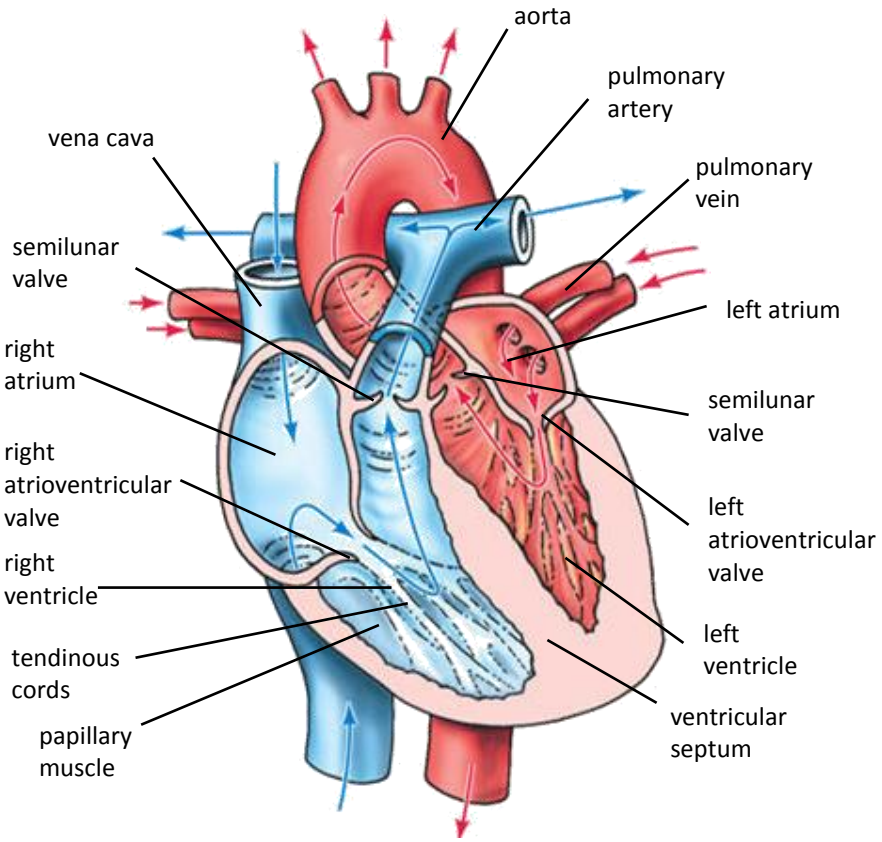
2.6 The Mammalian Heart

The structure and function of the mammalian heart

The **mammalian heart** is a muscular double pump. The right side pumps **deoxygenated** blood to the lungs, to be **oxygenated**. The left side pumps the oxygenated blood to the rest of the body. The heart squeezes the blood, which puts it under pressure forcing it along arteries.

The heart is made mainly of dark red muscle, which surrounds the two main pumping chambers: the **ventricles**. Above the ventricles are two thin-walled chambers: the **atria** (plural of **atrium**). Whilst in diagrams these may be drawn as fairly big, atria are very small in size and are easy to overlook. There are **coronary arteries** which lay over the heart surface to provide the heart muscle itself with oxygenated blood, as hard-working muscles. These arteries are of particular importance to the wellbeing of both the heart and mammal as a whole. If blood flow to the heart is restricted it may cause **angina** or a **heart attack** (**myocardial infarction**). There are a number of larger veins and arteries at the very top of the heart which carry the blood into and out of the heart.



The heart is split into four chambers: the two atria and two ventricles. *Deoxygenated* blood flows from the **vena cava** into the right atrium. *Oxygenated* blood flows from the lungs flows from the **pulmonary vein** into the left atrium.

From the atria, blood flows down through **atrioventricular valves** into the ventricles. These are pocket tissues which fill up with blood and remain closed whenever the ventricles contract. This ensures the blood flows upwards into the major arteries and not back into the atria.

Inside the ventricles are **tendinous cords**, which attach the valves to the walls of the ventricle, preventing the valves from turning inside out, which would also allow the backflow of blood back into the atria.

A wall of muscle (called the **ventricular septum**) separates the ventricles from each other. This ensures that the oxygenated blood in the left side of the heart and the deoxygenated blood in the right side are kept separate.

Deoxygenated blood leaving the right ventricle flows into the **pulmonary artery** leading to the lungs. Oxygenated blood leaving the left ventricle flows into the **aorta**. This carries blood to a wide series of arteries which supply the rest of the body with blood. At the base of the major arteries, where they exit the heart, are **semilunar valves** which prevent the blood returning the heart as the ventricles relax.

Blood Pressure

The muscle of each chamber contracts to create an increased pressure in the blood. The higher the pressure created in the heart, the further it will push the blood. The muscle of the atria wall is very thin. This is because their only function is to push the blood into the ventricles, so there is no need for a very high pressure.

However, the walls of the *right ventricle* are thicker. This enables the right ventricle to pump the blood out of the heart. The *left ventricle* has walls which are even thicker than the right, often two or three times thicker. This is for several reasons. Mainly, this is because the left ventricle needs to pump the oxygenated blood all around the body, whereas the right ventricle only needs to pump the deoxygenated blood round to the lungs, which are situated alongside the heart in the chest cavity, so the distance it needs to be pumped is a lot smaller. Another reason is that the lungs contain a network of very fine capillaries which are in close contact with the alveoli. The alveoli walls are very thin, and therefore the capillaries are not supported and could therefore burst if there were a too high pressure, which also helps to explain the lower pressure in the right ventricle.

The diagram below shows pressure changes within the vascular system during both circuits of the blood: