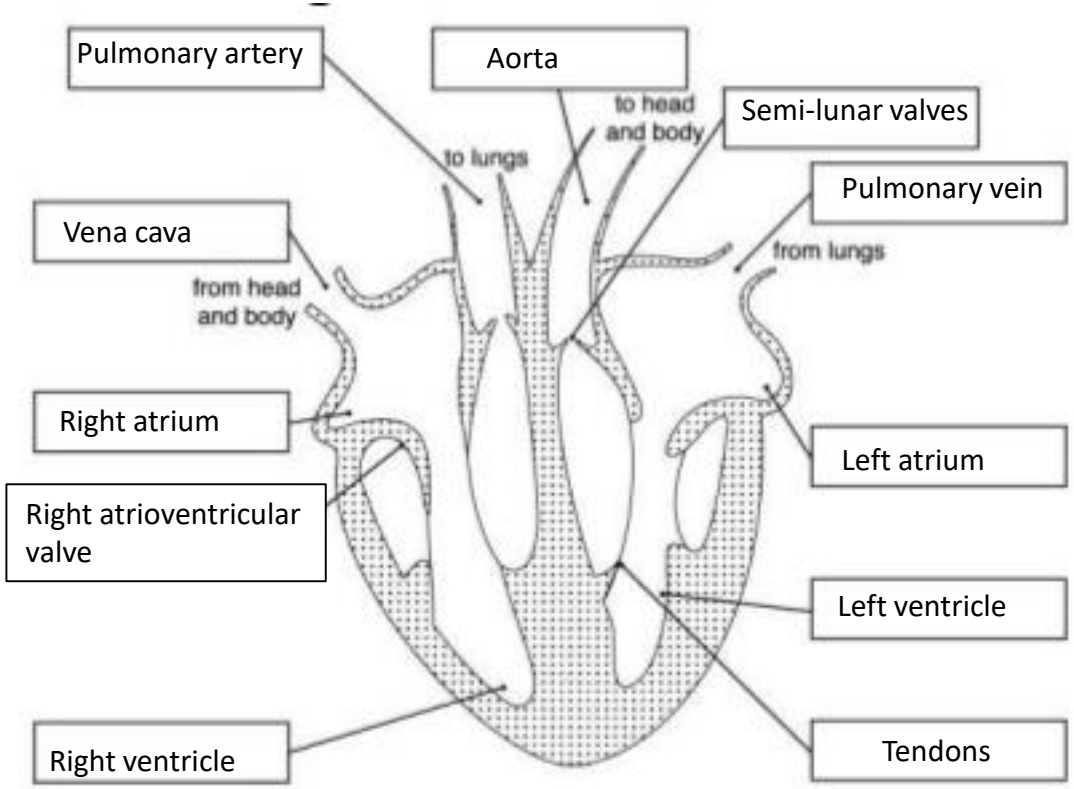
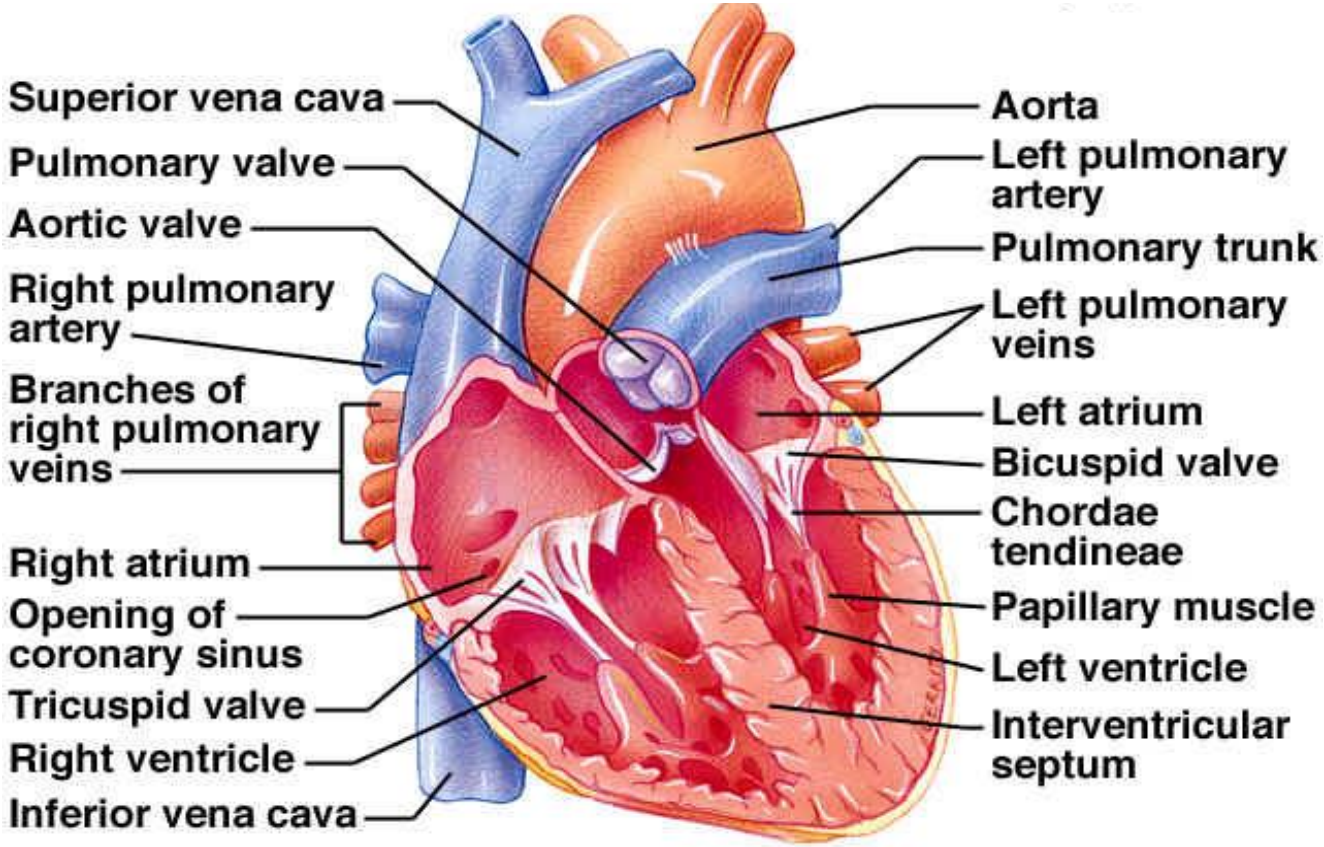
The Heart





Remember:

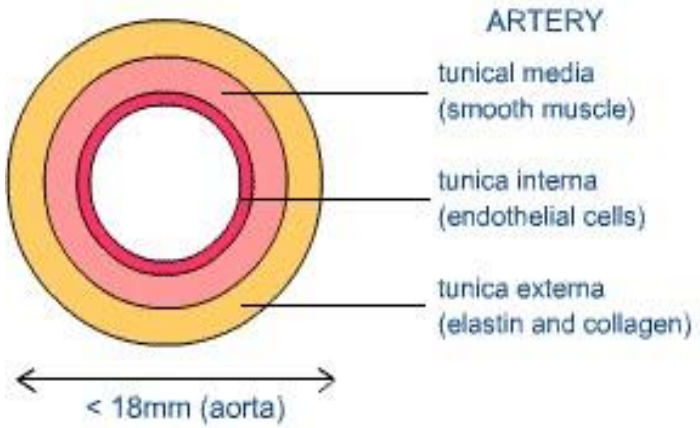
Arteries – **A**way from the heart
Veins – back to the heart
Coronary or **cardiac** – to do with the heart
Pulmonary – to do with the lungs
Aorta – the main artery leaving the heart
Vena cava – the main vein entering the heart
Left side of the heart is always on the right hand side of the diagram!

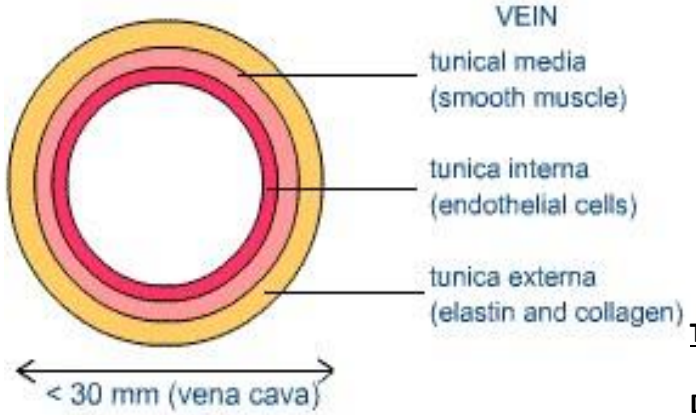
Transport systems

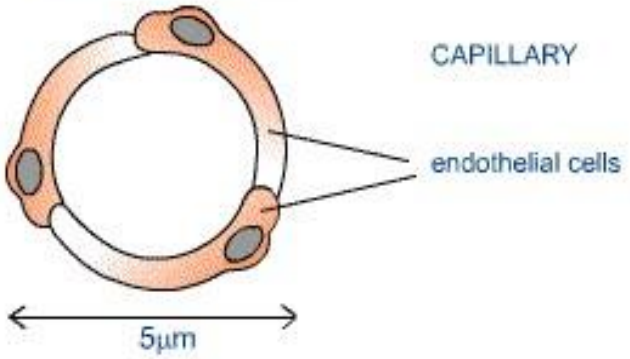
As the size of an organism increases, its surface area to volume ratio decreases. This means it has relatively less surface area available for substances to diffuse through, so the rate of diffusion may not be fast enough to meet its cells requirements.
Large multicellular organisms therefore cannot rely on diffusion alone to supply their cells with substances such as food and oxygen and to remove waste products. Large multicellular organisms require specialised transport systems.

Double and Single Circulatory System

In a single circulatory system blood will only pass through the heart once. A double circulatory system blood will pass through the heart twice. Blood travels from the heart to the lungs called the pulmonary system. Blood will return to the heart and travel onto the rest of the body.
A double allows oxygen rich and poor blood be kept separate and ensures the blood pressure is high enough to reach all parts of the body.







	Arteries	Capillaries	Veins
Function	Carry blood **away** from the heart at **high** pressure	-Supply all cells with their **requirements** -Take away **waste** products	**Return** blood to the heart at **low** pressure
Structure of wall	-**Thick**, strong -Contain **muscles**, **elastic** fibres and **fibrous** tissue	**Very thin**, only one cell thick	-**Thin** -Mainly **fibrous** tissue -Contain far **less muscle** and **elastic** tissue than arteries
Lumen	-**Narrow** -Varies with heartbeat (increases as a pulse of blood passes through)	-**Very narrow** -Just wide enough for a red blood cell to pass through	**Wide**
Valves	(-)	(-)	(+) Prevent backflow
How structure fits function	-Strength and elasticity needed to withstand the pulsing of the blood, prevent bursting and maintain pressure wave -Helps to maintain **high blood pressure**, preventing blood flowing backwards	- No need for strong walls, as most of the blood pressure has been lost -Thin walls and narrow lumen bring blood into close contact with body tissue, allowing **diffusion** of materials between capillary and surrounding tissues. -White blood cells can squeeze between cells of the wall	- No need for strong walls, as most of the blood pressure has been lost - Wide lumen offers **less resistance** to blood flow

The Cardiac Cycle

Diastole – relaxation of the heart: Initially the heart is in diastole with atria and ventricles relaxed, the atrioventricular valves are open, but the semilunar valves are shut. The venous return of deoxygenated blood from the body enters the relaxing right atrium through the venae cavae. The venous return of oxygenated blood from the lungs enters the relaxing left atrium through the pulmonary veins. At this stage some blood also passes through the open atrioventricular valves into the relaxing ventricles.

Atrial Systole – contraction of atria: When the atria are full, their walls contract pushing blood through the open atrioventricular valves into the relaxed ventricles. Blood cannot pass back into the veins because they contain valves which prevent backflow, and also the contracting of the atrial walls partly closes off the entries of the venae cavae and pulmonary veins to the atria.

Ventricular Systole – contraction of ventricles: After a short delay the ventricles contract, forcing the blood at high pressure into the arteries. At this time the atrioventricular valves slam shut, preventing backflow of blood to the atria, and the semilunar valves open to allow the passage of blood up and into the arteries. When the ventricles relax (**diastole**) the sudden fall in pressure causes the semilunar valves to slam shut, thus preventing backflow of blood from the arteries.