

# Blood

## Composition of Blood

Blood contains a nonliving fluid matrix (plasma) in which living cells (formed elements) are suspended. Blood contains 55% plasma and 45% formed elements.

- Plasma is over 90% water. It also contains electrolytes (salts), plasma proteins, and substances transported by blood (i.e. nutrients, hormones, etc.).
- The three types of formed elements are erythrocytes (RBCs), leukocytes (WBCs), and platelets.

## Erythrocytes (RBCs)

- The most numerous of blood cells.
- Biconcave disk shape.
- Produced in the bone marrow.
- Anucleate (lacking a nucleus) when mature and circulating. This results in them being unable to reproduce or repair damage.
- Life span is 100-120 days after which they fragment and are destroyed in the spleen mainly.
- Function – transport oxygen and carbon dioxide.

## Leukocytes (WBCs)

- Formed in the bone marrow.
- Nucleated cells that function in defense and immunity. They are pathogen-destroying cells that are transported in the blood or lymph.
- Ability to move in and out of blood vessels, diapedesis, and can wander through tissues by amoeboid motion.

## Two Major Groups:

Granulocytes contain granules in their cytoplasm and lobed nuclei.

- **Neutrophils** are phagocytes. Their numbers increase exponentially during acute infections.
- **Eosinophils** attack parasitic worms and lessen allergy attacks. The nucleus is figure 8 or bilobed in shape.
- **Basophils** have a large U- or S- shaped nucleus. They release antihistamines and contain heparin.

Agranulocytes contain no visible cytoplasmic granules. Their nuclei are spherical, oval, or kidney shaped.

- **Lymphocytes** act via antibodies or direct cell attack.
- **Monocytes** convert to macrophages once in tissues.

Leukocytes in order of most to least abundant: Neutrophils, Lymphocytes, Monocytes, Eosinophils, and Basophils.

### Platelets

- Formed in bone marrow and are instrumental in blood clotting.
- Thrombocytopenia is a disorder where there are not enough platelets in the blood.
- Thrombocytosis is a disorder where there are too many platelets circulating in the blood.

### Hematologic Tests

A total WBC count or RBC count determines the total number of that cell type per unit volume of blood. Very useful in diagnosis of illnesses.

- Leukocytosis – a very high WBC count
- Leukopenia – a decrease in WBC numbers below 4000/mm<sup>3</sup>
- Polycythemia – an increase in the RBC count
- Anemia – a decreased oxygen-carrying capacity of blood that usually results from either a decrease in RBC number or size

### Blood Typing

Classification is based on the presence of specific glycoproteins on the outer surface of the RBC plasma membrane. These proteins are called antigens. Antigens react with RBCs carrying different antigens resulting in agglutination.

Blood types include A, B, AB, and O. Type O doesn't contain any antigens.

Rh positive indicates the presence of Rh surface antigen. Rh negative blood lacks the surface antigen. There are no agglutinins for Rh positive or Rh negative blood. Rh negative people can synthesize anti-Rh if exposed to Rh positive blood.

- Review Rh factors and pregnancy in lecture textbook and know frequencies of blood types.

Universal Blood Donor: O-

Universal Blood Receiver: AB+ (b/c no antibodies are present in plasma)

