Bloodstream

The bloodstream is a critical component of the circulatory system, responsible for transporting various substances throughout the body. It plays a key role in maintaining homeostasis by delivering oxygen and nutrients to tissues, removing waste products, and serving as a conduit for signaling molecules, immune cells, and more.

Components of the Bloodstream

Blood:

Composed of plasma (the liquid part) and cellular components.

Red Blood Cells (RBCs): Carry oxygen using hemoglobin.

White Blood Cells (WBCs): Defend against infections and foreign substances.

Platelets: Aid in blood clotting.

Plasma transports nutrients, hormones, waste products, and proteins like clotting factors.

Blood Vessels:

Arteries: Carry oxygenated blood away from the heart.

Veins: Return deoxygenated blood to the heart.

Capillaries: Tiny vessels where the exchange of gases, nutrients, and waste occurs between blood and tissues.

Circulating Biomolecules:

Nutrients: Glucose, amino acids, lipids, vitamins.

Gases: Oxygen (O_2) and carbon dioxide (CO_2).

Hormones: Chemical messengers like insulin and adrenaline.

Waste Products: Urea and other substances for excretion via kidneys or liver.

Other Particles:

Exosomes: Small vesicles carrying proteins, RNA, and other molecules.

Cell-free DNA (cfDNA): DNA fragments from normal and tumor cells, including circulating tumor DNA (ctDNA) in cancer patients.

Pathogens: Viruses, bacteria, or other microorganisms in cases of infection.

Functions of the Bloodstream:

Transport:

Delivers oxygen and nutrients to cells.

Removes carbon dioxide and metabolic waste.

Regulation:

Maintains body temperature, pH balance, and fluid balance.

Protection:

Facilitates immune defense by circulating WBCs and antibodies.

Promotes clot formation to prevent excessive blood loss during injury.

Clinical Relevance:

Diseases Affecting the Bloodstream:

Sepsis: A severe infection leading to systemic inflammation and blood poisoning.

Atherosclerosis: Build-up of plaques in arteries, restricting blood flow.

Anemia: Low red blood cell count affecting oxygen delivery.

Cancer Metastasis: Tumor cells enter the bloodstream to spread to distant sites.

Diagnostics:

Blood tests for biomarkers (e.g., glucose, cholesterol, ctDNA) can reveal health status or disease.

Liquid biopsies analyze the bloodstream for cancer markers, reducing the need for invasive procedures.

The bloodstream is essential for systemic health, acting as the body's transportation network and defense mechanism.