Blood

Humans can't live without blood. Without blood, the body's organs couldn't get the oxygen and nutrients they need to survive, we couldn't keep warm or cool off, fight infections, or get rid of our own waste products. Without enough blood, we'd weaken and die.Here are the basics about the mysterious, life-sustaining fluid called blood.

Blood and What It Does

Two types of blood vessels carry blood throughout our bodies: The arteries carry oxygenated blood (blood that has received oxygen from the lungs) from the heart to the rest of the body. The blood then travels through the veins back to the heart and lungs, where it receives more oxygen.

As the heart beats, you can feel blood traveling through the body at pulse points — like the neck and the wrist — where large, blood-filled arteries run close to the surface of the skin.

The blood that flows through this network of veins and arteries is called whole blood, and it contains three types of blood cells:

1. red blood cells (RBCs)
2. white blood cells (WBCs)
3. platelets

These blood cells are mostly manufactured in the bone marrow (the soft tissue inside our bones), especially in the bone marrow of the vertebrae (the bones that make up the spine), ribs, pelvis, skull, and sternum (breastbone).

The cells travel through the circulatory system suspended in a yellowish fluid called plasma. Plasma is 90% water and contains nutrients, proteins, hormones, and waste products. Whole blood is a mixture of blood cells and plasma.

Red blood cells (also called erythrocytes) are shaped like slightly indented, flattened disks. RBCs contain the iron-rich protein hemoglobin. Blood gets its bright red color when hemoglobin picks up oxygen in the lungs. As the blood travels through the body, the hemoglobin releases oxygen to the tissues. The body contains more RBCs than any other type of cell, and each has a life span of about 4 months. Each day, the body produces new red blood cells to replace those that die or are lost from the body.

White blood cells (also called leukocytes) are a key part of the body's system for defending itself against infection. They can move in and out of the bloodstream to reach affected tissues. The blood contains far fewer WBCs than red cells, although the body can increase production of WBCs to fight infection.

There are several types of WBCs, and their life spans vary from a few days to months. New cells are constantly being formed in the bone marrow.

Several different parts of blood are involved in fighting infection. White blood cells called granulocytes and lymphocytes travel along the walls of blood vessels. They fight germs such as bacteria and viruses and may also attempt to destroy cells that have become infected or have changed into cancer cells.

Certain types of WBCs produce antibodies, special proteins that recognize foreign materials and help the body destroy or neutralize them. The white cell count (the number of cells in a given amount of blood) in someone with an infection often is higher than usual because more WBCs are being produced or are entering the bloodstream to battle the infection. After the body has been challenged by some infections, lymphocytes "remember" how to make the specific antibodies that will quickly attack the same germ if it enters the body again.

Platelets (also called thrombocytes) are tiny oval-shaped cells made in the bone marrow. They help in the clotting process. When a blood vessel breaks, platelets gather in the area and help seal off the leak. Platelets survive only about 9 days in the bloodstream and are constantly being replaced by new cells.

Important proteins called clotting factors are critical to the clotting process. Although platelets alone can plug small blood vessel leaks and temporarily stop or slow bleeding, the action of clotting factors is needed to produce a strong, stable clot.

Platelets and clotting factors work together to form solid lumps to seal leaks, wounds, cuts, and scratches and to prevent bleeding inside and on the surfaces of our bodies. The process of clotting is like a puzzle with interlocking parts. When the last part is in place, the clot happens — but if even one piece is missing, the final pieces can't come together.

When large blood vessels are severed (or cut), the body may not be able to repair itself through clotting alone. In these cases, dressings or stitches are used to help control bleeding.

Blood contains other important substances, such as nutrients from food that has been processed by the digestive system. Blood also carries hormones released by the endocrine glands and carries them to the body parts that need them.

Blood is essential for good health because the body depends on a steady supply of fuel and oxygen to reach its billions of cells. Even the heart couldn't survive without blood flowing through the vessels that bring nourishment to its muscular walls.

Blood also carries carbon dioxide and other waste materials to the lungs, kidneys, and digestive system to be removed from the body.

Blood cells and some of the special proteins blood contains can be replaced or supplemented by giving a person blood from someone else via a transfusion. In addition to receiving whole-blood transfusions, people can also receive transfusions of a particular component of blood, such as platelets, RBCs, or a clotting factor. When someone donates blood, the whole blood can be separated into its different parts to be used in this way.

Things That Can Go Wrong With Blood

Most of the time, blood functions without problems, but sometimes, blood disorders or diseases can cause illness. Diseases of the blood that commonly affect kids can involve any or all of the three types of blood cells. Other types of blood diseases affect the proteins and chemicals in the plasma that are responsible for clotting.

Diseases of the Red Blood Cells

The most common condition affecting RBCs is anemia, a lower-than-normal number of red cells in the blood. Anemia is accompanied by a decrease in the amount of hemoglobin. The symptoms of anemia — such as pale skin, weakness, a fast heart rate, and poor growth in infants and children — happen because of the blood's reduced capacity for carrying oxygen.

Anemia typically is caused by either inadequate RBC production or unusually rapid RBC destruction. In severe cases of chronic anemia, or when a large amount of blood is lost, someone may need a transfusion of RBCs or whole blood.

Anemia resulting from inadequate RBC production. Conditions that can cause a reduced production of red blood cells include:

- Iron deficiency anemia. The most common type of anemia, it affects kids and teens of any age who have a diet low in iron or who've lost a lot of RBCs (and the iron they contain) through bleeding. Premature babies, infants with poor nutrition, menstruating teenage girls, and those with ongoing blood loss due to illnesses such as inflammatory bowel disease are especially likely to have iron deficiency anemia.
- Lead poisoning. When lead enters the body, most of it goes into RBCs where it can interfere with the production of hemoglobin. This can result in anemia. Lead poisoning can also affect — and sometimes permanently damage — other body tissues, including the brain and nervous system. Although lead poisoning is much less common now, it still is a problem in many larger cities, especially where young children might ingest paint chips

or the dust that comes from lead-containing paints peeling off the walls in older buildings.

- Anemia due to chronic disease. Kids with chronic diseases (such as cancer or human immunodeficiency virus infection) often develop anemia as a complication of their illness.
- Anemia due to kidney disease. The kidneys produce erythropoietin, a hormone that stimulates production of red cells in the bone marrow. Kidney disease can interfere with the production of this hormone.

Anemia resulting from unusually rapid red blood cell destruction. When RBCs are destroyed more quickly than normal by disease (a process called hemolysis), the bone marrow will make up for it by increasing production of new red cells to take their place. But if RBCs are destroyed faster than they can be replaced, a person will develop anemia.

Several causes of increased red blood cell destruction can affect kids:

- G6PD deficiency. G6PD is an enzyme that helps to protect red blood cells from the destructive effects of certain chemicals found in foods and medications. When the enzyme is deficient, these chemicals can cause red cells to hemolyze, or burst. G6PD deficiency is a common hereditary disease among people of African, Mediterranean, and Southeast Asian descent.
- Hereditary spherocytosis is an inherited condition in which RBCs are misshapen (like tiny spheres, instead of disks) and especially fragile because of a genetic problem with a protein in the structure of the red blood cell. This fragility causes the cells to be easily destroyed.
- Autoimmune hemolytic anemia. Sometimes — because of disease or for no known reason — the body's immune system mistakenly attacks and destroys RBCs.
- Sickle cell anemia, most common in people of African descent, is a hereditary disease that results in the production of abnormal hemoglobin. The RBCs become sickle shaped, they cannot carry oxygen adequately, and they are easily destroyed. The sickle-shaped blood cells also tend to abnormally stick together, causing obstruction of blood vessels. This blockage in the blood vessels can seriously damage organs and cause bouts of severe pain.

Diseases of the White Blood Cells

- Neutropenia occurs when there aren't enough of a certain type of white blood cell to protect the body against bacterial infections. People who take certain chemotherapy drugs to treat cancer may develop neutropenia.
- Human immunodeficiency virus (HIV) is a virus that attacks certain types of WBCs (lymphocytes) that work to fight infection. Infection with the virus can result in AIDS (acquired immunodeficiency syndrome), leaving the body prone to infections and certain other diseases. Newborns can become infected with the virus from their infected mothers while in the uterus, during birth, or from breastfeeding, although HIV infection of the fetus and newborn is usually preventable with proper medical treatment of the mother during pregnancy and delivery. Teens and adults can get HIV from sex with an infected person or from sharing contaminated needles used for injecting drugs or tattoo ink.
- Leukemias are cancers of the cells that produce WBCs. These cancers include acute myeloid leukemia (AML), chronic myeloid leukemia (CML), acute lymphocytic leukemia (ALL), and chronic lymphocytic leukemia (CLL). The most common types of leukemia affecting kids are ALL and AML. In the past 25 years, scientists have made great advances in treating several types of childhood leukemia, most notably certain types of ALL.

Diseases of Platelets

- Thrombocytopenia, or a lower than normal number of platelets, is usually diagnosed because a person has abnormal bruising or bleeding. Thrombocytopenia can happen when someone takes certain drugs or develops infections or leukemia or when the body uses up too many platelets. Idiopathic thrombocytopenic purpura (ITP) is a condition in which the immune system attacks and destroys platelets.

Diseases of the Clotting System

The body's clotting system depends on platelets as well as many clotting factors and other blood components. If a hereditary defect affects any of these components, a person can have a bleeding disorder.

Common bleeding disorders include:

- Hemophilia, an inherited condition that almost exclusively affects boys, involves a lack of particular clotting factors in the blood. People with severe hemophilia are at risk for excessive bleeding and bruising after dental work, surgery, and trauma. They may experience episodes of life-threatening internal bleeding, even if they haven't been injured.
- Von Willebrand disease, the most common hereditary bleeding disorder, also involves a clotting-factor deficiency. It affects both males and females.

Other causes of clotting problems include chronic liver disease (clotting factors are produced in the liver) and vitamin K deficiency (the vitamin is necessary for the production of certain clotting factors).

BLOOD

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