

Description

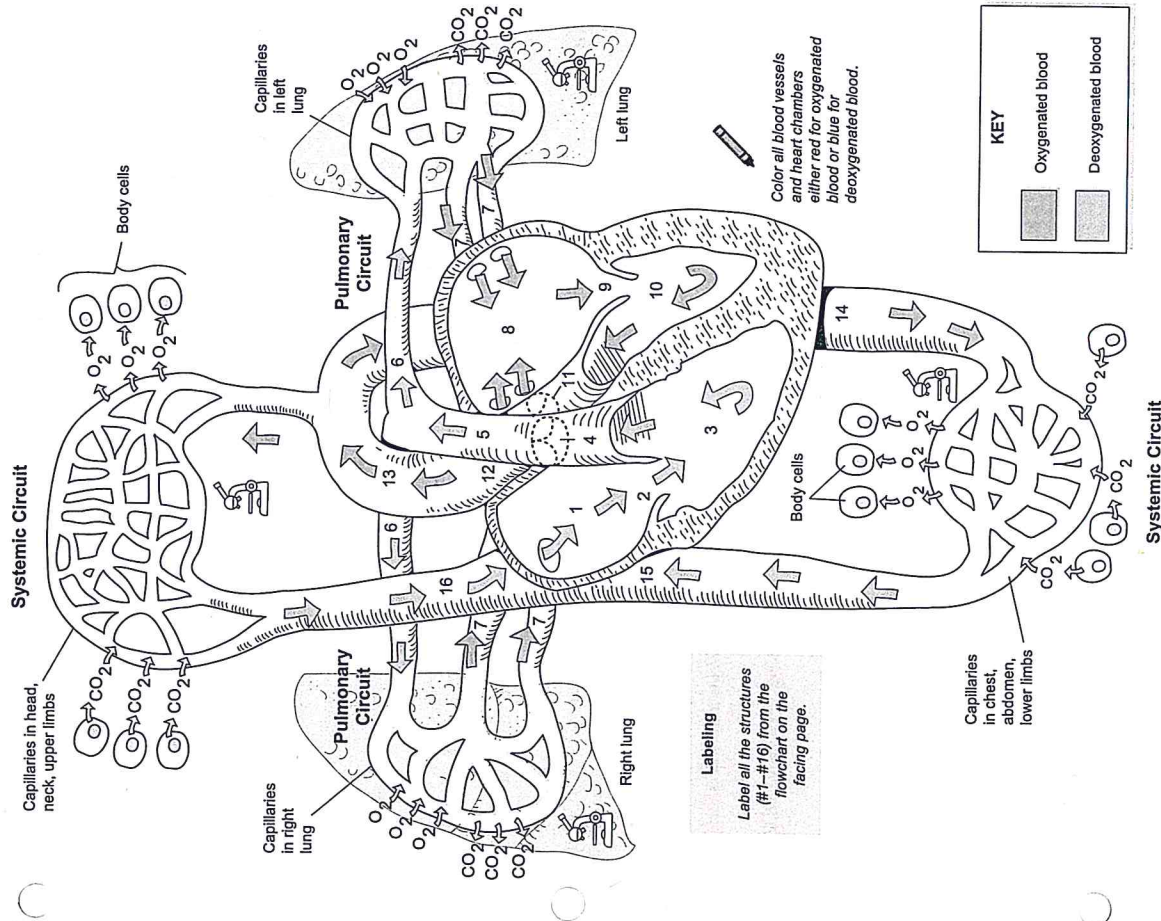
The cardiovascular system consists of the heart and all the blood vessels. Functionally, the heart is like a double pump. It consists of two receiving chambers called atria and two pumping chambers called ventricles. The left side of the heart always pumps oxygenated blood while the right side always pumps deoxygenated blood.

The illustration on the facing page shows blood flow through the heart, through the pulmonary circuit and through the systemic circuit. The pulmonary circuit refers to all the blood vessels that take deoxygenated blood from the right ventricle of the heart to the lungs and then return oxygenated blood to the left atrium. After this oxygenated blood is pumped from the left atrium to the left ventricle, it is pumped out to the rest of the body. The blood vessels that transport this oxygenated blood to the body are part of the systemic circuit.

All gas exchange occurs within capillaries. Capillaries are microscopic blood vessels that are only one cell layer in thickness. Their wall is made of simple squamous epithelium. These flat cells easily permit the diffusion of gases such as oxygen (O₂) and carbon dioxide (CO₂). Oxygen diffuses out of the blood and into body cells to be used in the process of cellular respiration. Carbon dioxide is a normal byproduct of cellular respiration and gradually builds up within body cells. Carbon dioxide diffuses from the body cells into the capillary.

Beginning in the right atrium, this is a flowchart for the blood flow:

- Right atrium (1) → tricuspid valve (2) → right ventricle (3) → pulmonary semilunar valve (4) → pulmonary trunk (5) → pulmonary arteries (6) → lungs → pulmonary veins (7) → left atrium (8) → bicuspid valve (9) → left ventricle (10) → aortic semilunar valve (11) → ascending aorta (12) → aortic arch (13) → descending aorta (14) → inferior vena cava (15) and superior vena cava (16) → right atrium (1)



Description

The illustration gives an overview of the general pattern of circulation. Blood always follows a predictable circuit through blood vessels. There are five fundamental types of blood vessels in the body: *arteries, arterioles, capillaries, venules, and veins*. All of them connect together in the following pattern:



The schematic illustration on the facing page shows three of these five: *arteries, veins, and capillaries*. Arteries always carry blood away from the heart. They are thicker-walled than veins because the blood within them is at a higher pressure. As distance from the heart increases, pressure decreases. All veins always carry blood back to the heart. Since the pressure within them is lower, they are thinner-walled. Arteries and veins connect together at the microscopic level by capillary networks. Capillaries are the smallest blood vessels in the body and are very important functionally since gas exchange and fluid exchange occurs here. Oxygen exits the blood to be used by body cells, and carbon dioxide enters the blood from cells. The liquid plasma is filtered out of the blood to become tissue fluid.

Let's follow the general pattern of circulation. Veins carrying low pressure, deoxygenated blood drain into the vena cava, which drains into the heart's right atrium (RA). This receiving chamber fills with blood, contracts, and forces blood into the right ventricle (RV). All this deoxygenated blood is then pumped out of the right ventricle to go to the lungs to get oxygenated. In the lungs, oxygen diffuses into the blood through the pulmonary capillaries. The oxygenated blood is then transported through veins to the left atrium (LA). The LA fills with blood, contracts, and forces blood into the left ventricle (LV). This oxygenated blood is then pumped to the body via the aorta. The heart feeds its own cardiac muscle first through coronary capillaries so it can continue pumping blood every minute of every day. Arteries carry oxygenated blood above the heart to the capillaries in the brain, trunk, and upper limbs. Other arteries carry blood below the heart to the following major areas:

- **Digestive organs and spleen**—After gas exchange occurs at the splenic and mesenteric capillaries, deoxygenated blood is carried by veins to the hepatic portal system in the liver. Note that capillaries in this system are not for the typical purpose of gas exchange. Instead, these highly permeable capillaries are specialized for delivering nutrients absorbed by the digestive tract to liver cells. The liver cells serve as special processing centers that perform many functions. For example, they detoxify harmful substances.
- **Kidney**—Another unique group of permeable capillaries is the glomerular capillaries. Like the capillaries in the hepatic portal system, these are also not for the purpose of gas exchange. Instead, they are specialized to filter the blood plasma, place it in a separate tubular system, and process this liquid into urine. These capillaries lead into the peritubular capillaries where gas exchange does occur.
- **Gonads**—In the male, gas exchange occurs at capillaries in the testes whereas, in the female, gas exchange occurs at capillaries in the ovaries.
- **Liver, lower limbs**

