

9 The mammalian heart

By the end of this chapter you should be able to:

- describe the external and internal structure of the mammalian heart
- explain the differences in the thickness of the walls of the different chambers in terms of their functions
- describe the cardiac cycle
- explain how heart action is initiated and controlled.

The heart of an adult human has a mass of around 300 g, and is about the size of your fist (Figure 9.1). It is a bag made of muscle and filled with blood. Figure 9.2 shows the appearance of a human heart, looking at it from the front of the body.

The muscle of which the heart is made is called **cardiac muscle**. Figure 9.3 shows the structure of this type of muscle. It is made of interconnecting cells, whose cell surface membranes are very tightly joined together. This close contact between the muscle cells allows waves of electrical excitation to pass easily between them, which is a very important feature of cardiac muscle, as you will see later.

Figure 9.2 also shows the blood vessels that carry blood



Figure 9.1 A human heart.

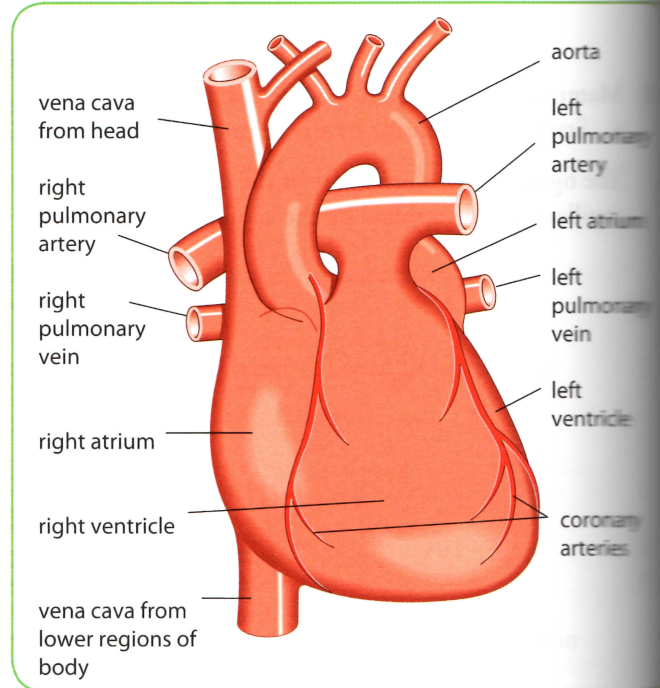


Figure 9.2 Diagram of the external structure of a human heart, seen from the front.

into and out of the heart. The large, arching blood vessel is the largest artery, the **aorta**, with branches leading upwards towards the head, and the main flow doubling back downwards to the rest of the body. The other blood vessel leaving the heart is the **pulmonary artery**. This, too, branches very quickly after leaving the heart, into two arteries taking blood to the right and left lungs. Running vertically on the right-hand side of the heart are the two large veins, the **venae cavae**, one bringing blood downwards from the head and the other bringing it upwards from the rest of the body. The **pulmonary veins** bring blood back to the heart from the left and right lungs.

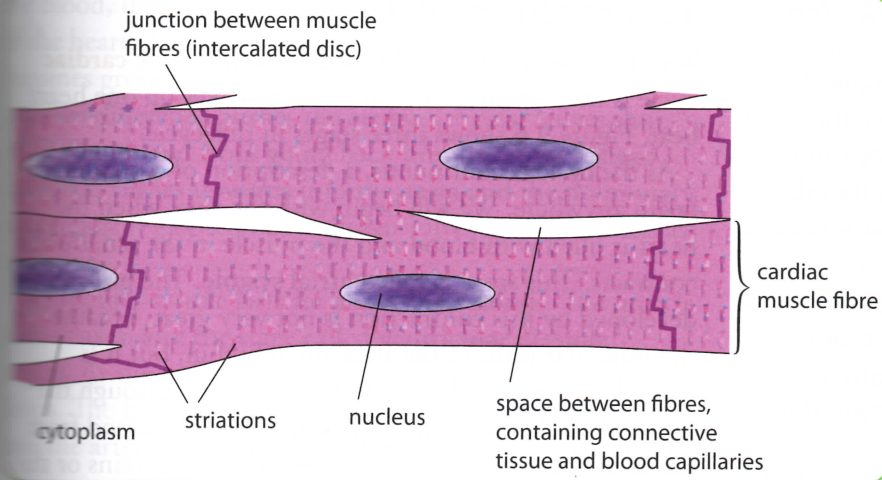


Figure 9.3 Cardiac muscle, as it appears under the high power of a light microscope ($\times 650$).

On the surface of the heart, the **coronary arteries** can be seen (Figures 9.1 and 9.2). These branch from the aorta, and deliver oxygenated blood to the walls of the heart itself.

If the heart is cut open vertically (Figures 9.4 and 9.5) it can be seen to contain four chambers. The two chambers on the left of the heart are completely separated from those on the right by a wall of muscle called the **septum**. Blood cannot pass through this septum; the only way for blood to get from one side of the heart to the other is for it

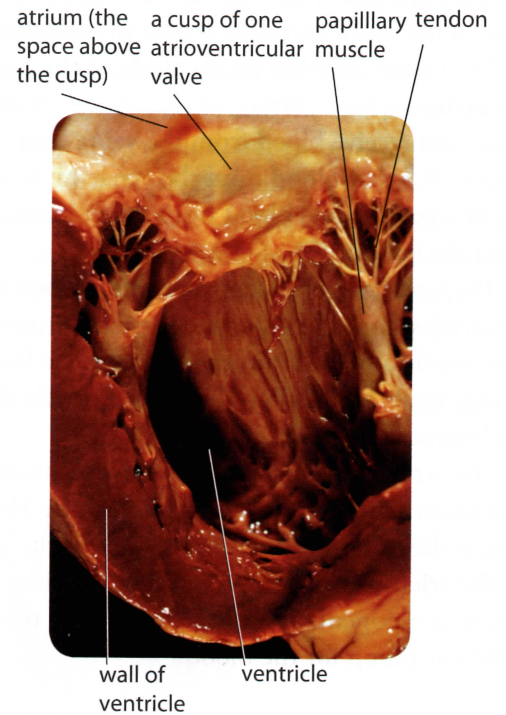


Figure 9.4 Section through part of the left side of the heart.

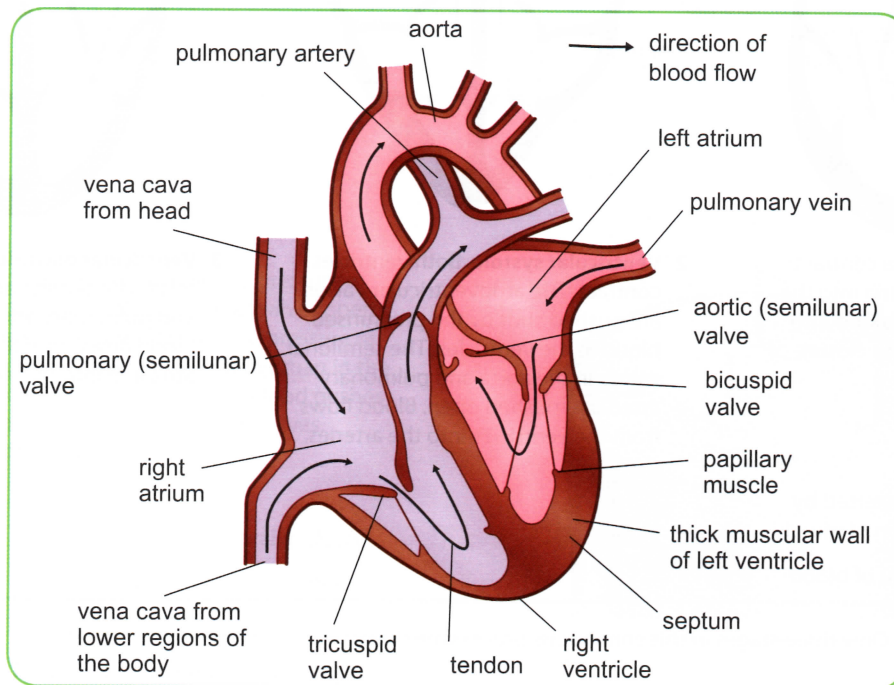


Figure 9.5 Diagrammatic section through a heart.