

The Thin Wall Between Air and Blood

A structural blueprint of the alveolar diffusion membrane.



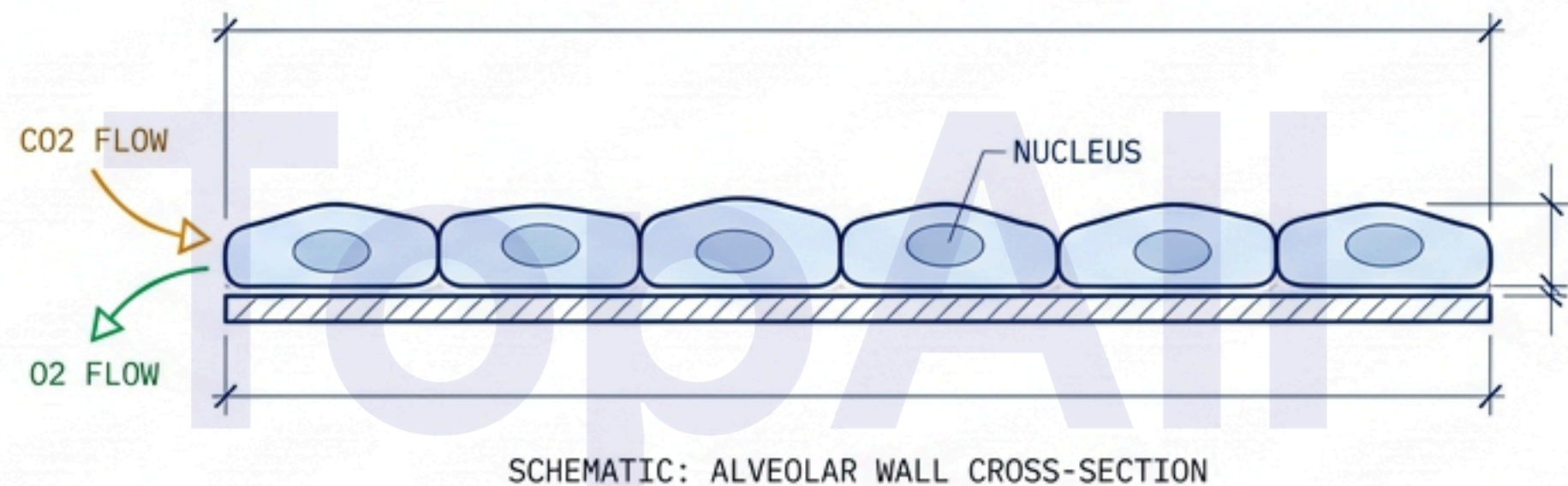
Human survival relies on a continuous, rapid exchange of atmospheric oxygen for cellular carbon dioxide. This entire process hinges on a single microscopic frontier.

Squamous Epithelium of Alveoli

LAYER 01: AIR INTERFACE

One-celled thick

This single layer of flattened epithelial cells forms the innermost lining of the alveolar cavity. It acts as the initial physical surface that atmospheric air contacts.



Atmospheric pO_2 : 104 mm Hg
Atmospheric pCO_2 : 40 mm Hg



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Let's Test Them Now.**

$$E=mc^2$$



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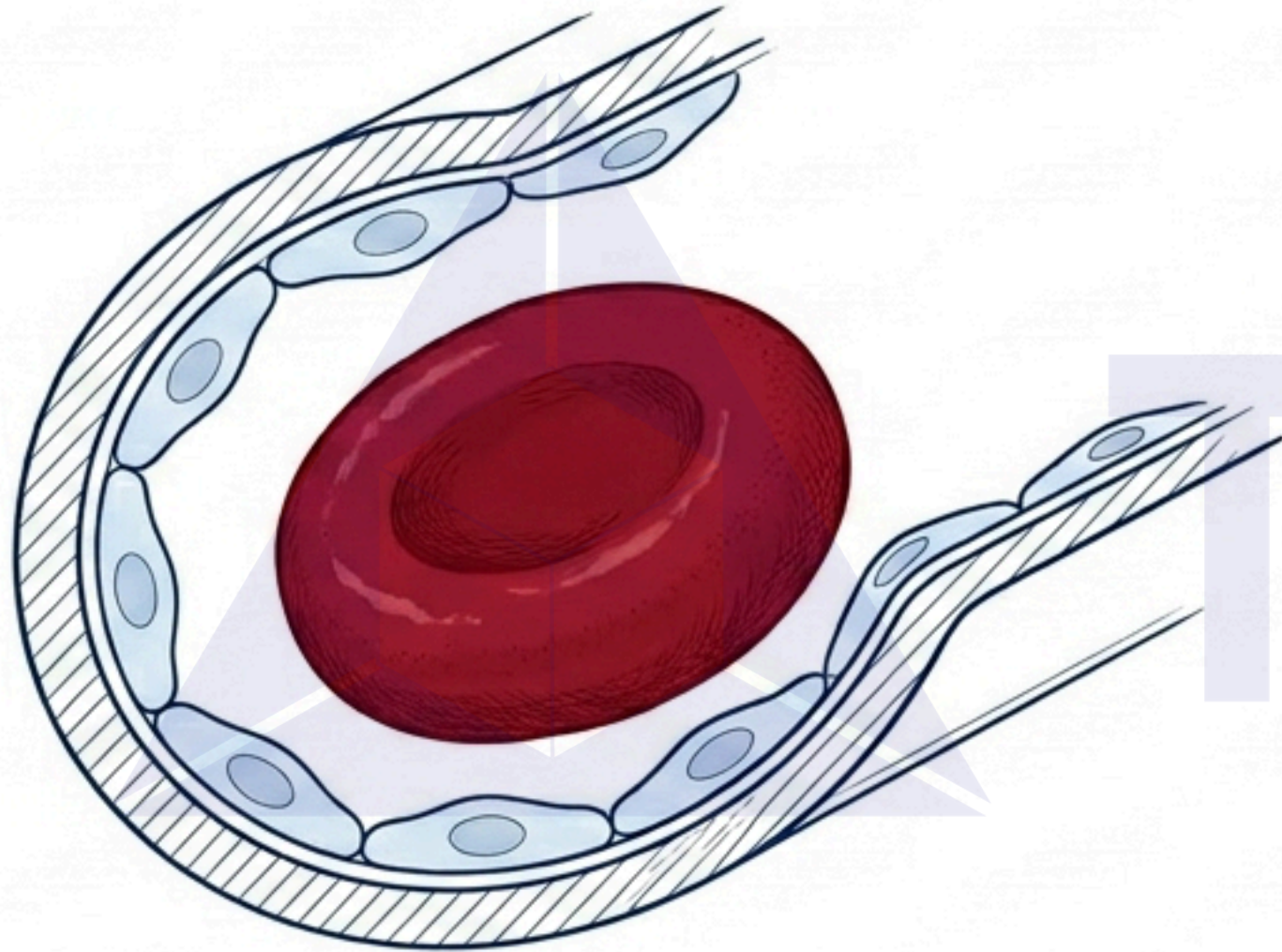
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Alveolar Capillary Endothelium



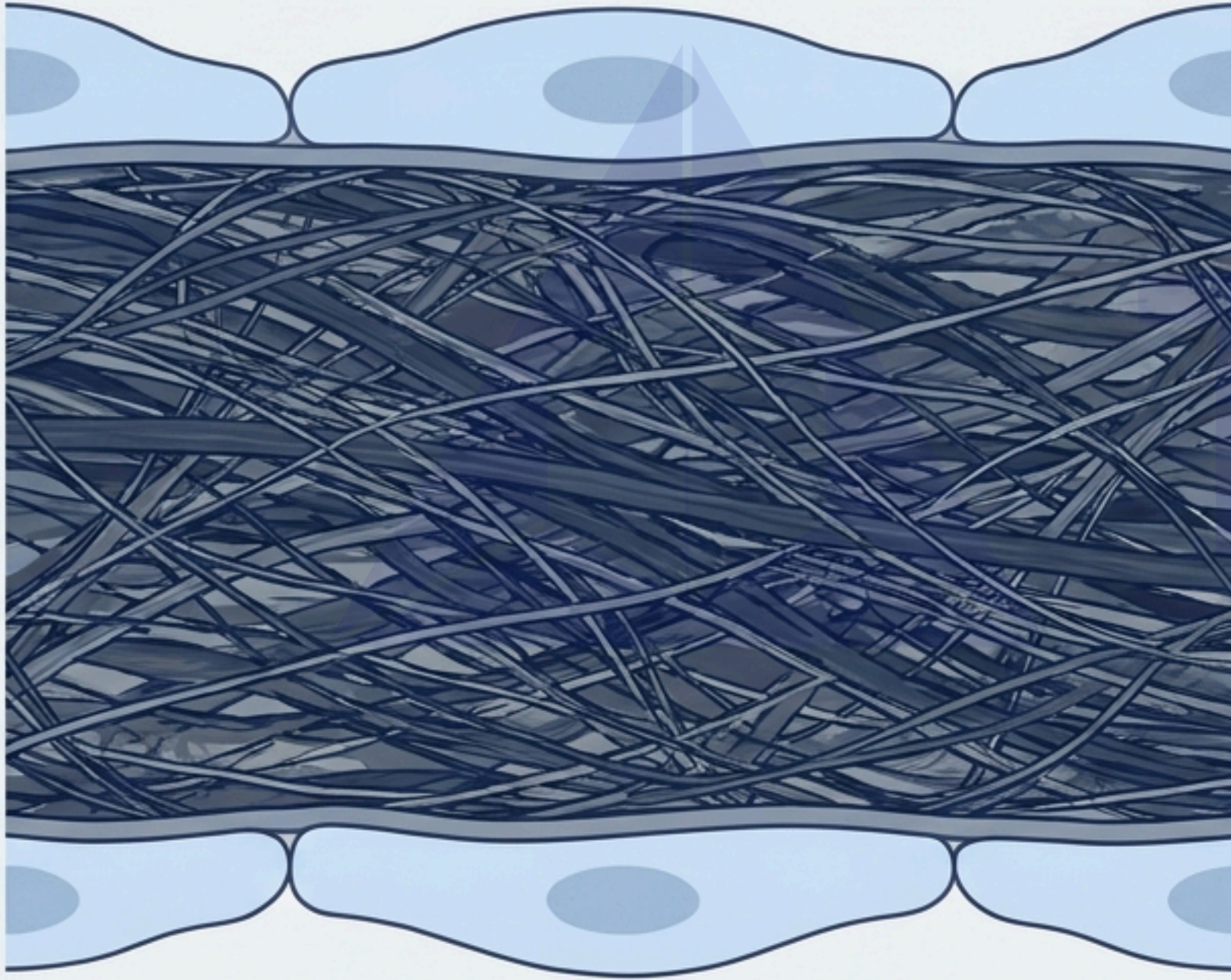
LAYER 03: BLOOD INTERFACE

Vascular boundary

The final cellular layer facing the bloodstream. This single layer of endothelial cells forms the actual wall of the surrounding capillaries, maintaining a sealed vascular system while permeable to gas molecules.

Deoxygenated Blood pO_2 : 40 mm Hg
Deoxygenated Blood pCO_2 : 45 mm Hg

The Basement Substance

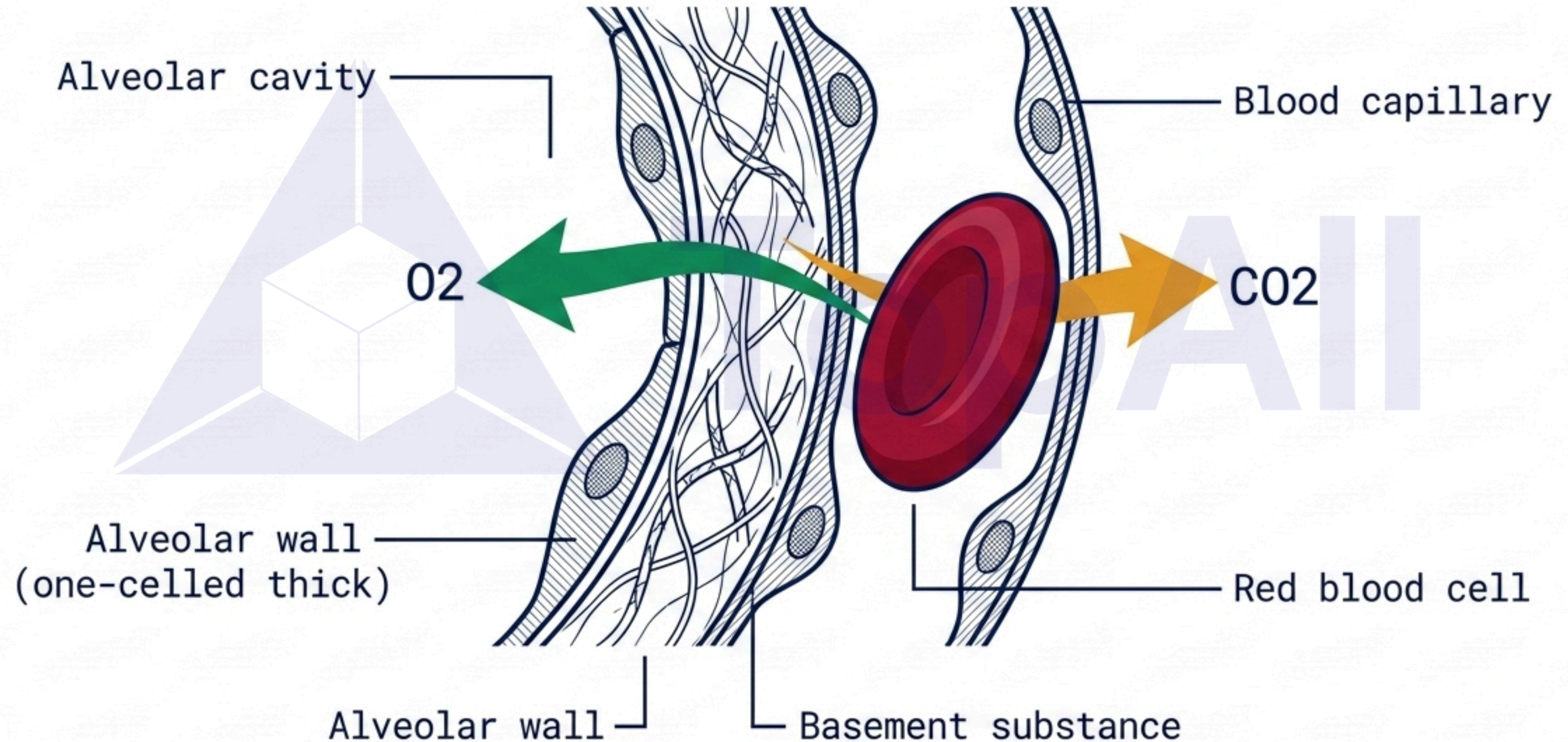


LAYER 02: STRUCTURAL MATRIX

An acellular support matrix sandwiched between the epithelial and endothelial layers. It provides the necessary structural integrity to keep the microscopic air sacs from collapsing or leaking blood, without impeding the flow of gases.

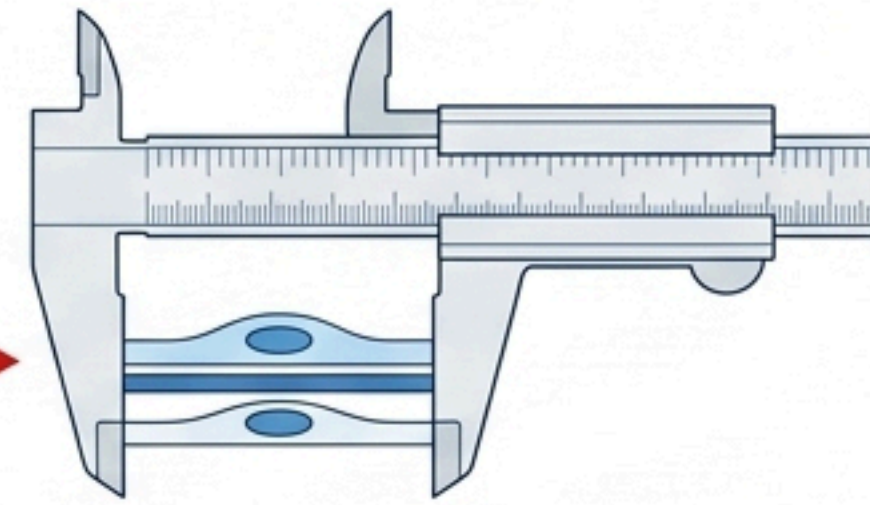
! Dual-Membrane Fusion. This substance is highly efficient because it is actually composed of two fused parts: a thin basement membrane supporting the squamous epithelium, and the basement membrane surrounding the capillary endothelial cells.

The Complete Diffusion Blueprint



The Efficiency of the Micro-Barrier

< 1mm
Total Thickness →



Despite containing three distinct structural layers, the total thickness of the diffusion membrane is much less than a single millimetre.

This sub-millimeter proximity, combined with high pressure gradients, creates the ultimate favorable conditions for rapid, passive diffusion of gases necessary for survival.

GRADIENT DRIVE:

O₂ diffuses from 104 → 40 mm Hg

SOLUBILITY FACTOR:

CO₂ diffuses efficiently because it is 20-25x more soluble than O₂.



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