

THE CIRCULATORY SYSTEM – THE BLOOD

Every living cell needs a constant supply of oxygen and nutrients. **Blood** supplies these substances to every cell of the body. **Blood carries oxygen from the lungs and nutrients from the digestive system.** Blood is also needed to help remove waste products from the bloodstream by delivering these wastes to the kidneys, liver, skin and lungs. These wastes are eliminated from the body from these organs. One major waste product is **carbon dioxide**, which we exhale from our lungs.

WHAT IS BLOOD MADE OF?

Blood is called a liquid tissue, and is composed of blood cells and a watery liquid in which the cells float, called **plasma**. There are **three types** of blood cells: **red blood cells, white blood cells, and platelets.**

WHAT ARE RED BLOOD CELLS?

Red blood cells are the most numerous of the blood cells. They are **produced inside the bone marrow** of the long bones of the body. Red blood cells contain an **iron – rich** substance called **hemoglobin**. The oxygen molecules that we breathe in become attached to the hemoglobin. The **red blood cells then deliver the oxygen molecules to every cell** of the body. Also, the **hemoglobin gives blood its red color**. Under a microscope, red blood cells **look like little disks** and are **without a nucleus**. They are **unable to multiply**.

WHAT ARE WHITE BLOOD CELLS?

White blood cells are larger and less numerous than red blood cells. They are **colorless**, and **have a nucleus**, so therefore, **can multiply**. There are **several types** of white blood cells. Some are produced in the **bone marrow**. Others are **produced** an organ called the **spleen**, and some are produced in special glands called **lymph nodes**. **The main role** of white blood cells in the body **is to fight disease**. **When there is an infection**, or when germs have entered the body, **they multiply, surround and attack the invading germ**.

WHAT ARE PLATELETS?

Platelets are the **smallest** of the blood cells. Their **main role in the blood** is to release a chemical that allows our blood **to clot when we get a cut or injury**. Without platelets, we would not be able to stop bleeding, both internally and externally.

WHAT IS PLASMA?

Plasma, the liquid in which blood cells float and move around the body, is made of 90% water. All of the body's important nutrients, chemicals, enzymes, hormones, blood cells, waste products etc. flow through the body inside the plasma. Every cell needs nourishment of many types, and the plasma delivers this "nourishment."

QUESTIONS

1. _____ deliver oxygen molecules to every cell of the body.
2. _____ fight and destroy germs and illnesses in the body.
3. _____ are the blood cells that function in helping our blood to clot.
4. _____ is the liquid part of blood.
5. An iron-rich substance called _____ gives blood its red color.
6. Plasma is made of _____ water.

ACTIVITIES: Complete the activities in the order they appear. Put a check by the # when you have completed the activity.

- _____ 1. Glue together Activity Sheets 1 – 6 to make your display sheet for the Cardiovascular System.
- _____ 2. Write your name and hour on the display sheet.
- _____ 3. Locate **DIAGRAM A** in your display sheet. **COLOR** the red blood cells red, and the plasma yellow. **LABEL** a red blood cell, a white blood cell, platelets, and plasma in the spaces provided on your Display Sheet.

THE HEART

The heart is a **muscular pump** that forces blood to circulate around the body. It is about the size of our fist, and is made of a **special tissue** called **cardiac muscle**.

The inside of the heart is divided into **four chambers**, or spaces. Each chamber has a special job to do in helping fill the heart with blood, as well as pumping it out. There are two **upper chambers** called **atria or auricles**, and two **lower chambers** are called **ventricles**. **Valves (flaps of tissue)** open and close repeatedly to allow blood to flow between the chambers. The **valves** also keep the blood from flowing in the wrong direction.

The heart is also separated into right and left sides. A **muscular wall** called the **septum** divides the right and left sides of the heart. Each side also has a special job to do in helping the heart fill with blood, as well as pumping it out.

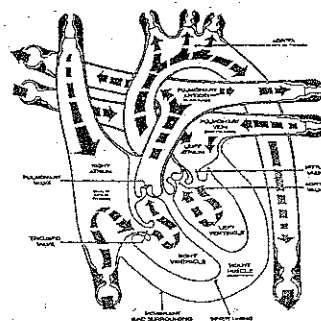
Blood Circulation

Blood that is low in oxygen is called **deoxygenated blood**. Deoxygenated blood is full of a waste product called carbon dioxide. This **deoxygenated blood** is what makes a type of **blood vessel**, the **veins**, appear **blue in color**. This blood must return to the heart to be re-oxygenated by the oxygen in the lungs. **Deoxygenated blood returns to the heart and collects in the right atrium**. A valve opens up, and the blood is pumped to the **right ventricle**. The heart contracts (squeezes) again, and the blood is pumped from the **right ventricle to both lungs**. Carbon dioxide is exhaled from the lungs, and oxygen is inhaled.

Blood that is high in oxygen is called **oxygenated blood**. This **oxygenated blood** is what makes a type of **blood vessel** the **arteries**, look **red in color**. This blood must return to heart from the lungs carrying a rich supply of oxygen in its red blood cells. The blood is **oxygenated**, and is a **bright red color**. **Oxygenated blood enters the left atrium**. A valve opens up, and the blood is pumped to the **left ventricle**. The heart contracts again, and the **oxygenated blood leaves the left ventricle through the largest artery in the body called the aorta**.

This filling and emptying of the heart is a **continuous process** that is repeated every second of our lives. This is called **circulation**.

how **your HEART WORKS**



The process of pumping blood from the right ventricle to the lungs and back into the heart is called **pulmonary circulation**. The process of pumping blood from the left ventricle to the body cells is called **systemic circulation**.

QUESTIONS

1. The two upper chambers of the heart are called _____.
2. The two lower chambers of the heart are called _____.
3. The chambers are separated by tissue that can open and close called _____.
4. The right and left sides of the heart are separated by a muscular wall called the _____.
5. The process of pumping blood to the lungs and back into the heart again is called _____.
6. The process of pumping blood from the heart to the body cells, and back into the heart again is called _____.

ACTIVITIES: Complete the activities in the order that they appear. Put a check by the # when you have completed the activity.

- _____ 1. Locate overlay 1 on activity sheet 7. Color the shade portions of overlay 1 brown (Br). Do not color the veins and arteries. Do not color over the identifying numbers.
- _____ 2. On your display sheet, color the two inside chambers on the left side of the heart red (R). Then color the two inside chambers on the right side of the heart blue (B).
- _____ 3. Color the remainder of the heart, valves, and septum brown.
- _____ 4. Cut out overlay 1. Then cut a slits 1 and 2 as marked on our display sheet. To attach, slide the tabs through the appropriate slits. Tape or glue the tabs on the back of your display sheet.
- _____ 5. Label the right atrium, left atrium, right ventricle, left ventricle, septum and lung in the spaces provided on our display sheet.

THE BLOOD VESSELS

Blood must circulate throughout the body in order to supply each cell with everything that it needs. Blood circulates, or travels **through tubes** called **blood vessels**. There are **three types of blood vessels** – arteries, veins and capillaries. Some blood vessels are visible and somewhat large, and some are invisible, or microscopic. Only the **microscopic blood vessels, the capillaries**, can reach and supply our microscopic cells. It is through the **very thin capillary walls** that oxygen is deposited into cells, and carbon dioxide is carried away from the cells.

ARTERIES

The **arteries** are the blood vessels that are very large close to the heart, and become very small further away from the heart. Very **small arteries** are called **arterioles**, and these become **capillaries**. **Arteries** are the blood vessels that **carry blood away from the heart** and they are **red** in color because the **blood inside them is oxygenated**.

MAJOR ARTERIES

- * **Aorta** – carries blood away from the left ventricle and is the largest blood vessel in the body. All other arteries are extensions of the aorta.
- * **Subclavian arteries** – supply the arms with blood.
- * **Carotid arteries** – supply the head and brain with blood.
- * **Renal arteries** – take blood to the kidneys where liquid wastes are removed.
- * **Iliac arteries** – supply the legs with blood.
- * **Coronary arteries** – supply the heart itself with blood.

VEINS

The **veins** are the blood vessels that **carry blood back to the heart**. Veins have valves inside them so that blood can go upward against gravity, and not pool in our feet. Arteries do not have valves. Very **small veins** are called **venules**. Arterioles are connected to venules by capillaries. Through this connection between arterioles and venules, blood is able to circulate from head to toe, and back to the heart. Veins are **bluish** in color because the blood inside them is **deoxygenated**.

MAJOR VEINS

- * **Jugular veins** – veins carrying blood back from the brain and head.
- * **Subclavian veins** – veins that connect to the jugular veins and also bring blood back from the arms and shoulders.

- *Superior vena cava – one of the two largest veins in the body -connects to the subclavian veins in the shoulders and enters the right atrium.
- *Renal veins – veins carrying blood from the kidneys.
- * Iliac veins – veins carrying blood from the legs.
- *Inferior vena cava – another of the largest veins that brings blood below the heart into the right atrium.

PULMONARY ARTERIES AND VEINS

The arteries and veins that travel to and from the lungs are called the **pulmonary arteries and veins**. We know that arteries carry blood away from the heart, and veins carry blood back to the heart. Arteries carry red, oxygenated blood, and veins carry blue, or deoxygenated blood. **There is one exception to this rule. The pulmonary arteries carry blue, deoxygenated blood OUT** of the right ventricle of the heart to the lungs. **The pulmonary veins bring red, oxygenated blood back INTO** the left atrium of the heart. **This is the only time where an artery carries blue blood, and a vein carries red blood!**

QUESTIONS

1. The exchange of oxygen for carbon dioxide occurs in the tiniest blood vessels called _____.
2. Blood vessels carrying blood away from the heart are called _____.
3. Blood vessels carrying blood toward the heart are called _____.
4. The largest blood vessel in the body is called the _____.
5. The two largest veins in the body are called the _____, and the _____.
6. Small arteries are called _____.
7. Small veins are called _____.
8. What connects the arterioles to the venules? _____.

ACTIVITIES

____ 1. On your *display sheet*, color the blood vessel (the **pulmonary artery**) leading from the **right ventricle** to the lungs blue (B). Remember that right and left are reversed as you look at "George". Then color the blood vessels (the **pulmonary veins**) leading from the lungs to the **left auricle** red (R).

____ 2. Locate *Diagram B* on your display sheet. This illustrates an EXCHANGE SITE where oxygen is dropped off and carbon dioxide is picked up. Color the **body cells** yellow and the **arteriole** and oxygen-rich portion of the **capillaries** red. Color the **venule** and the oxygen-poor portion of the capillaries blue. Label an **arteriole**, **venule**, **body cell**, and **capillary**. Label an **arteriole**, a **venule**, a **capillary** and **body cells**.

____ 3. Color the **arteries** (over the whole body) leading away from the **left ventricle** red (R) and the **veins** (from the whole body) returning to the **right auricle** blue (B).

____ 4. Locate *Diagram C* on your display sheet. Color the vein blue. Locate *Overlay 2* on *Activity Sheet 7*. Color *Overlay 2* blue.

____ 5. Locate *Diagram D* on your display sheet. Color the artery red. Locate *Overlay 3* on *Activity Sheet 7*. Color *Overlay 3* red.

____ 6. Cut out *Overlays 2 and 3*. Then cut at slits 3, 4, and 5 on your display sheet. Next, attach *Overlays 2 and 3* to your display sheet. To attach, slide the tabs through the appropriate slits. Tape the tabs to the back of your display sheet.

____ 7. Label the following in the spaces provided on your display sheet:

aorta	subclavian artery	subclavian vein
renal artery	renal vein	iliac artery
iliac vein	pulmonary artery	pulmonary veins
superior vena cava	inferior vena cava	coronary artery
carotid artery	jugular vein	spleen
kidney	liver	