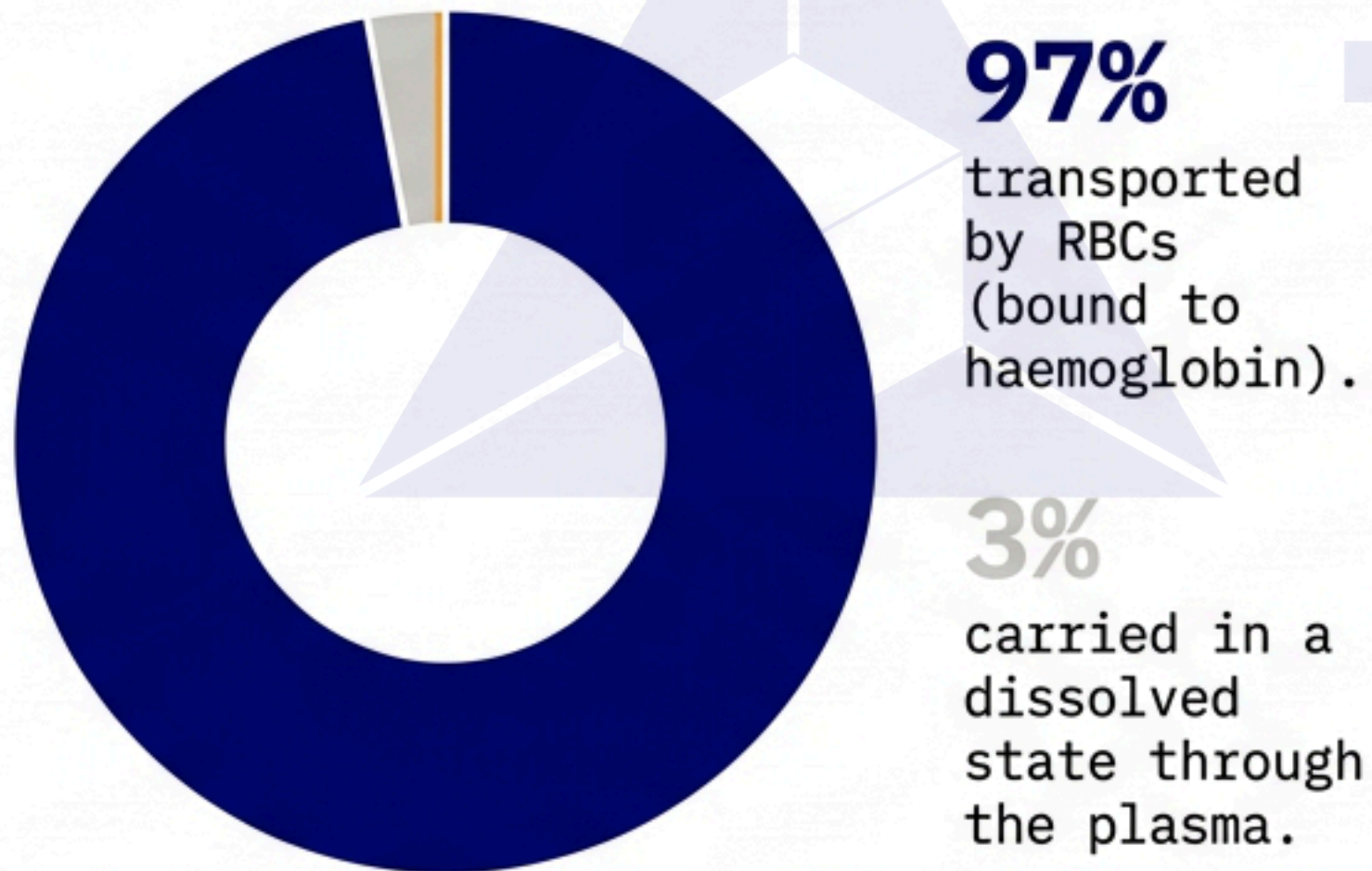
How Haemoglobin Loads and Unloads O_2

The biological logistics of oxygen transport from the alveoli to the tissues.



Haemoglobin & Oxyhaemoglobin

The Transport Medium

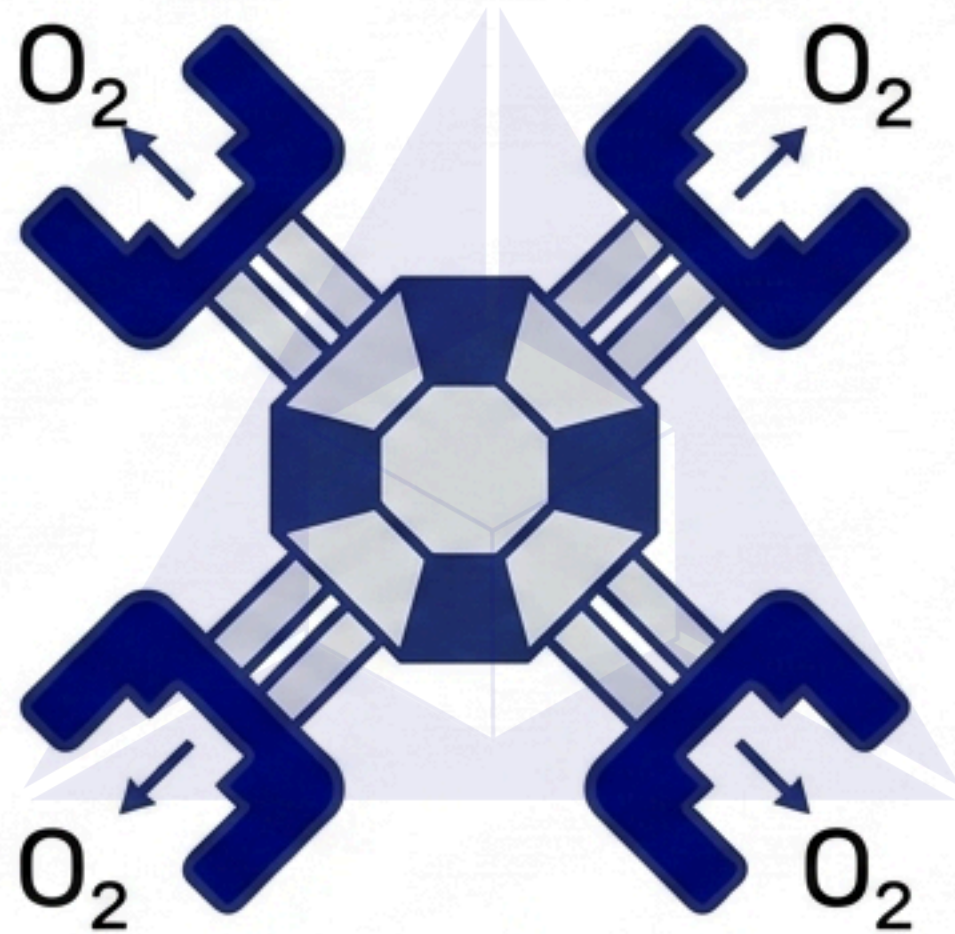


The Reversible Reaction

Haemoglobin is the red-coloured, iron-containing pigment in RBCs. It acts as the transport vehicle, binding reversibly with oxygen to form oxyhaemoglobin.



Maximum 4 O_2 per Haemoglobin



Absolute Capacity Limit:
A single haemoglobin molecule cannot carry more than four molecules of O_2 .

The degree of binding is primarily dictated by the partial pressure of oxygen (pO_2) in the immediate environment.

The Governing Dynamics of Oxygen Binding



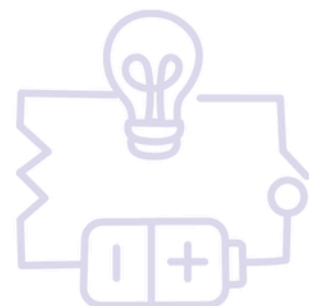
Four key environmental factors dictate whether haemoglobin binds to or releases oxygen.

Factor	Effect on Loading (Alveoli)	Effect on Unloading (Tissues)
Partial Pressure of O ₂ (pO ₂)	High pO ₂ drives binding.	Low pO ₂ drives dissociation.
Partial Pressure of CO ₂ (pCO ₂)	Low pCO ₂ is favorable.	High pCO ₂ interferes with O ₂ binding and drives dissociation.
Hydrogen Ion Concentration (H ⁺)	Lesser H ⁺ is favorable.	High H ⁺ (lower pH) favors the dissociation of oxygen.
Temperature	Lower temperatures favor loading.	Higher temperatures favor dissociation from oxyhaemoglobin.



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The Oxygen Dissociation Curve

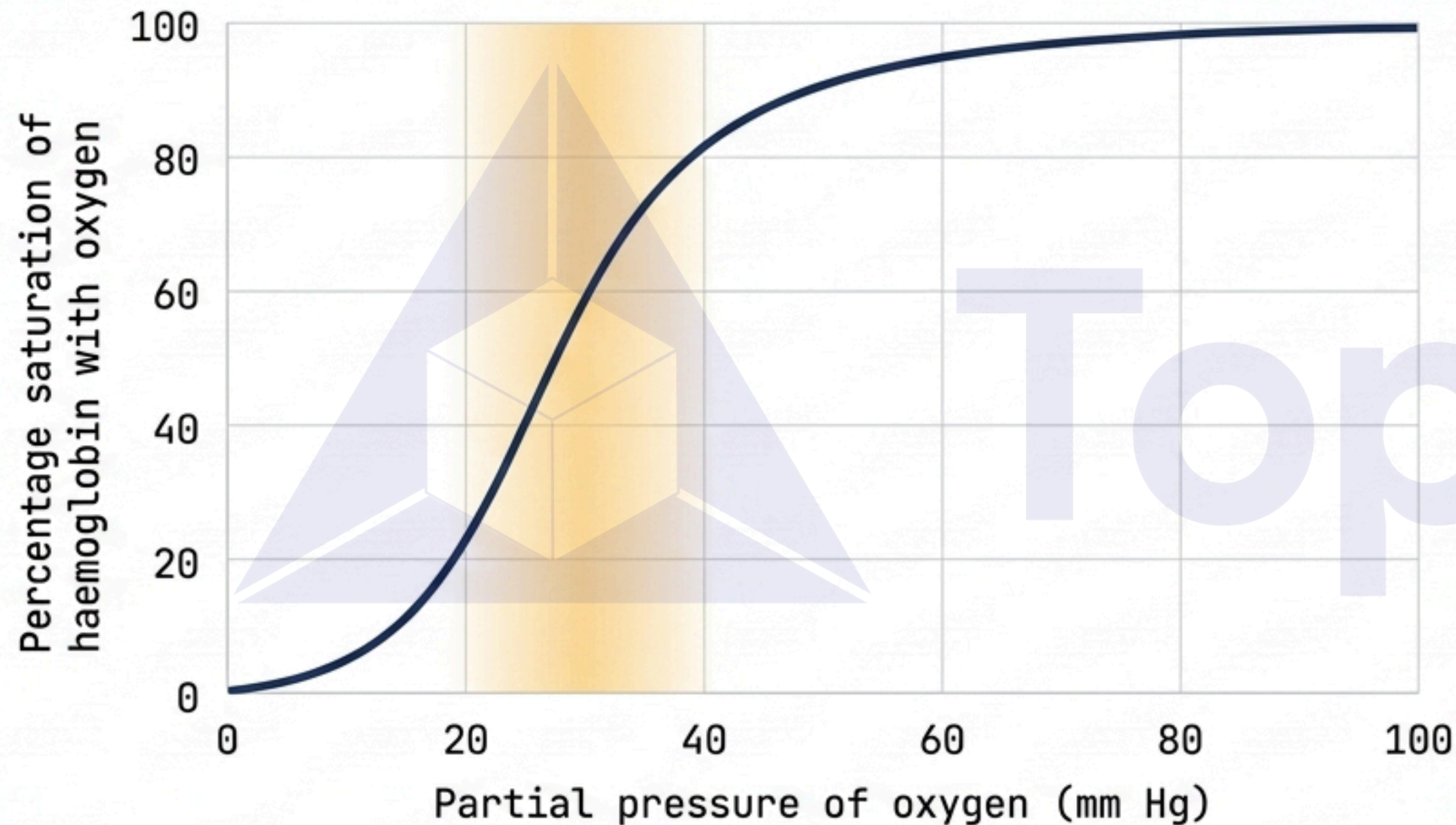
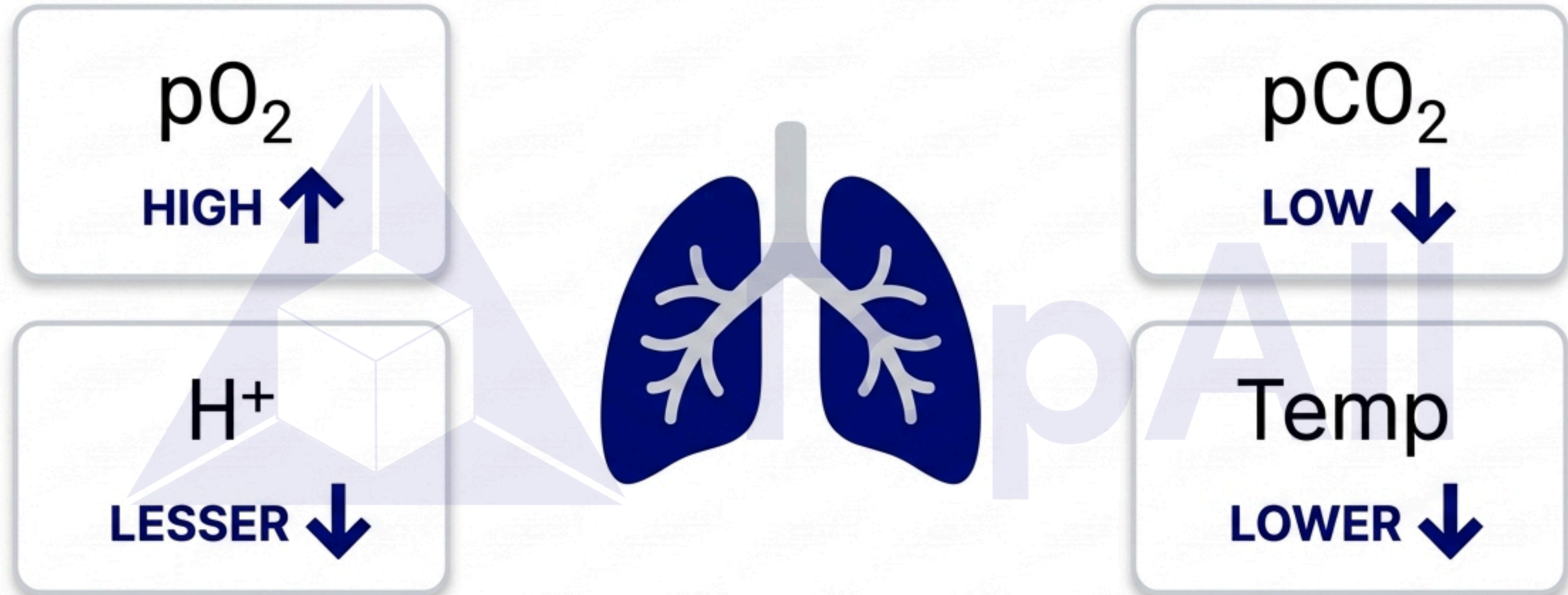


Figure 14.5 | Sigmoid curve plotting % saturation against pO_2 .

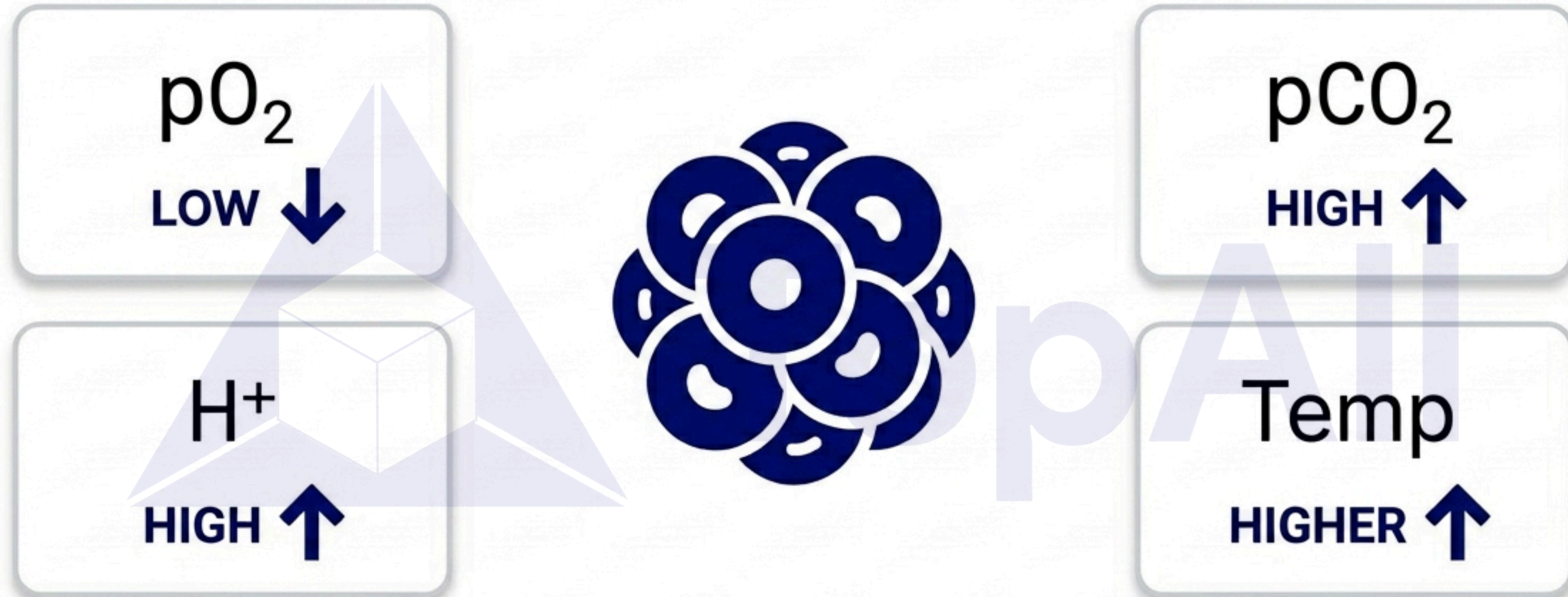
Why a sigmoid curve? The S-shape illustrates how haemoglobin's affinity for oxygen dynamically changes based on the surrounding pO_2 and the presence of interfering factors like pCO_2 and H^+ .

Phase 1: Loading at the Alveoli



In the alveoli, the combination of high oxygen concentration and low interfering factors creates the perfect environment. These conditions are highly favourable for the formation of **oxyhaemoglobin**. Oxygen binds to the haemoglobin at the lung surface, preparing for transport.

Phase 2: Unloading at the Tissues



As blood reaches the tissues, the environment is reversed due to cellular catabolism. The low oxygen and high presence of CO_2 and H^+ create conditions favourable for **dissociation**. Oxygen is forced to detach from the oxyhaemoglobin and diffuse into the cells where it is needed.

The Delivery Metric



Normal Physiological Conditions

Every **100 mL** of
oxygenated blood
delivers **~5 mL** of
 O_2 to the tissues.

This efficient loading and unloading mechanism ensures cells continuously receive the oxygen required to derive energy from glucose and other molecules.



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