



BLOOD PHYSIOLOGY: COMPOSITION, FUNCTIONS, AND IMPORTANCE

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Abstract : Blood is a specialized connective tissue that plays a critical role in maintaining physiological homeostasis. This article explores the composition, functions, and physiology of blood, including plasma, red blood cells, white blood cells, and platelets. Blood is essential for transport, regulation, and protection within the body. Its functions include oxygen and carbon dioxide transport, nutrient delivery, immune defense, and blood clotting. Additionally, the roles of red blood cells in gas exchange, white blood cells in immunity, and platelets in hemostasis are highlighted. Blood-related disorders such as anemia, leukemia, and hemophilia are also discussed.

Keywords: Blood physiology, plasma, red blood cells, white blood cells, platelets, transport, immunity, hemostasis, anemia, leukemia, hemophilia.

Blood is an essential connective tissue in the human body, composed of different elements that play vital roles in maintaining homeostasis, transporting nutrients and gases, regulating body functions, and providing immune protection. This article explores the components, functions, and overall physiology of blood.

Introduction

Blood is a vital fluid in the human body, essential for the proper functioning of various physiological systems. It is a type of connective tissue composed of a liquid matrix called plasma and cellular elements, including red blood cells, white blood cells, and platelets. Blood serves multiple functions crucial for maintaining homeostasis, including transportation of oxygen, nutrients, and hormones, regulation of body temperature and pH balance, and protection against infections and excessive blood loss.

The human body contains approximately 5 liters of blood, which circulates continuously through the cardiovascular system, delivering essential substances to tissues and organs and removing waste products. Blood is not only a transport medium but also plays a key role in immune response and wound healing. The study of blood physiology provides insight into its complex functions, its role in maintaining overall health, and the pathophysiological changes that occur in various disorders.

This article aims to provide a comprehensive overview of blood physiology, focusing on its components, their respective roles, and the physiological processes in which they are involved. Additionally, it highlights some common blood disorders that can affect the ability of blood to perform its functions effectively. Understanding the physiology of blood is essential for appreciating its significance in health and disease.

Composition of Blood

Blood consists of two main components: plasma and formed elements.

1. Plasma

Plasma is the liquid part of blood, accounting for about 55% of its total volume. It is composed of:

Water: Makes up about 90-92% of plasma, serving as the solvent for transporting various substances.

Proteins: The major plasma proteins include:

Albumin: Maintains osmotic pressure, which is essential for fluid balance between blood vessels and tissues.

Globulins: Play roles in immune response and lipid transport.

Fibrinogen: Involved in blood clotting.

Electrolytes: Such as sodium, potassium, calcium, and bicarbonate, which help maintain pH balance and osmotic pressure.

Nutrients, Hormones, and Waste Products: Plasma carries nutrients (like glucose, amino acids, and fatty acids), hormones, and waste products (like urea and carbon dioxide) to and from different body tissues.[2]

2. Formed Elements

Formed elements, comprising 45% of blood, include:

Red Blood Cells (Erythrocytes): These cells are responsible for transporting oxygen from the lungs to body tissues and returning carbon dioxide for exhalation. Erythrocytes contain hemoglobin, a protein that binds to oxygen and carbon dioxide, facilitating gas exchange.

White Blood Cells (Leukocytes): These are the immune cells of the blood. There are several types of leukocytes, each with distinct functions:

Neutrophils: The most abundant type, which helps fight infections by engulfing bacteria.

Lymphocytes: Includes B-cells, T-cells, and natural killer cells, which are involved in adaptive and innate immunity.

Monocytes: Differentiate into macrophages that engulf pathogens and dead cells.

Eosinophils and Basophils: Involved in allergic reactions and defense against parasites.

Platelets (Thrombocytes): Small cell fragments involved in blood clotting. They aggregate at the site of a blood vessel injury, helping to form a clot and prevent excessive bleeding.[4]

Blood is an essential component of the human body, performing a wide range of functions necessary for survival. It consists of plasma and formed elements, including red blood cells, white blood cells, and platelets, each contributing to vital physiological processes such as transport, regulation, and protection. Red blood cells are primarily responsible for oxygen transport, while white blood cells play a crucial role in immune defense. Platelets, along with plasma clotting factors, ensure that blood clotting occurs efficiently, preventing excessive blood loss in case of injury.

The intricate balance maintained by blood allows for the proper functioning of the body's systems, and any disruption can lead to significant health issues. Disorders such as anemia, leukemia, and hemophilia illustrate the importance of maintaining healthy blood physiology. Understanding blood physiology not only provides insight into the body's basic functions but also helps in diagnosing, treating, and preventing a wide range of diseases. Blood is truly a lifeline that connects and sustains all aspects of human health.

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