Leukocytes are white blood cells (AKA colorless (non-pigmented) blood cells). (Much) smaller in number than RBCs. Unlike RBCs, there are several different types of WBCs. All contain a visible nucleus. The "type" of nucleus can be used to distinguish one WBC type from another. Nearly all WBCs are independently mobile.

The Most Fundamental Distinguishing Feature of Leukocytes Is The Presence (Or Absence) of Granules.

**Granulocytes vs. Agranulocytes**

- **Granulocytes** are characterized by granules in the cytoplasm.
- **Agranulocytes** lack granules in the cytoplasm.

**Granulocytes – 3 Types**
- Granulocytes are 2X the size of RBCs.
- Each granulocyte contains cytoplasm that seems to contain grains, or granules.
- Granulocytes are produced in red bone marrow along with RBCs.
- There are three main types of granulocytes: neutrophils, eosinophils, and basophils.
Granulocytes:

**Neutrophils**
- By far, the most common granulocyte.
- Nearly ALL of the leukocytes that you see will be neutrophils.
- If a leukocyte that you are viewing is small and has a dark purple nucleus, it is probably a neutrophil.
- Neutrophils have a nucleus containing 2-5 lobes connected by thin bridges.
- These are the first white blood cells to arrive at an infection site - they are the "Marines" of the WBCs.
- Phagocytize bacteria, fungi, and some viruses.
- Immature neutrophils have a deep "U" shaped nucleus that has not yet divided into lobes.

**WARNING:** They are frequently misidentified as monocytes and eosinophils by FHC students.

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**Eosinophils**
- 1-4% of the cells in a hematocrit
- An eosinophil nucleus has only two lobes.
- The lobes are shaped like teardrops.
- The 2 lobes are larger and fainter than neutrophil lobes.
- The lobes are connected to one another by a very narrow "isthmus".
- Eosinophil granules stain red in an acid stain.
- These are the largest granulocyte.
- They are often involved with allergic reactions.
- They defend against parasitic worm infection.

Note: The cytoplasm is red and granular - a KEY FEATURE of eosinophils. (Eosin = red)
3 Very Nice Examples of Eosinophils:

Beware Young Person: It is very easy to mistake a bilobed neutrophil for an eosinophil. Many students have misidentified a bilobed neutrophil due to this similarity. Eosinophils are slightly (20%) larger than neutrophils AND the bilobed nucleus does not stain the deep rich purple that the neutrophil nuclei all stain. A bilobed cell is much more likely to be a neutrophil than it is to be an eosinophil.
The lobes of an eosinophil are larger than the lobes of a neutrophil.

Basophils
• Basophils are similar to eosinophils in size and in the shape of their nuclei, but they are so heavily granulated that the entire interior stains a deep purple.
• Students rarely misidentify this granulocyte because they see no cytoplasm.
• Basophils release histamines (to promote inflammation) and heparin (to inhibit blood clotting) - the effect of these releases is increased blood flow to injured or infected tissues!

![Pictured To The Left: 3 Excellent Examples of Basophils.]

Agranulocytes

**Lymphocytes**

• Lymphocytes are only slightly larger than RBCs.
• They typically show a large, round nucleus surrounded by an agranular thin layer of cytoplasm. Often, this thin layer appears to be a very light blue.
• The two major types of lymphocytes are B cells and T cells.
• T cells directly attack microorganisms, tumor cells, and transplant ("non-self" cells)
• B cells produce antibodies.
• Lymphocytes account for 25-33% of leukocytes, so they are not difficult to find.
• Lymphocytes may live for years. (Memory cells)

![Note The Difference Between The Basophil (left) And The Lymphocyte (right):]
Monocytes
• These are the largest of the leukocytes!
• The nuclei vary in shape and are round, kidney-shaped, oval, or lobed. They are distinctly more lightly colored than the granulocyte nuclei!
• Monocytes have much more cytoplasm than lymphocytes!
• Monocytes that leave the bloodstream are called macrophages.
• Macrophages phagocytize bacteria, dead cells, and other debris.
• Monocytes make up 3-9% of WBCs in a hematocrit.

Caution: An immature neutrophil looks somewhat like a monocyte but it is only trying to trick you!!!!!!! An immature neutrophil is a smaller cell than a monocyte with a much darker nucleus!