

BLOOD

Blood consists of **plasma** and **formed elements**. The plasma is the fluid portion of the blood and consists of water, proteins, and dissolved materials such as oxygen, carbon dioxide, electrolytes (ionic particles), and other materials. Plasma makes up about 55 percent of the blood volume. Formed elements make up about 45 percent of the blood volume and consist of **erythrocytes** (red blood cells), **leukocytes** (white blood cells), and **thrombocytes** (platelets). Label and color in the red blood cells with a light red color. Label the white blood cells and color in the nucleus with purple and the cytoplasm a light blue. Label and color the thrombocytes purple. There are about 200,000–450,000 thrombocytes per cubic millimeter of blood. They assist the body in clotting to prevent blood from flowing out of small ruptures in blood vessels.

There are about 5 million erythrocytes per cubic millimeter of blood. The erythrocytes do not have a nucleus, and they appear like a donut with a thin spot instead of the donut hole. About a third of the weight of a red blood cell is due to **hemoglobin**, which makes the cells red. Color in the surface view and cross section of the red blood cell. Note also the size of the thrombocyte.

There are about 7,000 leukocytes per cubic millimeter of blood. There are two main types of leukocytes: **granular leukocytes** and **agranular leukocytes**. The granular leukocytes have cytoplasmic granules that either stain pink or dark purple or do not stain much at all. The granular leukocytes that do not stain much at all are called **neutrophils** because the granules are neutral to the stains. They are the most numerous of the leukocytes, making up 60–70 percent of the leukocytes. Neutrophils have a three- to five-lobed nucleus. Color in the cells by shading the cytoplasm light blue and coloring in the nucleus purple.

The **eosinophils** are granular leukocytes that have pink or orange staining granules. The nucleus is generally two-lobed. Color in the eosinophil by first coloring in the purple nucleus and then adding orange to the cytoplasm. Eosinophils make up about 3 percent of the white blood cells.

Basophils are a rare granular leukocyte in that they make up less than 1 percent of the white blood cells. The nucleus is S-shaped but is frequently difficult to see because it is obscured by the dark-staining cytoplasmic granules. Label the basophil and color in the granules a dark purple.

The two kinds of agranular leukocytes are the **lymphocytes** and the **monocytes**. The lymphocytes can be large or small, and they make up 20–30 percent of the leukocytes. The cytoplasm is light blue, and the nucleus is purple. The nucleus of the lymphocyte is dented or flattened. Lymphocytes come in two kinds. **B cells** secrete antibodies (antibody-mediated immunity), and **T cells** are involved in cell-mediated immunity. Label and color the lymphocytes.

The monocytes are large cells (about three times the size of a red blood cell) and have a strongly lobed nucleus. Some people say this looks like a kidney bean or a horseshoe. They represent only about 5 percent of the leukocytes. Color in the nucleus with a purple and the cytoplasm a light blue.

