Microcirculation

In the mammalian body blood flows from the heart through the aorta and then branches many, many times to flow through the microcirculation consisting, at the smallest level, of capillaries with a typical diameter of $5 - 10\mu m$. These subsequently combine eventually returning to the heart through the venous system.

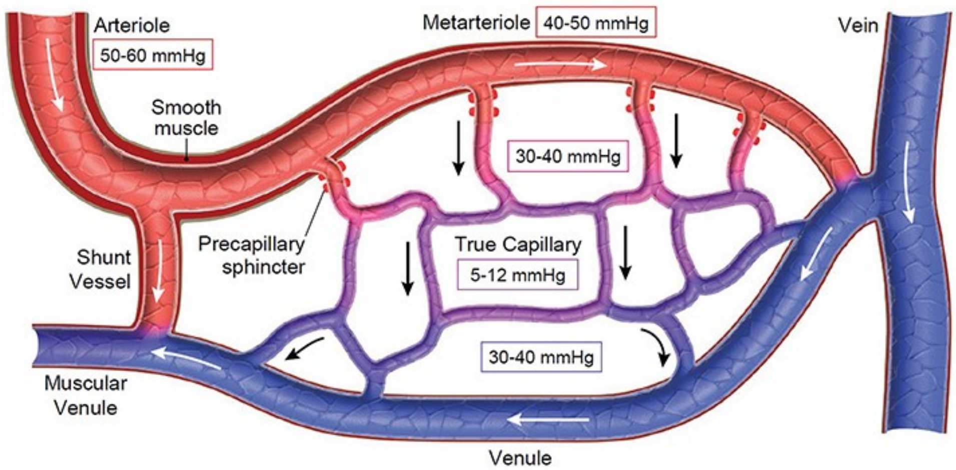

Figure 1: Schematic of the microcirculation showing the average interstitial (tissue) oxygen tension at the various stages. From Cooper and Silverstein (2021).

Figure 1 is a diagram of the microcirculation indicating the average interstitial (tissue) oxygen tension (in $mmHg$) at the various stages of the flow from the arterial to the venous system. Typical sizes of the vessels as the flow progresses through the microcirculation are: (1) Arteriole: $10-150\mu m$ (2) Metarteriole: $10 - 20\mu m$ (3) Capillaries: $5 - 10\mu m$ (4) Venules: $10 - 100\mu m$. The capillaries are smaller than the red blood cells which are squeezed and distorted as they pass through the microcirculation. This enhances the dissolved gas diffusion into and out of the red blood cells, a process that is driven by the gradients in the dissolved oxygen or carbon dioxide concentrations. The fluxes of gas that this causes are thus driven by the so-called "Starling Forces". Thus, over the breadth of the microcirculation there is a overall net flux for each of the dissolved gases and other substances as the blood passes from the arterial to the venous systems. The difference between the oxygen diffusion out of the blood into the surrounding tissue at the arterial end and the diffusion back into the blood on the venous side is described by the "Starling Equation" which effectively represents the net of two diffusion processes. In a similar but reversed process carbon dioxide is carried from the venous system back to the arterial system.