18.8C: Bulk Flow: Filtration and Reabsorption

Capillary fluid movement occurs as a result of diffusion (colloid osmotic pressure), transcytosis, and filtration.

Learning Objectives

• Explain the process of filtration and reabsorption in capillaries

Key Points

• Bulk flow is a process used by small lipid-insoluble proteins to cross the capillary wall.
• Capillary structure plays a large role in the rate of bulk flow, with continuous capillaries limiting flow and discontinuous capillaries facilitating the greatest amount of flow.
• When moving from the blood to the interstitium, bulk flow is termed filtration.
• When moving from the interstitium to the blood, bulk flow is termed re-absorption.
• The kidney is a major site of bulk flow where waste products are filtered from the blood.

Key Terms

• **filtration**: In bulk flow, this refers to the movement of proteins or other large molecules from the blood into the interstitium.
• **reabsorption**: In bulk flow, this refers to the movement of proteins or other large molecules from the interstitium into the blood.

Bulk flow is one of three mechanisms that facilitate capillary exchange, along with diffusion and transcytosis.
Bulk Flow Process

Bulk flow is used by small, lipid-insoluble solutes in water to cross the capillary wall and is dependent on the physical characteristics of the capillary. Continuous capillaries have a tight structure reducing bulk flow. Fenestrated capillaries permit a larger amount of flow and discontinuous capillaries allow the largest amount of flow.

The movement of materials across the capillary wall is dependent on pressure and is bidirectional depending on the net filtration pressure derived from the four Starling forces.

When moving from the bloodstream into the interstitium, bulk flow is termed filtration, which is favored by blood hydrostatic pressure and interstitial fluid oncotic pressure. When moving from the interstitium into the bloodstream, the process is termed reabsorption and is favored by blood oncotic pressure and interstitial fluid hydrostatic pressure.

Modern evidence shows that in most cases, venular blood pressure exceeds the opposing pressure, thus maintaining a positive outward force. This indicates that capillaries are normally in a state of filtration along their entire length.

The Kidneys and Bulk Flow

The kidney is a major site for bulk flow transport. Blood that enters the kidneys is filtered by nephrons, the functional unit of the kidney. Each nephron begins in a renal corpuscle composed of a glomerulus containing numerous capillaries enclosed in a Bowman's capsule. Proteins and other large molecules are filtered out of the oxygenated blood in the glomerulus and pass into Bowman's capsule and the tubular fluid contained within. Blood continues to flow around the nephron until it reaches another capillary-rich region the peritubular capillaries, where the previously filtered molecules are reabsorbed from the tubule of the nephron.

Tubular reabsorption is the process by which solutes and water are removed from the tubular fluid and transported into the blood. Reabsorption is a two-step process beginning with the active or passive extraction of substances from the tubule fluid into the renal interstitium, and then the transport of these substances from the interstitium into the bloodstream.
Tubular Secretion: Diagram showing the basic physiologic mechanisms of the kidney and the three steps involved in urine formation.

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