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Al-Muthanna University
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Theory Human Anatomy

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Lec (3)

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Heart

The heart is a hollow muscular organ that is somewhat pyramid shaped and lies within the pericardium in the mediastinum (Figs. 3.33 and 3.34). It is connected at its base to the great blood vessels but otherwise lies free within the pericardium.

Surfaces of the Heart

The heart has three surfaces: sternocostal (anterior), diaphragmatic (inferior), and a base (posterior). It also has an apex, which is directed downward, forward, and to the left.

The **sternocostal surface** is formed mainly by the right atrium and the right ventricle.

The **diaphragmatic surface** of the heart is formed mainly by the right and left ventricles.

The **base of the heart,** or the **posterior surface**, is formed mainly by the left atrium. (Fig. 3.35). The base of the heart lies opposite the apex.

The **apex of the heart,** formed by the left ventricle, is directed downward, forward, and to the left (Fig. 3.34).

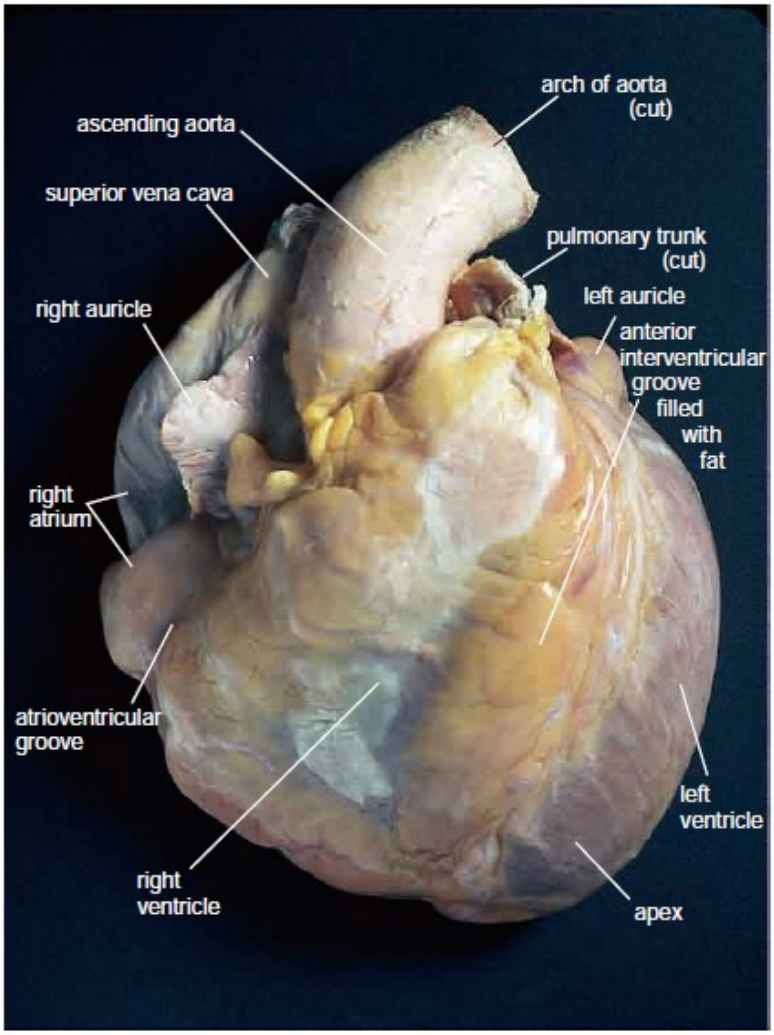

FIGURE 3.33 The anterior surface of the heart; the fibrous pericardium and the parietal serous pericardium have been removed. Note the presence of fat beneath the visceral serous pericardium in the atrioventricular and interventricular grooves. The coronary arteries are embedded in this fat.

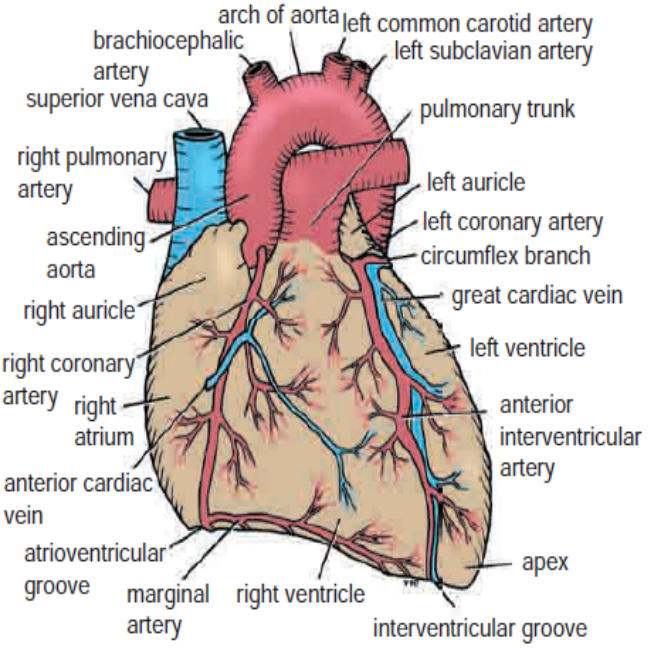

FIGURE 3.34 The anterior surface of the heart and the great blood vessels. Note the course of the coronary arteries and the cardiac veins.

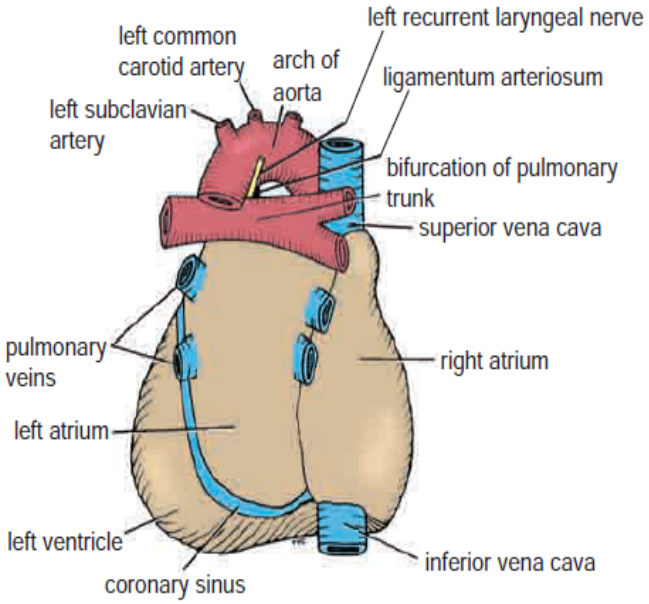

FIGURE 3.35 The posterior surface, or the base, of the heart.

Borders of the Heart

The **right border** is formed by the right atrium; the **left border**, by the left auricle; and below, by the left ventricle (Fig. 3.34).
The **lower border** is formed mainly by the right ventricle but also by the right atrium; the **apex** is formed by the left ventricle. These borders are important to recognize when examining a radiograph of the heart.

Chambers of the Heart

The heart is divided by vertical septa into four chambers: the right and left atria and the right and left ventricles. The right atrium lies anterior to the left atrium, and the right ventricle lies anterior to the left ventricle. The walls of the heart are composed of cardiac muscle, the **myocardium;** covered externally with serous pericardium, the **epicardium;** and lined internally with a layer of endothelium, the **endocardium.**

Openings into the Right Atrium

The **superior vena cava** (Fig. 3.36) opens into the upper part of the right atrium; it has no valve. It returns the blood to the heart from the upper half of the body.
The **inferior vena cava** (larger than the superior vena cava) opens into the lower part of the right atrium; It returns the blood to the heart from the lower half of the body.
The **coronary sinus,** which drains most of the blood from the heart wall (Fig. 3.36), opens into the right atrium between the inferior vena cava and the atrioventricular orifice.
The **right atrioventricular orifice** lies anterior to the inferior vena cava opening and is guarded by the tricuspid valve (Fig. 3.36). Many small orifices of small veins also drain the wall of the heart and open directly into the right atrium.

Right Ventricle

The right ventricle communicates with the right atrium through the atrioventricular orifice and with the pulmonary trunk through the pulmonary orifice (see Fig. 3.36). The projecting ridges give the ventricular wall a sponge like appearance and are known as **trabeculae carneae.**

The **tricuspid valve** guards the atrioventricular orifice (Figs. 3.36 and 3.38) and consists of three cusps formed by a fold of endocardium with some connective tissue enclosed: **anterior, septal,** and **inferior** (posterior) cusps.

The **pulmonary valve** guards the pulmonary orifice (Fig. 3.38A) and consists of three semilunar cusps formed by folds of endocardium with some connective tissue enclosed.

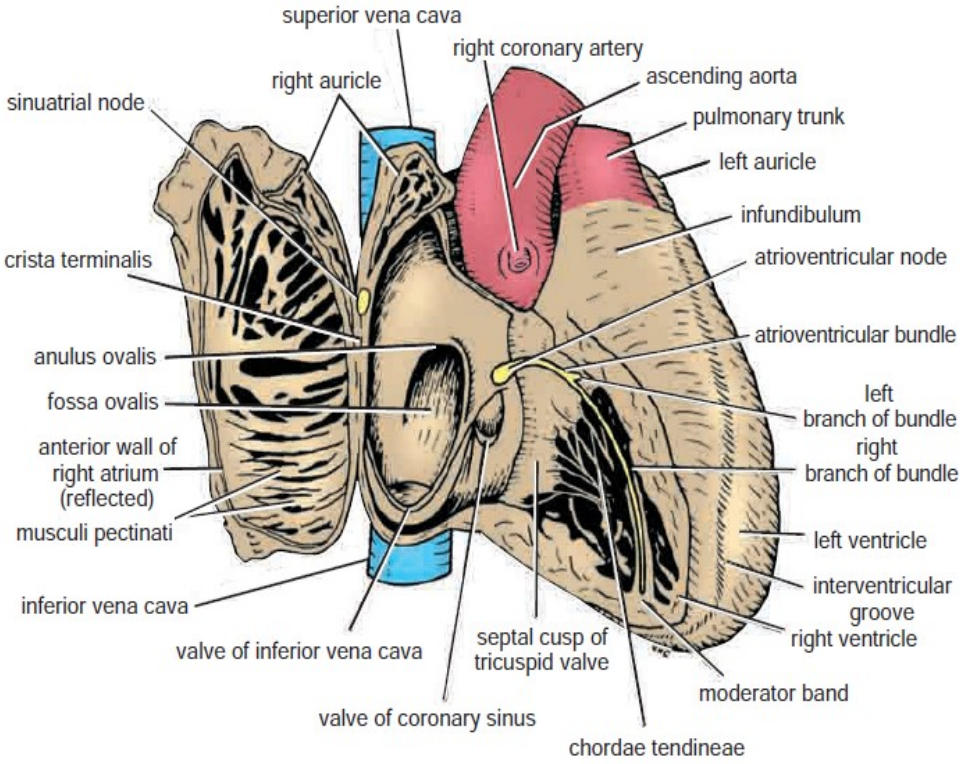

FIGURE 3.36 Interior of the right atrium and the right ventricle. Note the positions of the sinuatrial node and the atrioventricular node and bundle.

Left Atrium

Similar to the right atrium, the left atrium consists of a main cavity and a left auricle. The left atrium is situated behind the right atrium and forms the greater part of the base or the posterior surface of the heart (see Fig. 3.35).

Openings into the Left Atrium

The four pulmonary veins, two from each lung, open through the posterior wall (Fig. 3.35) and have no valves. The left atrioventricular orifice is guarded by the mitral valve.

Left Ventricle

The left ventricle communicates with the left atrium through the atrioventricular orifice and with the aorta through the aortic orifice. The walls of the left ventricle (Fig. 3.38) are three times thicker than those of the right ventricle.

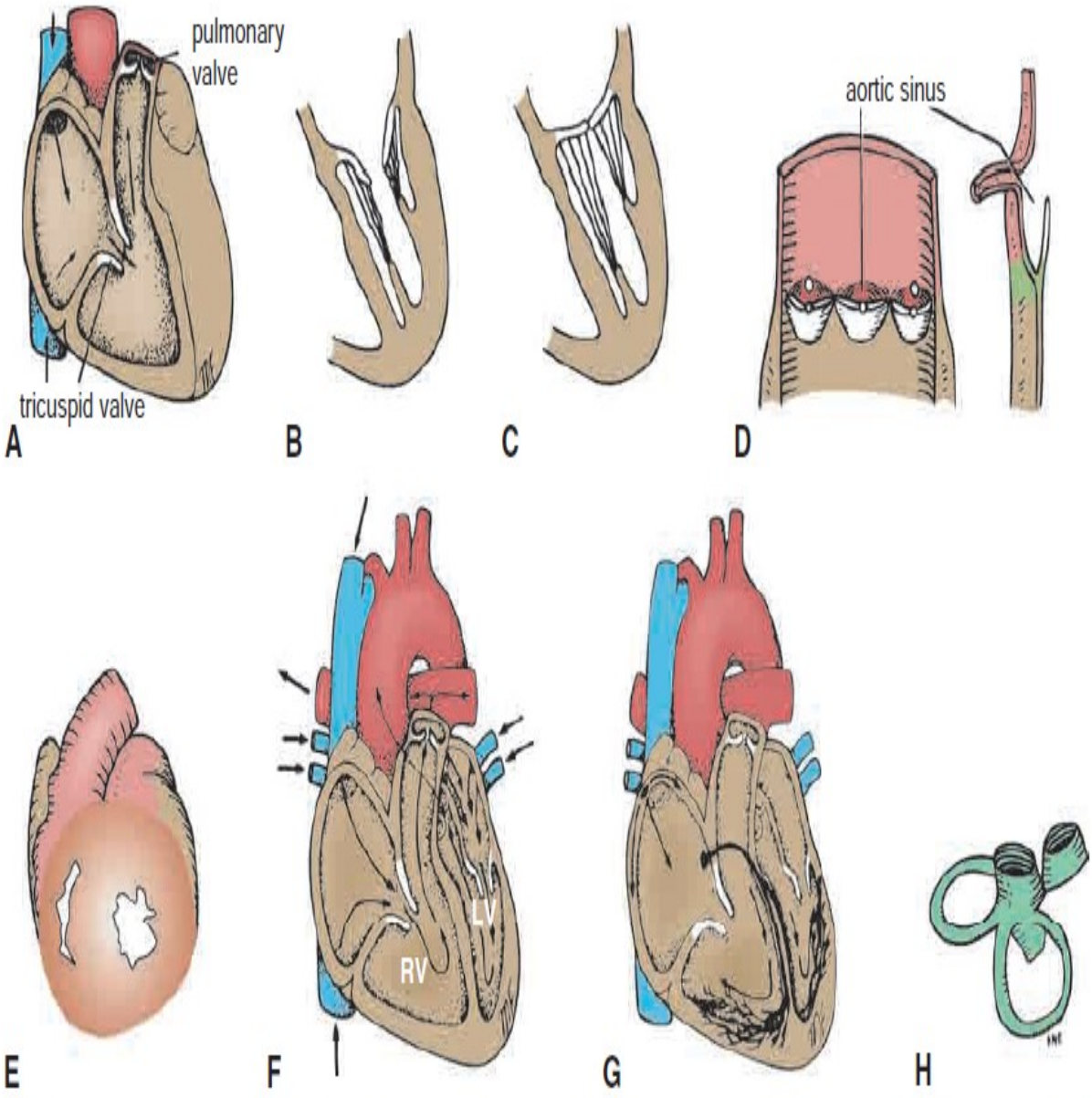

FIGURE 3.38 **A.** Position of the tricuspid and pulmonary valves. **B.** Mitral cusps with valve open. **C.** Mitral cusps with valve closed. **D.** Semilunar cusps of the aortic valve. **E.** Cross section of the ventricles of the heart. **F.** Path taken by the blood through the heart. **G.** Path taken by the cardiac impulse from the sinuatrial node to the Purkinje network. **H.** Fibrous skeleton of the heart.

Structure of the Heart

The walls of the heart are composed of a thick layer of cardiac muscle, the myocardium, covered externally by the epicardium and lined internally by the endocardium. The atrial portion of the heart has relatively thin walls and is divided by the **atrial (interatrial) septum** into the right and left atria. The septum runs from the anterior wall of the heart backward and to the right. The ventricular portion of the heart has thick walls and is divided by the **ventricular (interventricular) septum** into the right and left ventricles.

The Arterial Supply of the Heart

The arterial supply of the heart is provided by the right and left coronary arteries, which arise from the ascending aorta immediately above the aortic valve (Fig. 3.41).

Venous Drainage of the Heart

Most blood from the heart wall drains into the right atrium through the coronary sinus (Fig. 3.41), and is a continuation of the **great cardiac vein.** It opens into the right atrium to the left of the inferior vena cava.

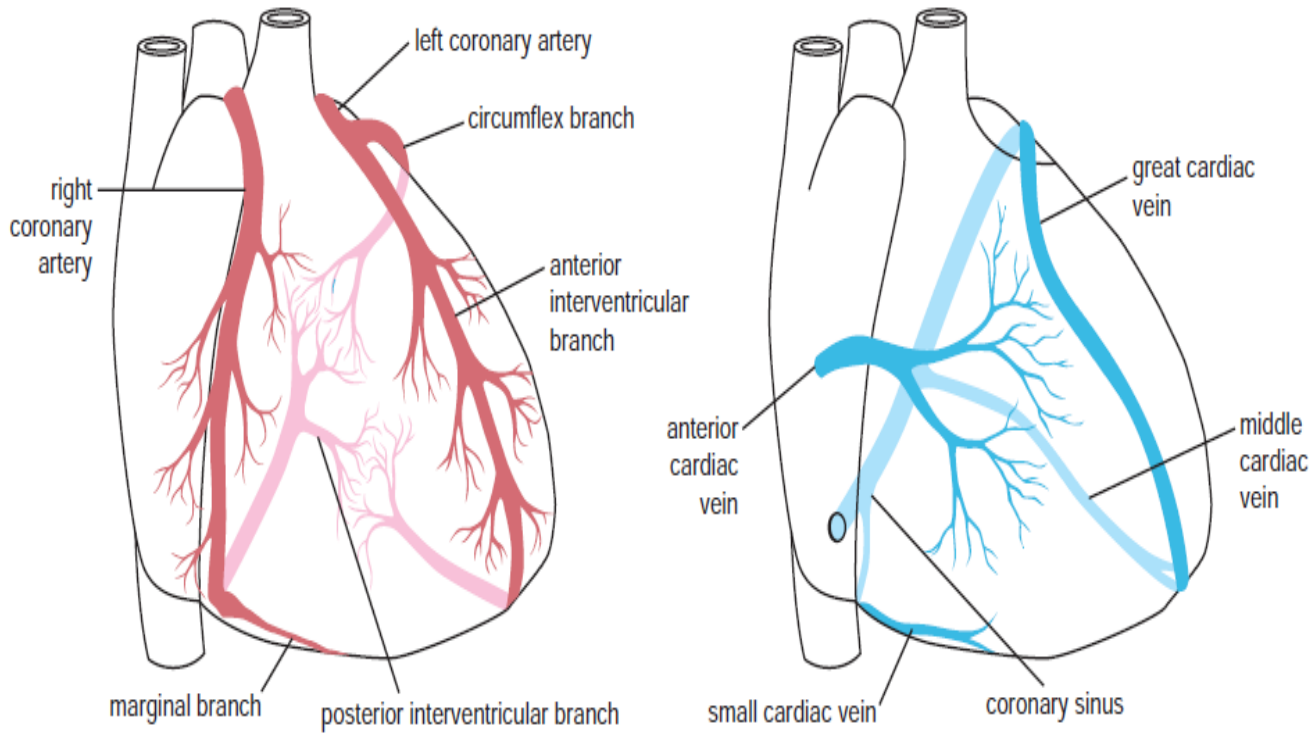

FIGURE 3.41 Coronary arteries and veins.

Surface Anatomy of the Heart Valves

The surface projection of the heart was described on page 56. The surface markings of the heart valves are as follows (Fig. 3.14):

- The **tricuspid valve** lies behind the right half of the sternum opposite the 4th intercostal space.
- The **mitral valve** lies behind the left half of the sternum opposite the 4th costal cartilage.
- The **pulmonary valve** lies behind the medial end of the third left costal cartilage and the adjoining part of the sternum.
- The **aortic valve** lies behind the left half of the sternum opposite the 3rd intercostal space.

Large Veins of the Thorax

Brachiocephalic Veins

The **right brachiocephalic vein** is formed at the root of the neck by the union of the right subclavian and the right internal jugular veins (Figs. 3.15 and 3.48). The **left brachiocephalic vein** has a similar origin (Figs. 3.30 and 3.32). It passes obliquely downward and to the right behind the manubrium sterni and in front of the large branches of the aortic arch. It joins the right brachiocephalic vein to form the superior vena cava (Fig. 3.48).

Superior Vena Cava

The superior vena cava contains all the venous blood from the head and neck and both upper limbs and is formed by the union of the two brachiocephalic veins (Figs. 3.32 and 3.48). It passes downward to end in the right atrium of the heart (Fig. 3.36).

Azygos Veins

The azygos veins consist of the main azygos vein, the inferior hemiazygos vein, and the superior hemiazygos vein. They drain blood from the posterior parts of the intercostal spaces, the posterior abdominal wall, the pericardium, the diaphragm, the bronchi, and the esophagus (Fig. 3.48).

Azygos Vein

The origin of the azygos vein is variable. It is often formed by the union of the **right ascending lumbar vein** and the **right subcostal vein.** It ascends through the aortic opening in the diaphragm on the right side of the aorta to the level of the fifth thoracic vertebra (Fig. 3.48). Here it arches forward above the root of the right lung to empty into the posterior surface of the superior vena cava (Fig. 3.15).

Inferior Hemiazygos Vein

The inferior hemiazygos vein is often formed by the union of the left ascending lumbar vein and the left subcostal vein. It ascends through the left crus of the diaphragm and, at about the level of the eighth thoracic vertebra, turns to the right and joins the azygos vein (see Fig. 2.11**).**

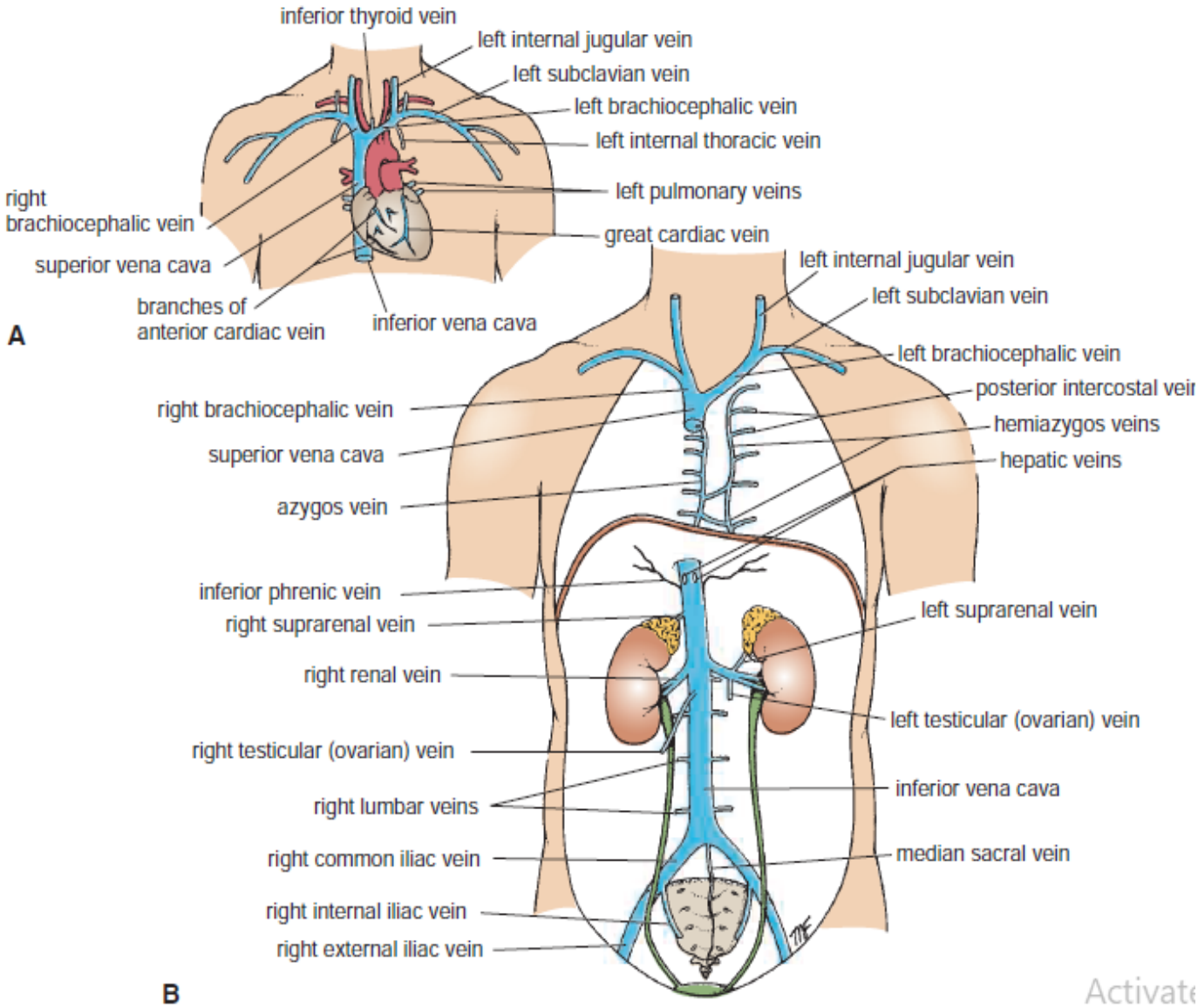

FIGURE 3.48 **A.** Major veins entering the heart. **B.** Major veins draining into the superior and inferior venae cavae.

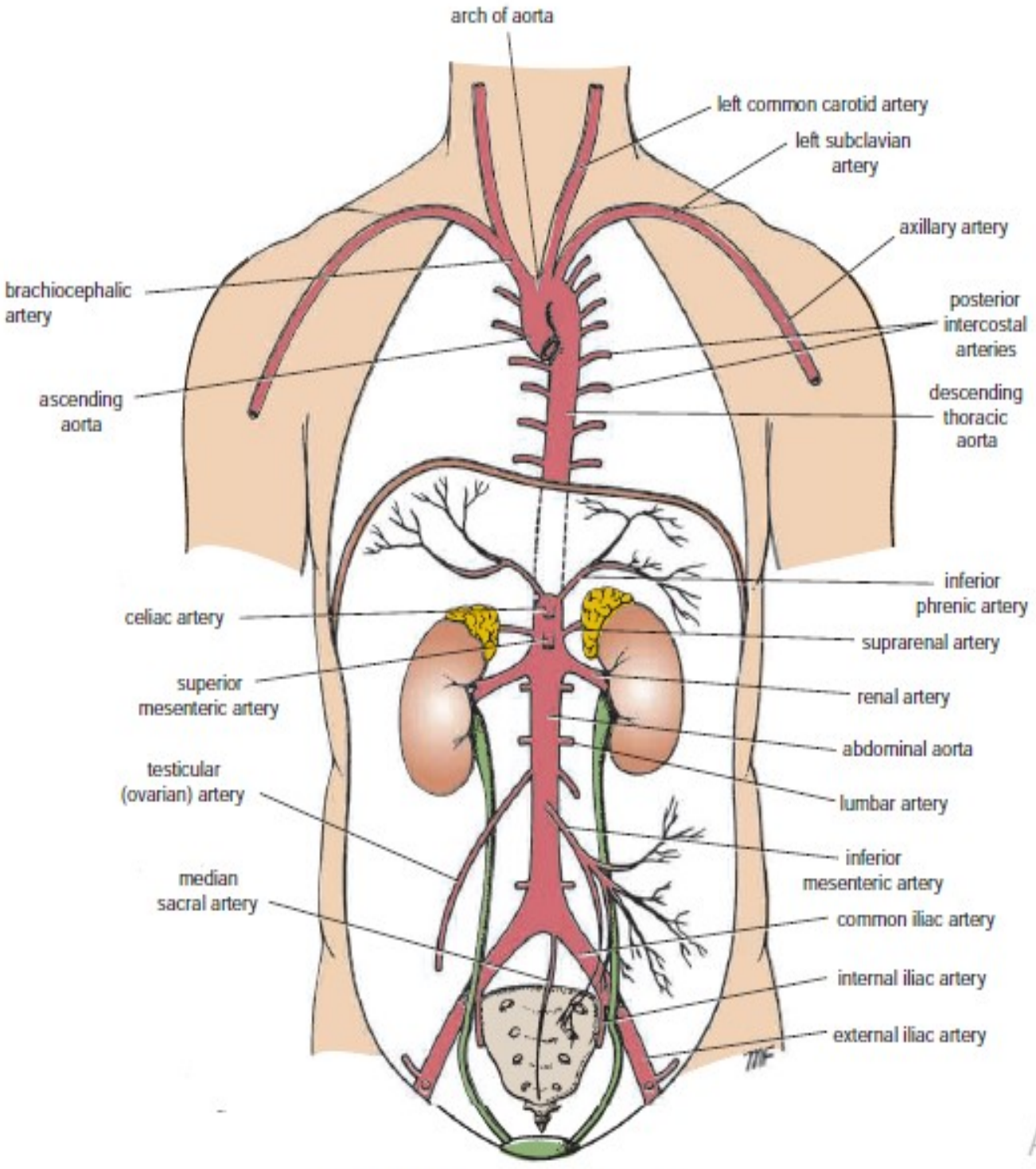

FIGURE 3.49 Major branches of the aorta.