

Capillaries Encyclopedia Article

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Capillaries

Capillaries are the microscopic **blood** vessels branching from the arterioles and merging into venules. Despite the fact that there are approximately 40 billion capillaries in the body, they hold only 5% of total blood volume. There are two reasons for this. First, the size of the capillaries is only 5-10nm in diameter. Second, at any give time only a fraction (25%) of capillaries are fully filled with blood, especially in tissues at rest, as blood flow in microvessels is dependent on the metabolic activity of the **tissue** and is regulated at the sites of their origin by the precapillary sphincter muscles.

Capillaries are essential for the delivery of oxygen to the tissues and the exchange of nutrients between the blood and **interstitial fluid** surrounding the cells. This function is well supported by the **anatomy** of the vessels. The thin walls of the capillaries are composed of a single layer of endothelial cells. As a result, gasses such as CO₂ and O₂ can diffuse through their walls, as can lipid soluble substances. In contrast, an exchange of lipid-insoluble substances occurs via transcytosis, which involves formation of pinocytotic vesicles at one side of the endothelial cell, their transport across the cells, and release of contents from the other side of the cell.

Capillaries also play an important role in regulating the relative volume of the blood and interstitial fluid by allowing a bulk flow through their walls. This exchange of water and solutes occurs in response to the pressure gradient across the capillary wall.

Based on the structure of the endothelial cells, there are three types of capillaries. Continuous capillaries are a tube developed by the endothelial cells with no intercellular or intracellular gaps (**brain, retina**), or small intercellular gaps. In contrast, fenestrated endothelium has pores of 70-100nm in size which allow some substances to pass through. Finally, there are discontinuous capillaries (or sinusoids) that are the largest capillaries and have little or no basal membrane, and large intercellular pores and fenestrations.

Capillaries form functional units known as capillary beds and these are not uniformly distributed among the different tissues. Sites of high metabolic activity (**liver, kidneys**) contain numerous capillaries, while sites with little metabolic activity (such as the lens of the **eye**) are capillary-free.