

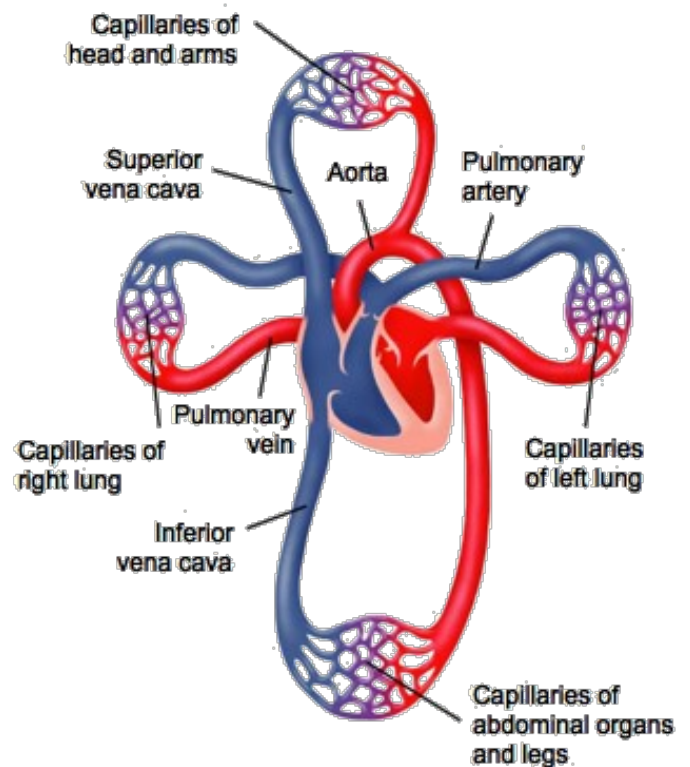


## The circulatory (or cardiovascular) system

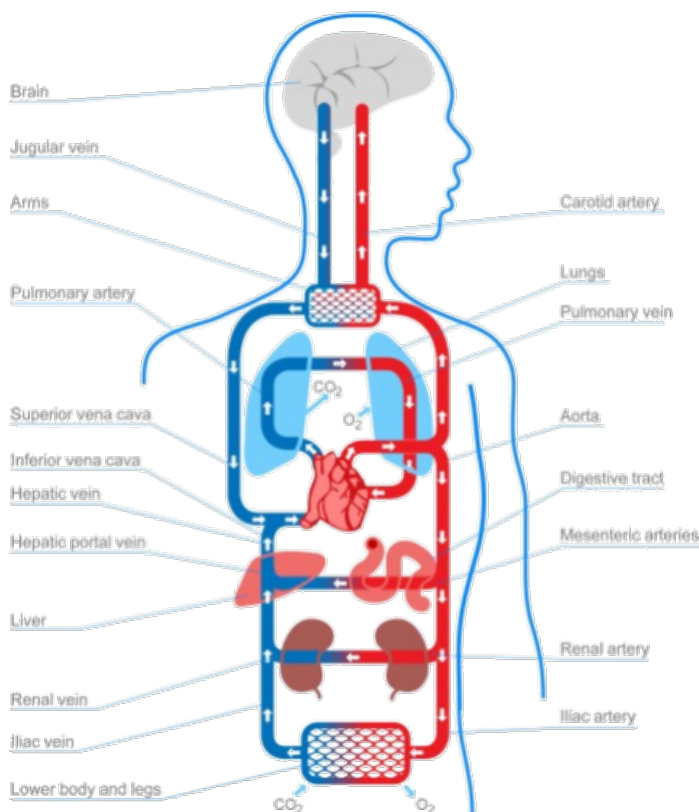
The **structure** of the circulatory system consists of blood, blood vessels and the heart. The **function** of the circulatory system is to be the body's transportation system, moving oxygen, carbon dioxide, nutrients, wastes, hormones, vitamins, minerals and water throughout the body. It also aids in regulation of temperature.

The circulatory system is sometimes called the cardiovascular system. The **vascular** system is composed of arteries, arterioles, capillaries, venules and veins. The **structure** of the vessels in the different parts of the vascular system varies and the differences relate directly to the **function** of each type of vessel.

The **cardio** system is composed of the heart that pumps the blood around the body.



## Components of the circulatory system



The circulatory system connects to many other systems and transports vital chemicals around the body required for life.

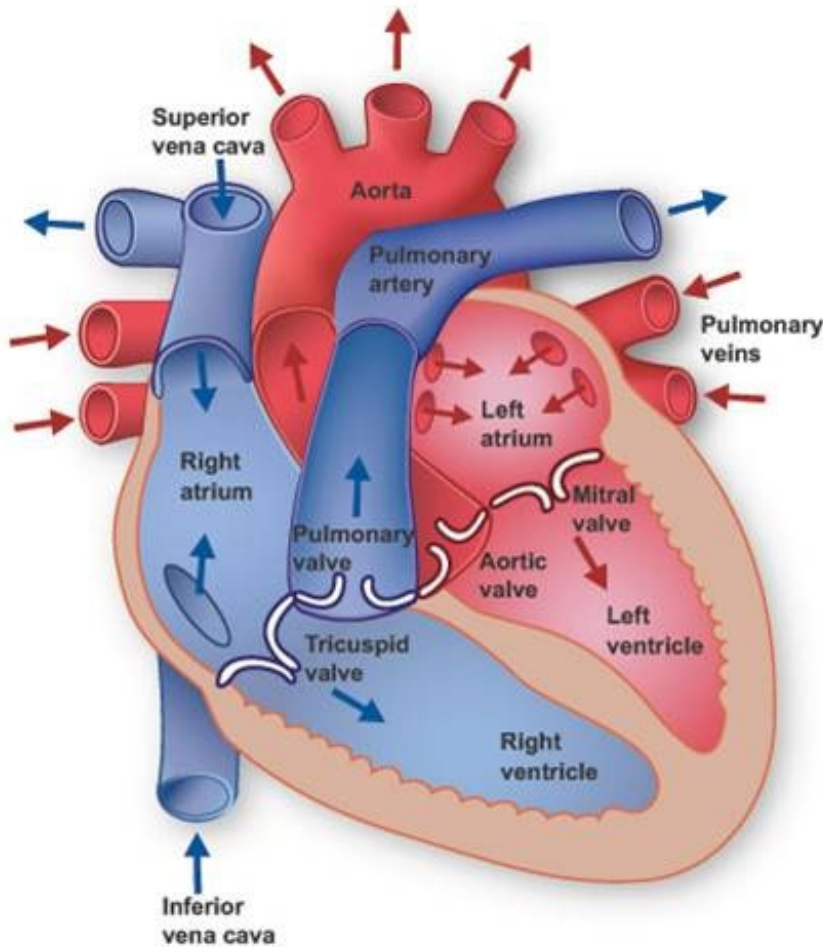
The respiratory system provides oxygen to the blood to move around the body and removes carbon dioxide.

The blood filters through the excretory system to remove waste products from the body.

The digestive system provides a way for energy from food to be supplied to every cell via the circulatory system.

The heart in the circulatory system is a muscular pump to keep everything moving around a circulatory system.

## The heart



The Human has a four chambered heart with full division between the ventricles. This means there is no mixing of the oxygenated and deoxygenated blood. It contains valves, and heart beat is controlled by the nervous system pacemaker.

The function of the Circulatory system must:

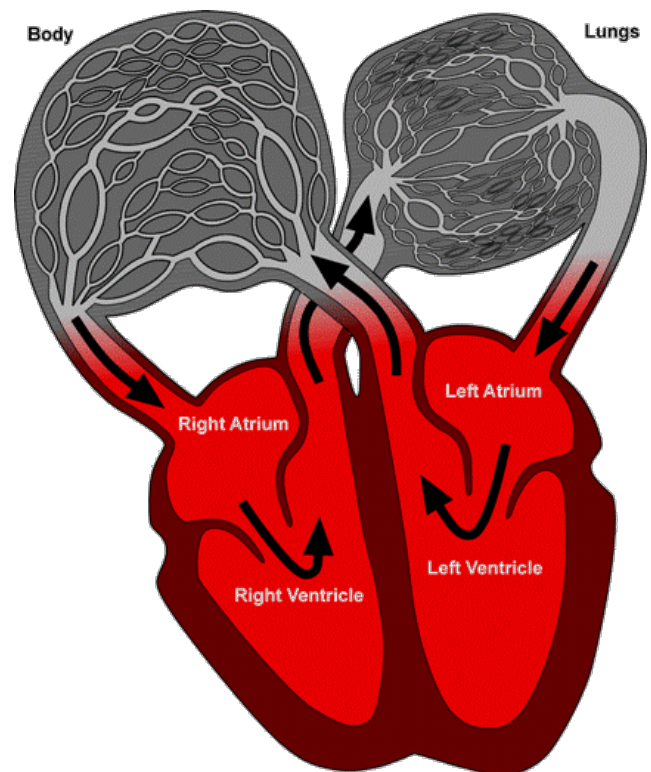
- ☐ ensure delivery of blood to all tissues
- ☐ adapt so that blood flow can be controlled and changed to individual tissues or the body as a whole
- ☐ convert a pulsating blood flow in the arteries into a steady flow in the capillaries to allow optimum **diffusion** to and from the cells
- ☐ return blood to the heart

Note: blood without oxygen is not blue but a dark red colour compared to the bright red colour of blood that contains oxygen

## Flow of blood through the heart

Blood enters the heart into the atrium and then is pumped into the ventricle and out of the heart. The valves between atrium and ventricle prevent the blood from flowing backwards. The left side of the heart is more muscular than the right-hand side as it needs to pump oxygenated (rich with oxygen) blood to the entire body.

The de-oxygenated (with most of the oxygen used by the body) blood returns to the right-hand side through the atrium and ventricle, then out to the lungs to have the carbon dioxide removed and more oxygen added back to the blood.



## The blood vessels

Arteries carry blood away from the heart, veins carry blood towards the heart.

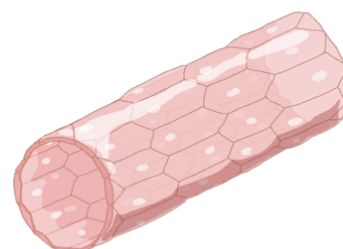
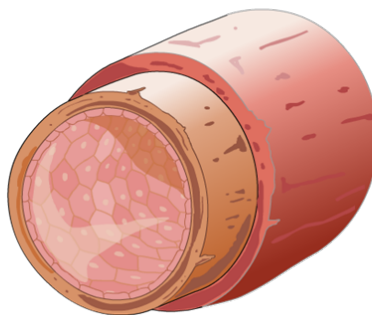
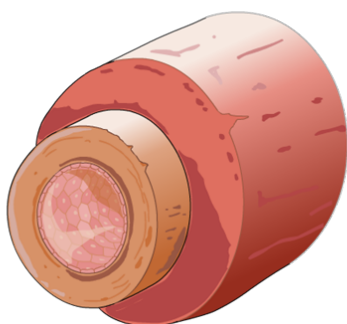
There are three main types of blood vessels:

- ❑ arteries, which carry blood away from the heart at relatively high pressure.
- ❑ veins, which carry blood back to the heart at relatively low pressure.
- ❑ capillaries which provide the link between the arterial and venous blood vessels

**Arteries** have thick muscular and elastic walls to accommodate the high blood pressure of the blood leaving the heart.

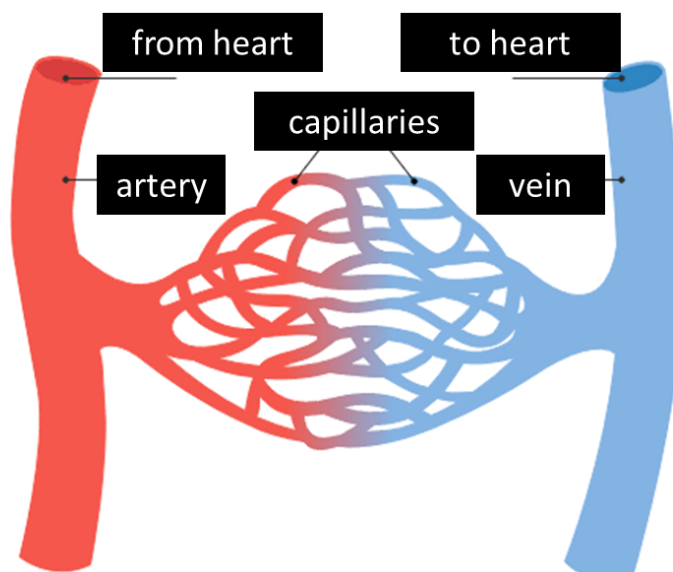
**Veins** have thinner, non-muscular walls to accommodate the lower blood pressure of the blood returning to the heart.

**Capillaries** are only one cell thick.



Capillaries link arteries with veins and are the sites of exchange with the tissues.

Arteries divide into smaller arterioles around targeted tissues. The arterioles divide once more into smaller capillaries which are only one cell thick. Nutrients and  $O_2$  diffuse across the membranes of the capillaries from the blood to the cell supplied – from high to low concentration. Waste products, such as  $CO_2$ , will diffuse from the cell into the capillary near the venule end. The venules re-join into veins and waste product contained within the blood will be pumped back to the heart.



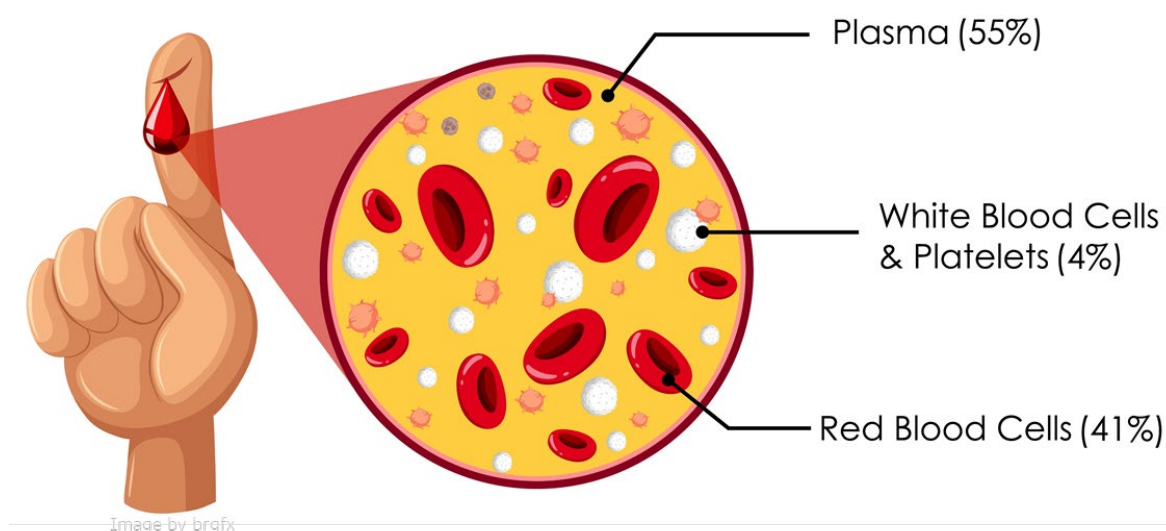
# Blood

Blood consists of fluid (plasma) containing cells – white blood cells, red blood cells and platelets.

**White blood cells** (leucocytes) – some produce antibodies to tag foreign and harmful objects, others surround and eat tagged objects. White blood cells prevent infection becoming established. Make up the immunity system. Cells contain nucleus.

**Red Blood cells** (erythrocytes) – contain haemoglobin, a pigment which binds to oxygen molecules and carries it through the circulatory system. They contain no nucleus.

**Platelets** – they collect where there is a hole in the blood vessels and stop the unwanted flow of blood by clotting.



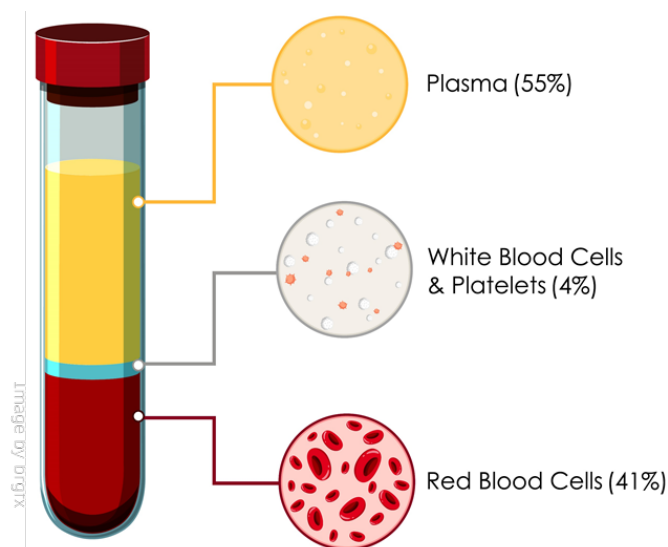
**Red blood cells carry oxygen, attached to haemoglobin, around the body of a mammal.**

Mammalian red blood cells (**erythrocytes**) lose their nuclei and cell organelles when they are mature in order to provide more space for **haemoglobin** (oxygen carrying pigment).

Because the cells have no nucleus or organelles, they cannot produce any protein, and therefore they cannot divide or repair themselves. They are constantly replaced by new red blood cells.

Red blood cells are **biconcave disks** and this shape optimises the cell for the exchange of oxygen in the lungs. The red blood cells are flexible, so they can fit through tiny capillaries, where they release their oxygen to cells.

**Plasma transports glucose, carbon dioxide, urea and hormones.**



Plasma carries **dissolved** molecules required by the body to each cell and waste products like **carbon dioxide** and **urea** out of the body.

Plasma also carries many important proteins. Albumin, the main protein in blood, helps control the water content of tissues and blood.

Plasma is usually yellow in colour due but can become milky when it transports fat absorbed from the intestines to other organs of the body.

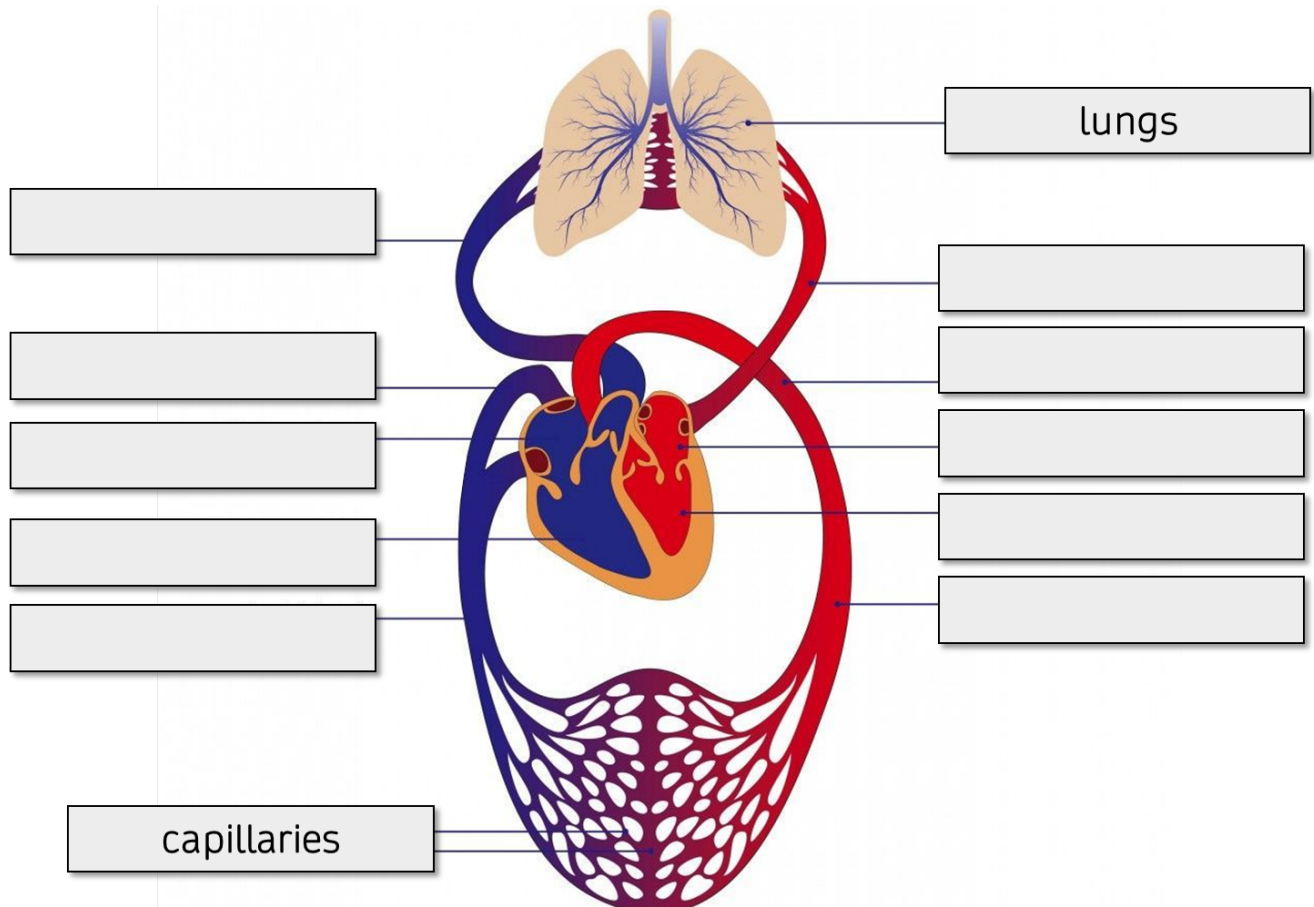




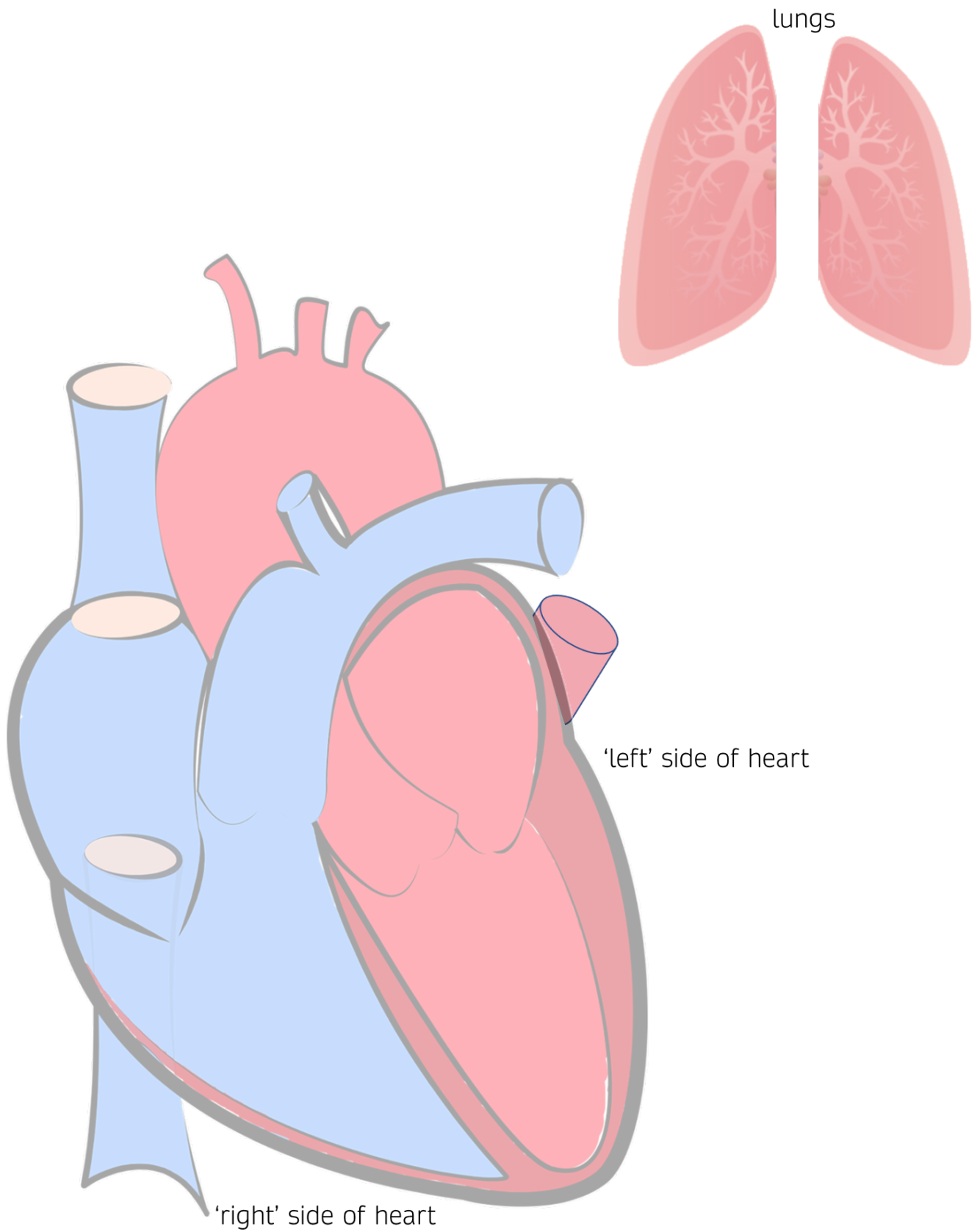
1. Different blood vessels and chambers in the heart carry either oxygenated blood (often coloured red in diagrams) or deoxygenated blood (often coloured blue in diagrams). Match the blood vessels and heart chambers to their correct group THEN connect a line to their matching definitions.

veins	arteries	pulmonary vein	pulmonary artery	vena cava	aorta
left atrium		right atrium	right ventricle	left ventricle	
Deoxygenated Blood (low oxygen)		Definition		Oxygenated Blood (high oxygen)	
		●	Chamber where blood enters heart from body	●	
		●	Chamber where blood enters heart from lungs	●	
		●	Chamber where blood leaves heart to body	●	
		●	Chamber where blood leaves heart to lungs	●	
		●	Carries blood to heart from lungs	●	
		●	Carries blood from lungs to heart	●	
		●	Vessel carrying blood directly into heart	●	
		●	Vessel carrying blood directly away from heart	●	
		●	These carry blood towards heart	●	
		●	These carry blood away from heart	●	

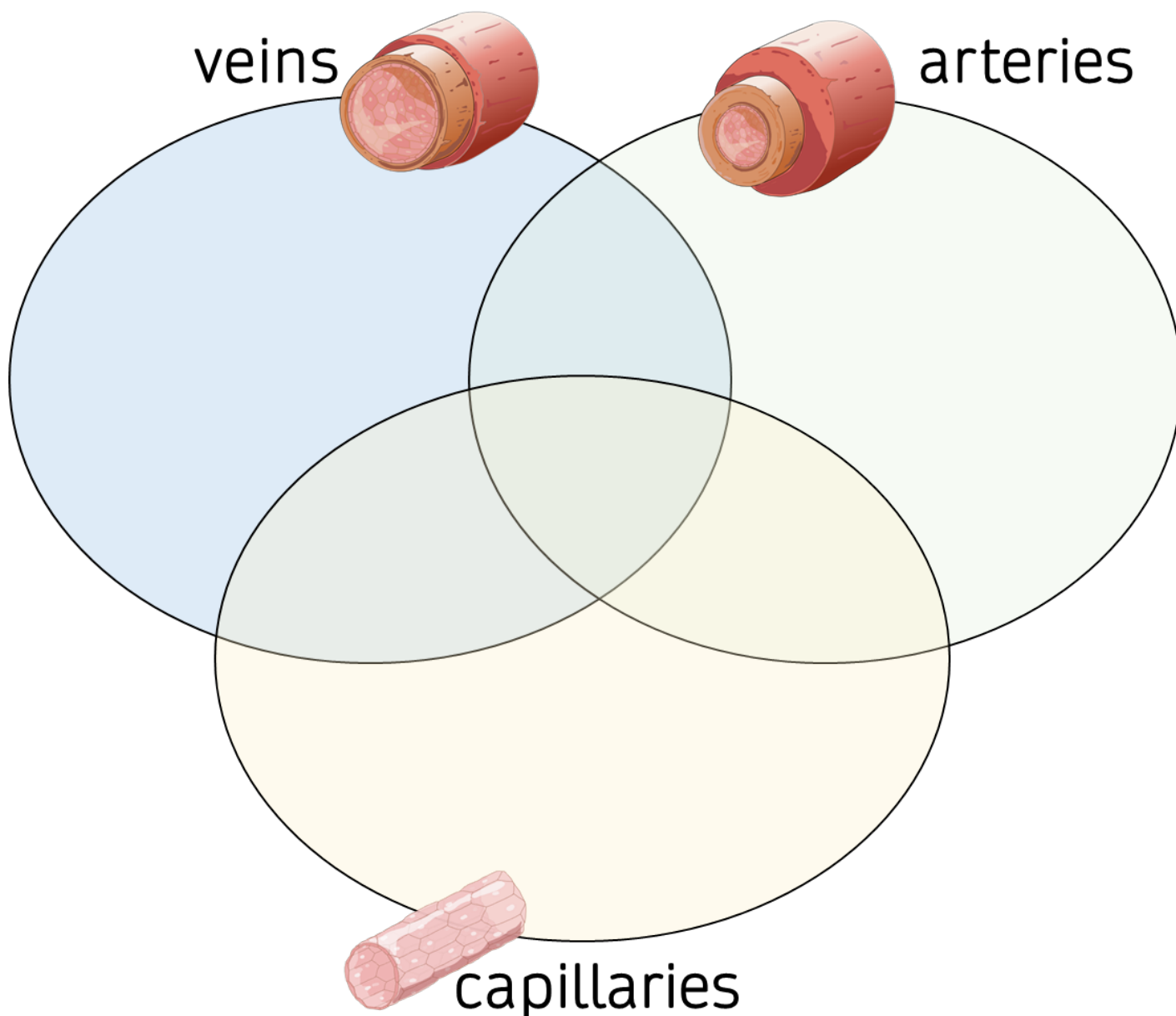
2. Use the terms for vessels and heart chambers above to complete the labels on the circulatory system diagram.



3. Use the diagram of the heart below to show the direction of flow of blood. Draw in arrows and label where necessary



4. Veins, capillaries and arteries have features that are the same and features that are different from each other. Complete the Venn diagram below to demonstrate this.



5. Blood is essential for delivering oxygen and nutrients to every cell while removing CO<sub>2</sub> and waste products. Fill in the the chart below to summarise information about each

	Red blood cell	White blood cell	Platelets	Plasma
Function(s)				
Makes up what percentage of the blood?				