Normal Blood Cell Morphology

Blood cell morphology is studied by microscopic examination of a Wright's-stained peripheral blood smear. The feathered edge (thin end) of the stained smear should be located .

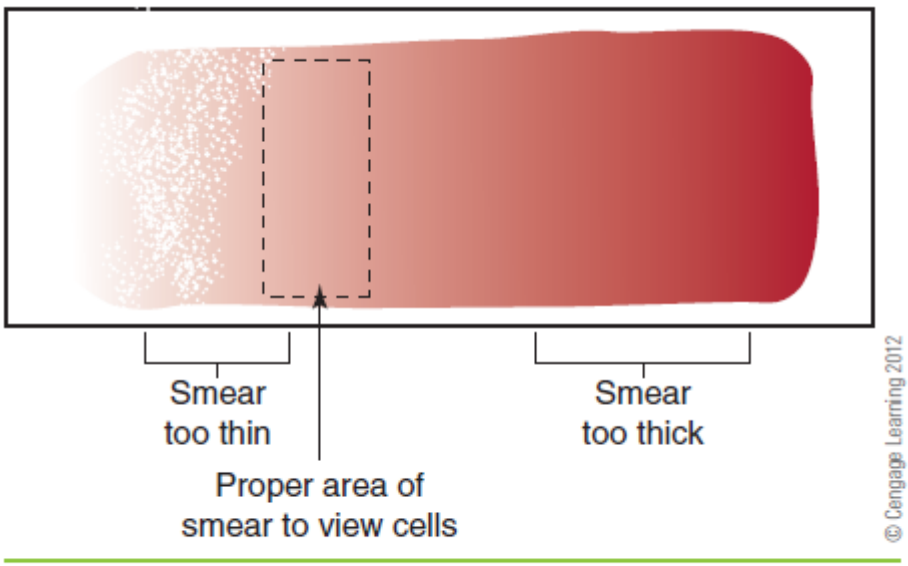


FIGURE 2-51 Proper area of the smear to view for microscopic identification of blood cells

Identification of Blood Cells in a Blood Smear

The formed elements of the blood seen in a stained blood smear include the:

- **red blood cells (RBCs)**, also called **erythrocytes**,
- **white blood cells (WBCs)**, also called **leukocytes**,
- **platelets** or thrombocytes

The blood cells can be classified in slides by evaluating three features:

- Relative cell size
- Nuclear characteristics
- Cytoplasmic characteristics

Red Blood Cells

RBCs are flattened, disk-like shape, called a biconcave disk. Normal mature RBCs stain pink-tan, have no nucleus, and are 6 to 8 μm in diameter . The pink-tan color is due to the staining of hemoglobin within the cells. Because RBCs are thin in the center, the centers of the cells stain lighter than the cell margins.

Platelets

They are also the smallest of the formed blood elements, being about 2 to 3 μm in diameter, or about one-third the diameter of a RBC. The platelet cytoplasm stains bluish and usually contains small reddish-purple granules.

White Blood Cells

WBCs are the largest of the normal peripheral blood components. Their sizes range from a diameter of 8-20 μm.

The granular WBCs : **neutrophil**, **eosinophil**, and **basophil**. contain numerous cytoplasmic granules, and each has a segmented nucleus.

The agranular WBCs :**lymphocyte** and **monocyte** have few, if any, easily visible cytoplasmic granules, and each has a non-segmented nucleus.

1- Neutrophil

The neutrophil nucleus is usually segmented into two to five lobes. The nucleus stains a dark purple . The cytoplasm is pale pink and contains fine pink granules. The neutrophil is about twice the diameter of an red blood cell and is the most numerous of the white blood cells in normal adult peripheral blood . Other names for the neutrophil are polymorphonuclear cell (*PMN*), *poly*, or *seg*.

A younger, or more immature, stage of the neutrophil called a **band cell** can occasionally be seen in normal peripheral blood. However, the nucleus is not segmented but is shaped like a curved sausage .

2- Eosinophil

The **eosinophil** is the WBC with granules that have an affinity for the eosin portion of the Wright's stain. The nucleus of the eosinophil is usually divided into two or three lobes and stains purple.

The cytoplasm is pink-tan but is often difficult to see because it is filled with large red-orange (eosinophilic) granules .

3- Basophil

The **basophil** is the WBC with granules that have an affinity for the basic portion of the Wright's stain. The basophil nucleus is segmented and stains light purple. However, the nuclear shape is often difficult to see because numerous large blue-black granules often obscure the nucleus and the cytoplasm.

4- Lymphocyte

The lymphocyte Nucleus a round or oval shape, and stains purple. The cytoplasm is **basophilic** (blue) and varies in amount.

Most lymphocytes are only slightly larger than a red blood cell and have blue cytoplasm visible around the large nucleus.

5- Monocyte

The **monocyte** is the largest circulating WBC. The monocyte nucleus can be oval, indented, or horseshoe-shaped and can have brain-like convolutions or folds. The cytoplasm is gray-blue and often has an irregular margin.

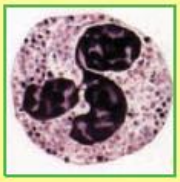
	Neutrophilic Series					
	Segmented (mature)	Band or Stab (immature)	Eosinophil	Basophil	Lymphocyte	Monocyte
						
Cell Size (μm)	10–15	10–15	10–15	10–15	8–15	12–20
Nucleus						
Shape	2–5 lobes	Sausage or U-shaped	Bilobed	Segmented	Round, oval	Horseshoe
Structure	Coarse	Coarse	Coarse	Difficult to see	Smoothly stained, velvety	Folded, convoluted
Cytoplasm						
Amount	Abundant	Abundant	Abundant	Abundant	Scant	Abundant
Color	Pale pink-tan	Pale pink-tan	Pale pink-tan	Pale pink-tan	Blue	Gray-blue
Inclusions	Small, lilac granules	Small, lilac granules	Coarse, orange-red granules	Coarse, blue-black granules	Occasional red-purple granules	Ground-glass appearance

FIGURE 2-53 White blood cell identification guide

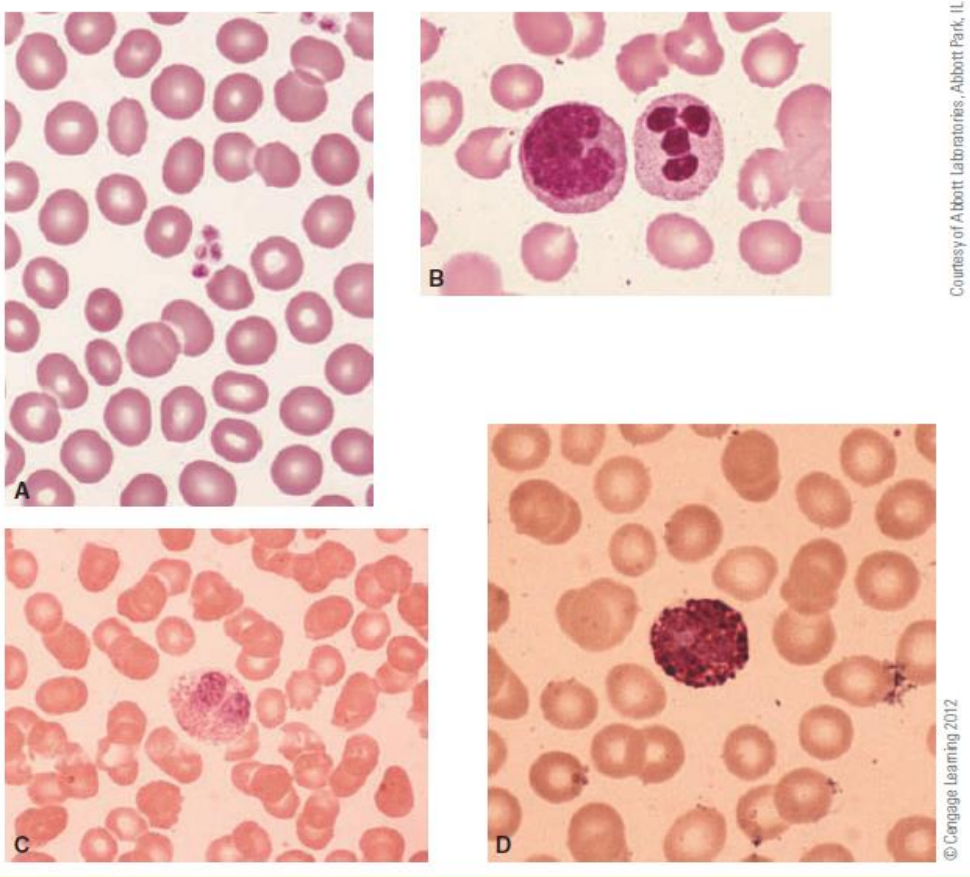


FIGURE 2-54 Photomicrographs of cells in peripheral blood: (A) normal red blood cells and platelets; (B) monocyte (left) and segmented neutrophil (right); (C) eosinophil; and (D) basophil

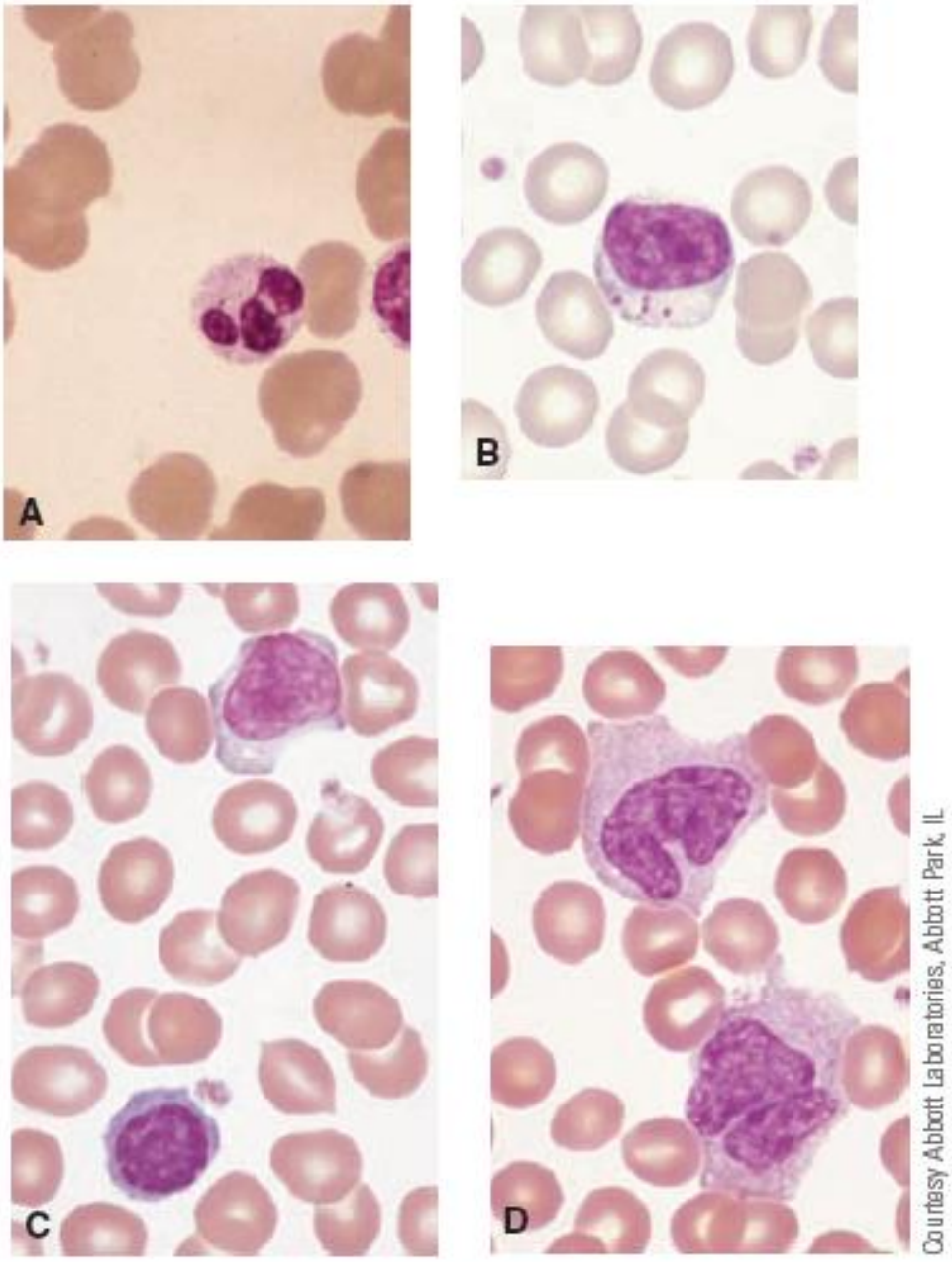


FIGURE 2-55 Photomicrographs of cells in peripheral blood: (A) segmented neutrophil; (B) lymphocyte with azurophilic granules; (C) intermediate lymphocyte and small lymphocyte; and (D) monocytes

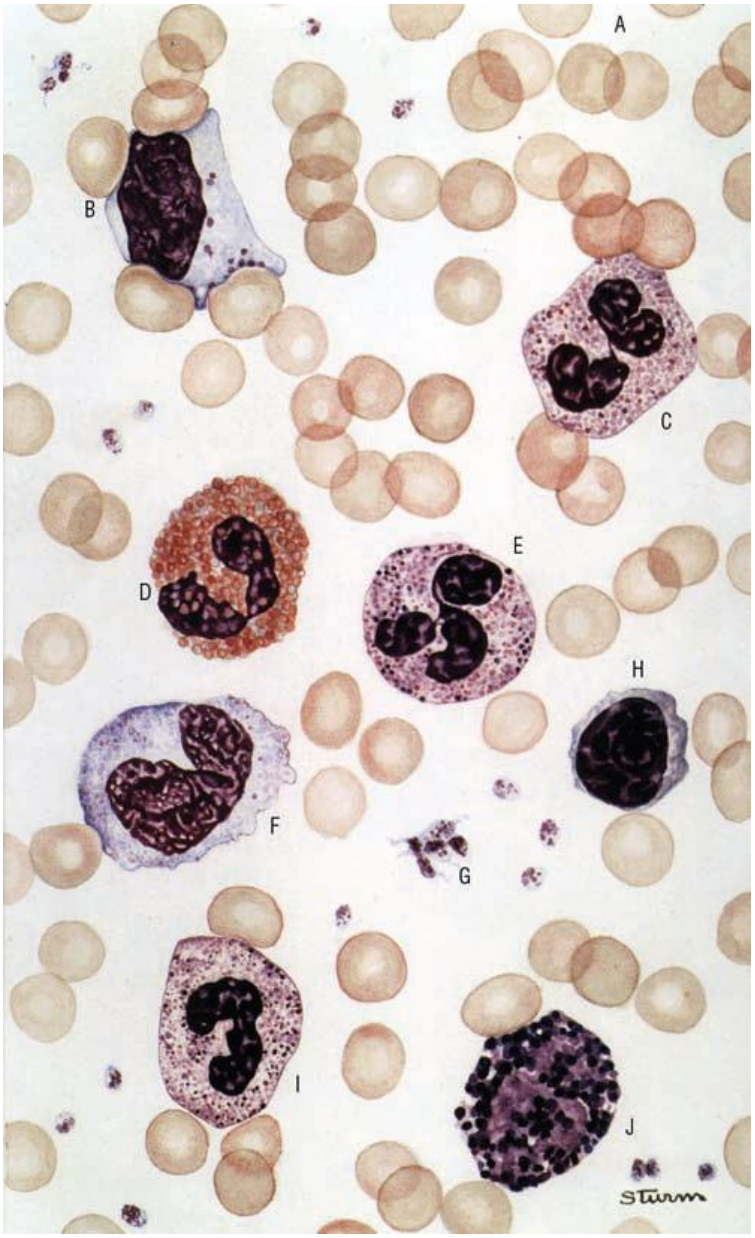


FIGURE 2-52 Cells present in normal peripheral blood: (A) red blood cells; (B) large lymphocyte with azurophilic granules; (C) neutrophil; (D) eosinophil; (E) neutrophil; (F) monocyte; (G) platelets; (H) small lymphocyte; (I) band cell; (J) basophil