

The Main Constituents of Blood

Described as a “fluid connective tissue,” blood is comprised of approximately 55% plasma (a yellow-ish but transparent fluid) and 45% cellular volume (erythrocytes (red cells), thrombocytes (platelets), and leukocytes (white cells)). Blood is “the bus” that delivers gases, nutrients, blood cells, metabolic wastes, immune cells, and hormones throughout the body wherever they need to travel to or from, and it interacts with other body fluids for the purposes of exchange and transfer.



Plasma: Plasma is approximately 90% water and it represents the ‘fluid’ part of blood tissue. It is additionally comprised of dissolved substances, such as nutrients, cellular waste, proteins, gases, enzymes, hormones, and salts.

Nutrients: Obviously, the food we ingest has to be broken down, digested, and carried off in the form of nutrients to various body systems. These are broken down into amino acids, fatty acids, sugars, and vitamins and provide energy to body cells to perform work (synthesis), provide heat, and to prompt growth and repair.

Cellular Waste: Organic waste is produced by the body as it performs the various functions designed for life. Carbon dioxide must be moved from the cells to the lungs so it can be exhaled and exchanged for oxygen. Urine is formed as a result of protein metabolism and must be moved through the liver and kidneys to be excreted by the bladder. Perspiration is another form of waste and it has the added function of cooling the body.

Proteins: Mostly responsible for maintaining circulation within the blood by sustaining appropriated blood pressure (which keeps plasma in fluid form and where it is supposed to be). Other proteins aid the delivery of hormones and vitamins.

Clotting Factors: These are essential proteins that stop the flow of blood when needed by helping to form clots. These also contribute, with Albumin, to the viscosity of blood plasma.

Albumins: Formed in the liver, are largely responsible for plasma osmotic pressure and contributes to plasma viscosity.

Globulins: Formed in the liver and in lymph tissues, these proteins act as antibodies, agents to transfer hormones (which are passed directly into the blood from the endocrine glands which produce them) and vitamins, and as inhibitors.

Thrombocytes: Commonly called Platelets, these small colorless discs are the agents of blood clotting (haemostasis). Continually renewed by splitting from cytoplasm in stem cells in bone marrow, they have a lifespan of approximately 10 days. These become sticky when in contact with damaged blood vessels and assist the stemming of blood flow by releasing constricting agents. This action attracts more platelets to the site,

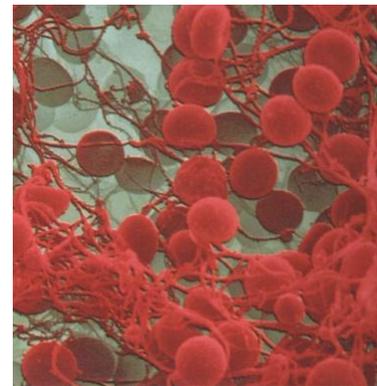


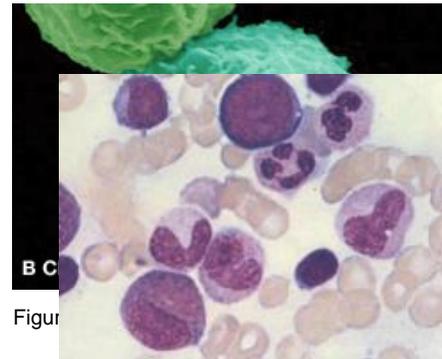
Figure 2: Coagulated Blood



Figure 1: Plasma Collection Bag

and these form together at the site to form a 'platelet plug,' which is a temporary seal to stop blood flow while coagulation takes place. Coagulation, or clotting, causes the formation of fibrin through a series of stages, trapping red blood cells to form a 'scab' on the surface, or outside of the circulatory system. Internal (Intrinsic) actions also take place to repair damages to the vessel itself. This whole process is a very complex task involving thirteen different coagulating factors in the blood. Dysfunction with the formation of Thrombocytes and the actions related to clotting can either cause failure to clot (bleeding disorders) or excessive clotting (coagulation of blood within the circulatory system).

Leukocytes: Referred to as White Blood Cells (WBC), the five types of cells make up the official 'Army' of the body, protecting and defending it against the intrusion of unwanted organisms and materials. The five types of cells are classified into two groups: Granulocytes (basophils, eosinophils, and neutrophils) and Agranulocytes (monocytes and lymphocytes).



Figure

Figure 3: White Blood Cells

Basophils: These cells produce histamine in the event of contact with certain allergens, making the blood

vessels more permeable, easing the passage of fluids from the capillaries into inflamed body tissues.

Eosinophils: These cells play a role in the removal of parasitic infections, relates to the inflammatory process during certain allergic responses (they ingest antigen and antibody complexes), and in the breakdown of histamines.

Neutrophils: Functioning to remove waste materials and to protect against foreign materials (such as microbes), these cells surround and engulf the 'enemy.' Their granules, lysosomes, contain an enzyme that digests the material (a process called phagocytosis). Worn-out neutrophils form the components of pus.

Monocytes: When mobilized at an infection site, these cells engulf and digest cellular remnants and promote the healing of wounds. Their job is to defend against infections and dispose of cellular breakdown products (necrosis). They filter large amounts of body fluids (liver, spleen, and lymph nodes), and cause a rise in body temperature in response to infection. These cells promote production of T-cells and globulins.

Lymphocytes: These are the T-cells (which mature in the thymus) and B cells, which normally mature in bone marrow, and once activated, respond to foreign materials in the body (antigens). Antigens may be in the form of cells regarded as foreign (in some

case, a breakdown in the endocrine and/or immune systems will cause these cells to attack and destroy healthy cells), pollen, bacteria, fungi, and certain types of drugs.

Erythrocytes: Known as Red Blood Cells (RBC), these are disc-shaped cells approximately 7 microns in diameter. These are formed in red bone marrow and have a lifespan of approximately 120 days, taking about 7 days to mature and form the component hemoglobin (a complex protein consisting of iron and globin). Hemoglobin combines with oxygen in the lungs, then provides this supply throughout the body to all cells. As these cells breakdown, the iron is released and recycled, while the remainder of the cell is processed in the liver into bile. Antigens on the surface of red blood cells determine the 'type' of blood a person has (A, B, O).



Figure 5: Red Blood Cells with B-Cell

Bibliography

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