

Human (Mammalian) and Frog Blood Cells

Humans vs Frogs

Human and frog are two kinds of animals with different evolutionary paths. Humans are mammals while frogs are amphibians. The three main types of blood cells are red blood cells, white blood cells, and platelets. The main difference between human blood cells and frog blood cells is that human red blood cells lack nuclei whereas frog blood cells contain nuclei. The white blood cells of both human and frog are similar to each other by means of morphology as well as function.

Key Areas Covered

1. What are Human Blood Cells
- *Definition, Blood Cell Types, Function*
2. What are Frog Blood Cells
- *Definition, Blood Cell Types, Function*
3. What are the Similarities Between Human and Frog Blood Cells
- *Outline of Common Features*
4. What is the Difference Between Human and Frog Blood Cells
- *Comparison of Key Differences*

Key Terms: Agranulocytes, Frog Blood Cells, Granulocytes, Human Blood Cells, Red Blood Cells, Red Cell Nuclei, Platelets

What are Human Blood Cells

Human blood cells are the circulating cells in the human blood. Human blood is composed of blood cells and plasma (the fluid component of blood). An adult human has about 5 liters of blood and blood cells take up about 2 liters of the total volume of the blood. The rest of the volume (~3 liters) consists of plasma. Blood cells are suspended in plasma. The three main types of blood cells in humans are red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes). The most common type of blood cells are red blood cells. They account for 49% to 45% of the total blood cells. The characteristic red color of blood

is due to the hemoglobin in the red blood cells. Hemoglobin is a protein that binds to oxygen to transport it throughout the body. Generally, red blood cells are round and flat cells. They have a characteristic biconcave shape. The shape of the red blood cells change (flex) to a great extent in order to be transported through small blood vessels (capillaries). Human red blood cells are shown in Figure 1.

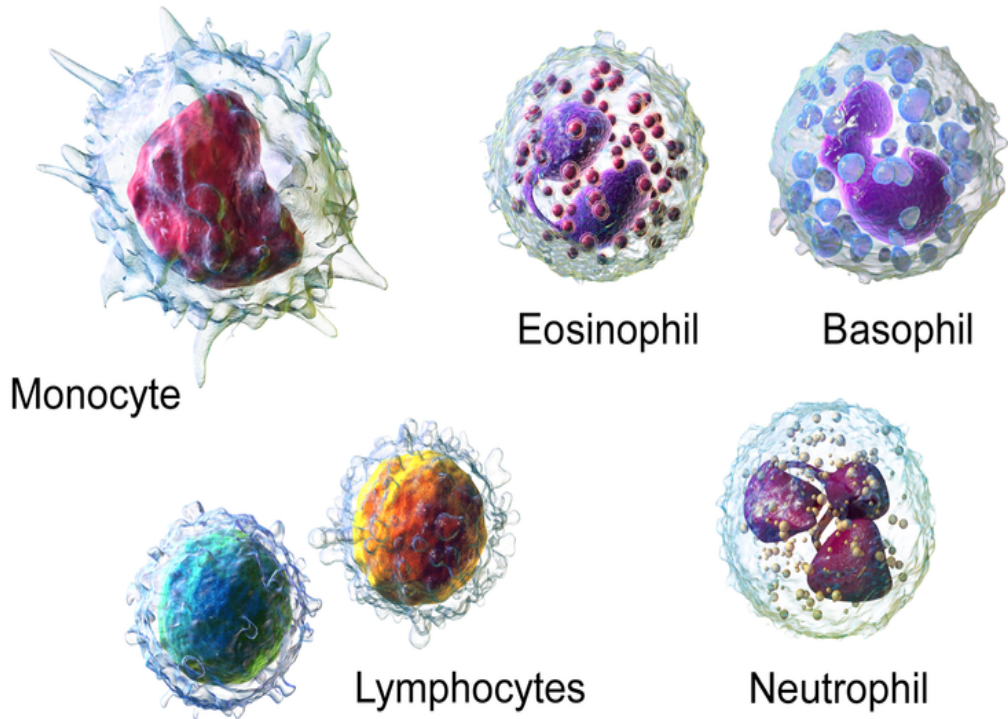


Figure 1: Human Red Blood Cells under x1000 Magnification

The red blood cells of humans and other mammals lack a nucleus or organelles (such as mitochondria, vesicles, ribosomes, etc.). This increases the space available within the red blood cells to carry more hemoglobin molecules inside the cell, increasing the oxygen-carrying capacity. Human/mammalian red blood cells are incapable of dividing due to the lack of a nucleus. These cells need to be replaced on a continuous basis by other organs (spleen, bone marrow) since the life of a human red blood cell is about 30 days.

As mentioned above, human red blood cells lack mitochondria, which may increase the oxygen-carrying capacity. If they did have them, the aerobic (oxygen consuming) respiration, which is carried out by mitochondria, would consume the oxygen that is transported by the red blood cells. Thus, the absence of

mitochondria in red blood cells saves the oxygen that is to be transported to the body cells. The five types of white blood cells in humans are shown in Figure 2.



White Blood Cells

Figure 2: White Blood Cells

White blood cells serve as a part of the immune system of animals. The two major types of white blood cells are granulocytes and agranulocytes. Granulocytes contain enzymes in granules to digest foreign materials in the circulation by taking them into the cells by phagocytosis. The three types of granulocytes are neutrophils, eosinophils, and basophils. Monocytes and lymphocytes are the agranulocytes, lacking digestive enzymes. Monocytes enter the infected tissues and become macrophages. The two types of lymphocytes are T lymphocytes and B lymphocytes. All white blood cells produce non-specific immune responses in innate immunity, except lymphocytes. Lymphocytes trigger specific immune responses in the adaptive immunity.

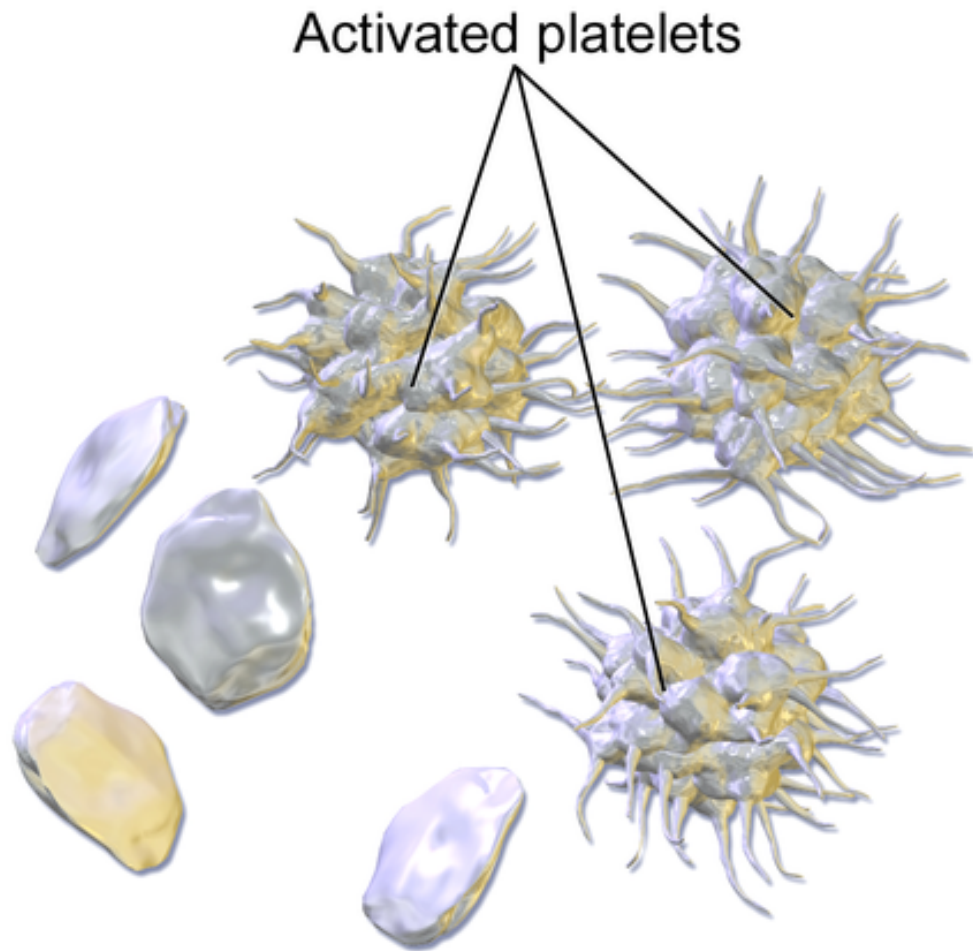


Figure 3: Platelets

Platelets are involved in the blood clotting by forming a platelet plug. This prevents both internal and external bleeding. Platelets are shown in Figure 3.

What are Frog Blood Cells

Frog blood cells refer to the circulating cells in the frog blood. Though humans and other mammals are warm-blooded animals, fish, and amphibians such as frog, and reptiles are cold-blooded animals. This means they rely on external heat to heat up their blood. The heart of the frogs consists of three chambers: two atria and a single ventricle. Oxygenated blood is mixed with deoxygenated blood to some extent in the frog's heart. Therefore, frogs have to maintain a slow metabolic rate in their body. Frogs absorb some amount of oxygen through their skin as well. Frogs have red blood cells and white blood cells in their blood. The red blood cells of frogs are shown in Figure 4.

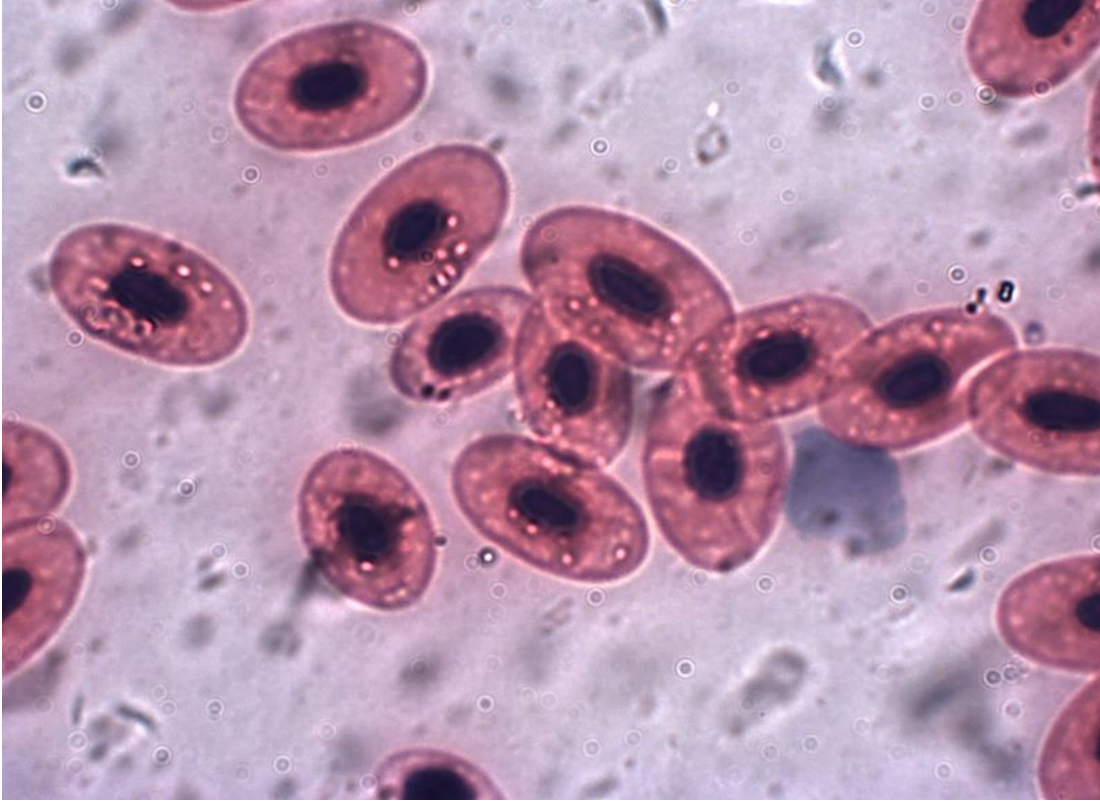


Figure 4: Frog Red Blood Cells under x1000 Magnification

The red blood cells of frogs are larger than human red blood cells. They are also somewhat elliptical rather than round like human red blood cells. Unlike humans (mammals), fish, amphibian, reptile, and avian red blood cells contain a nucleus (the dark body in cells shown in Figure 4). The white blood cells of frogs are more similar to that of humans in both morphology and function. However, frogs lack platelets in their blood.

The differences in size and shape between frog and human red blood cells is more evident when comparing them next to each other, as shown in Figure 5. Frog red blood cells are ~3 times the diameter of human red blood cells.

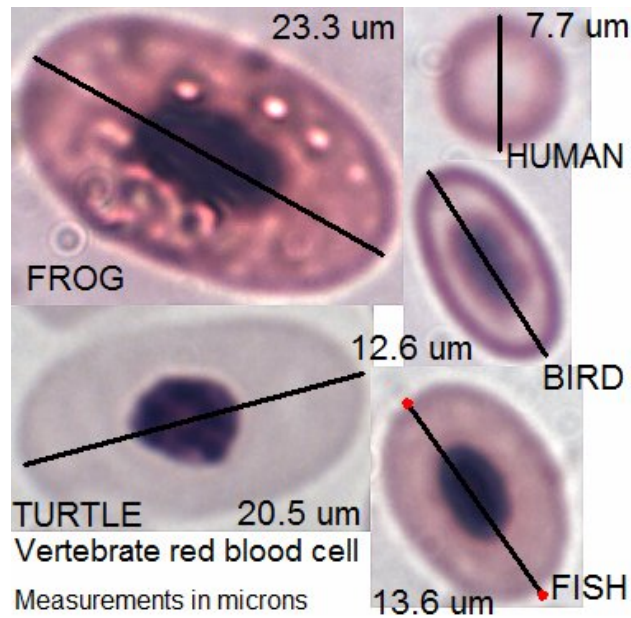


Figure 5. Comparison of blood cells of different animals.

Similarities Between Human and Frog Blood Cells

- Both human and frog blood cells are produced in the bone marrow by a process called hematopoiesis.
- Both human and frog blood cells are circulated throughout the body by being suspended in the blood.
- The most common type of blood cells in both humans and frogs are the red blood cells.
- Red blood cells of both humans and frogs carry oxygen to the cells of the body.
- Both human and frog red blood cells contain hemoglobin as the respiratory pigment.
- White blood cells of both humans and frogs have similar morphology and function.

Differences Between Human and Frog Blood Cells

Type of Cells

Humans blood contain red blood cells, white blood cells, and platelets.

Frogs blood contain red blood cells and white blood cells.

Red Cell Nuclei and Other Organelles

Human Blood Cells: Human red blood cells lack nuclei and other organelles.

Frog Blood Cells: Frog blood cells contain nuclei and other organelles.

Division

Human Blood Cells: Human blood cells are unable to divide.

Frog Blood Cells: Frog blood cells are capable of dividing by themselves since they contain nuclei.

Advantage/Disadvantage of a Nucleus

Human Blood Cells: Human red blood cells can carry more oxygen due to the lack of nuclei, allowing a large percentage of total cell volume for hemoglobin.

Frog Blood Cells: Frog blood cells carry oxygen than humans due to the presence of nuclei.

Size of Red Blood Cells

Human Blood Cells: Human red blood cells are small.

Frog Blood Cells: Frog red blood cells are larger than the human red blood cells.

Shape of the Red Blood Cells

Human Blood Cells: Human red blood cells are spherical in shape.

Frog Blood Cells: Frog red blood cells are elliptical in shape.

Conclusion

Human and frog blood cells are the circulating cells in the blood. The most abundant type of blood cells are red blood cells. Human red blood cells lack nuclei but, the red blood cells of frogs contain nuclei. Though the red blood cells of humans are rounded in shape, those of the frogs are elliptical. White blood cells of both types of animals are similar. Frogs lack platelets in their blood. The platelets present in human blood consists are involved in blood clotting.

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