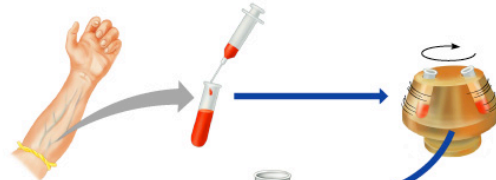


## BLOOD CLASS NOTES

Blood is the only \_\_\_\_\_ tissue in the human body. It is composed of living cells (\_\_\_\_\_) and non-living cells (\_\_\_\_\_)

The color of blood ranges. Oxygen rich blood is \_\_\_\_\_ while oxygen poor blood is a \_\_\_\_\_.

The pH must remain between \_\_\_\_\_ and its temperature is slightly \_\_\_\_\_ than the body's temperature. Blood plasma is composed of about \_\_\_\_\_ water and includes many dissolved substances. These include:






Plasma 55%		Formed elements (cells) 45%		
Constituent	Major Functions	Cell Type	Number (per mm <sup>3</sup> of blood)	Functions
Water	Solvent for carrying other substances; absorbs heat	Erythrocytes (red blood cells)	4 – 6 million	Transport oxygen and help transport carbon dioxide
Salts (electrolytes) Sodium Potassium Calcium Magnesium Chloride Bicarbonate	Osmotic balance, pH buffering, regulation of membrane permeability	Leukocytes (white blood cells)	4000 – 11,000	Defense and immunity
Plasma proteins Albumin Fibrinogen Globulins	Osmotic balance, pH buffering Clotting of blood Defense (antibodies) and lipid transport	Basophil Eosinophil Neutrophil		Lymphocyte Monocyte
Substances transported by blood Nutrients (glucose, fatty acids, amino acids, vitamins) Waste products of metabolism (urea, uric acid) Respiratory gases (O <sub>2</sub> and CO <sub>2</sub> ) Hormones		Platelets	250,000 – 500,000	Blood clotting





Blood plasma proteins include:

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The formed elements in blood include:

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Cell type	Occurrence in blood (per mm <sup>3</sup> )	Cell anatomy*	Function
<b>Erythrocytes</b> (red blood cells, or RBCs) 	4–6 million	Salmon-colored biconcave disks; anucleate; literally, sacs of hemoglobin; most organelles have been ejected	Transport oxygen bound to hemoglobin molecules; also transport small amount of carbon dioxide
<b>Leukocytes</b> (white blood cells, or WBCs)	4000–11,000		
<i>Granulocytes</i>			
• Neutrophils 	3000–7000 (40–70% of WBCs)	Cytoplasm stains pale pink and contains fine granules, which are difficult to see; deep purple nucleus consists of three to seven lobes connected by thin strands of nucleoplasm	Active phagocytes; number increases rapidly during short-term or acute infections
• Eosinophils 	100–400 (1–4% of WBCs)	Red coarse cytoplasmic granules; figure-8 or bilobed nucleus stains blue-red	Kill parasitic worms; increase during allergy attacks; might phagocytize antigen-antibody complexes and inactivate

Cell type	Occurrence in blood (per mm <sup>3</sup> )	Cell anatomy*	Function
<ul style="list-style-type: none"> <li>Basophils</li> </ul> 	20–50 (0–1% of WBCs)	Cytoplasm has a few large blue-purple granules; U- or S-shaped nucleus with constrictions, stains dark blue	Granules contain histamine (vasodilator chemical), which is discharged at sites of inflammation
<p>Agranulocytes</p> <ul style="list-style-type: none"> <li>Lymphocytes</li> </ul> 	1500–3000 (20–45% of WBCs)	Cytoplasm pale blue and appears as thin rim around nucleus; spherical (or slightly indented) dark purple-blue nucleus	Part of immune system; one group (B lymphocytes) produces antibodies; other group (T lymphocytes) involved in graft rejection, fighting tumors and viruses, and activating B lymphocytes
<ul style="list-style-type: none"> <li>Monocytes</li> </ul> 	100–700 (4–8% of WBCs)	Abundant gray-blue cytoplasm; dark blue-purple nucleus often kidney-shaped	Active phagocytes that become macrophages in the tissues; long-term "clean-up team"; increase in number during chronic infections such as tuberculosis
<p><b>Platelets</b></p> 	250,000–500,000	Essentially irregularly shaped cell fragments; stain deep purple	Needed for normal blood clotting; initiate clotting cascade by clinging to broken area; help to control blood loss from broken blood vessels

\*Appearance when stained with Wright's stain.

## Erythrocytes ( \_\_\_\_\_ )

- The main function is to carry \_\_\_\_\_
- Anatomy of circulating erythrocytes
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- Outnumber white blood cells \_\_\_\_\_

## Hemoglobin

- \_\_\_\_\_ containing protein
- Binds \_\_\_\_\_ but reversibly to \_\_\_\_\_
- Each molecule has \_\_\_\_\_ binding sites
- Each erythrocyte contains \_\_\_\_\_ million hemoglobin molecules

## Leukocytes ( \_\_\_\_\_ )

- Crucial in the body's defense against \_\_\_\_\_
- These contain a \_\_\_\_\_ and \_\_\_\_\_
- Able to move into and out of blood \_\_\_\_\_
- Can move by \_\_\_\_\_ motion
- Can respond to chemicals released by \_\_\_\_\_ tissues

Normal levels are between \_\_\_\_\_ and \_\_\_\_\_ per millimeter.

Abnormal leukocyte levels

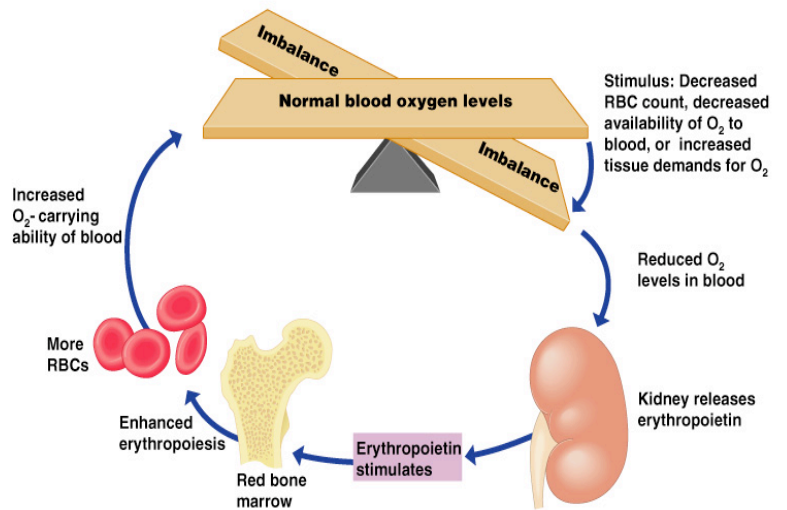
- Leukocytosis
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- Leukopenia
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### Platelets

Derived from ruptured \_\_\_\_\_ cells and are needed for the \_\_\_\_\_ process.  
The normal platelet count is \_\_\_\_\_ per cubic mm.

### Hematopoiesis

This is \_\_\_\_\_ cell formation that occurs in the \_\_\_\_\_ bone marrow. All blood cells are derived from a common stem cell called a \_\_\_\_\_. Since erythrocytes do not \_\_\_\_\_ or grow them must be produced. They wear out in \_\_\_\_\_ to \_\_\_\_\_ days. They are eliminated in the \_\_\_\_\_ or \_\_\_\_\_. The control of formation is controlled by a hormone called \_\_\_\_\_. The \_\_\_\_\_ produce most of the erythropoietin in response to reduced \_\_\_\_\_ levels in the blood. Homeostasis is controlled by a \_\_\_\_\_ feedback loop.



### Hemostasis

This is the \_\_\_\_\_ of blood flow which can result from a break in a \_\_\_\_\_.

This involves three phases:

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To form a platelet plug, collagen fibers are exposed by a \_\_\_\_\_ in the blood vessel. The platelets become \_\_\_\_\_ and cling to the fibers. The anchored platelets release chemicals to attract \_\_\_\_\_ more platelets. This causes the platelets to pile up and form a \_\_\_\_\_. Blood clots usually occur within \_\_\_\_\_ minutes. The clot remains as \_\_\_\_\_ regenerates. The clot is broken down after \_\_\_\_\_ repair.

Undesirable clotting can happen.

Thrombus

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Embolus

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There are some bleeding disorders.

Thrombocytopenia

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Hemophilia

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## Blood Groups and Transfusions

Large losses of blood will have serious consequences

- Loss of 15-30% causes \_\_\_\_\_
- Loss of over 30% will cause \_\_\_\_\_ and could be \_\_\_\_\_

Transfusions are the only way to replace blood \_\_\_\_\_ but must be the same blood \_\_\_\_\_.

Blood contains genetically determined \_\_\_\_\_. A foreign protein (\_\_\_\_\_) may be attacked by the immune system. Blood is typed using antibodies that will cause the blood to clump. There are over \_\_\_\_ common red blood cell antigens but the most vigorous reactions are to the \_\_\_\_\_ and \_\_\_\_\_ blood group antigens.

The ABO blood group is based on the presence or absence of two antigens

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The lack of these antigens is called type \_\_\_\_\_. If both antigens are present is type \_\_\_\_\_.

The Rh portion is based on the presence or absence of one of \_\_\_\_\_ Rh antigens. Most Americans are \_\_\_\_\_. Problems will occur if Rh groups are mixed.

Dangers in mixing can occur during pregnancy. The danger is if mom is \_\_\_\_\_ and dad is \_\_\_\_\_. The problem occurs when the child inherits the \_\_\_\_\_. The first pregnancy is usually ok. However mom will produce antibodies against \_\_\_\_\_, so mom's body will attack the second child if the child is Rh+.

### Developmental Aspects

In the fetus, the \_\_\_\_\_ and \_\_\_\_\_ are early sites for bone cell formation. By the \_\_\_\_\_ month the bone marrow takes over for blood cell production. Fetal hemoglobin also \_\_\_\_\_ from the hemoglobin produced after \_\_\_\_\_.