into its two branches, the right and left pulmonary veins, the phrenic nerves, and some bronchial lymph glands.

The **Posterior Mediastinum** (Figs. 968, 969) is an irregular triangular space running parallel with the vertebral column; it is bounded in front by the pericardium above, and by the posterior surface of the diaphragm below, behind by the vertebral column from the lower border of the fourth to the twelfth thoracic vertebra, and on either side by the mediastinal pleura. It contains the thoracic part of the descending aorta, the azygos and the two hemiazygos veins, the vagus and splanchnic nerves, the esophagus, the thoracic duct, and some lymph glands.

**THE LUNGS (PULMONES).**

The lungs are the essential organs of respiration; they are two in number, placed one on either side within the thorax, and separated from each other by the heart and other contents of the mediastinum (Fig. 970). The substance of the lung is of a light, porous, spongy texture; it floats in water, and crepitates when handled, owing to the presence of air in the alveoli; it is also highly elastic; hence the retracted state of these organs when they are removed from the closed cavity of the thorax. The surface is smooth, shining, and marked out into numerous polyhedral areas, indicating the lobules of the organ: each of these areas is crossed by numerous lighter lines.

![Diagram of heart and lungs](image)

**Fig. 970.**—Front view of heart and lungs.

At birth the lungs are pinkish white in color; in adult life the color is a dark slaty gray, mottled in patches; and as age advances, this mottling assumes a black color. The coloring matter consists of granules of a carbonaceous substance deposited in the areolar tissue near the surface of the organ. It increases in quan-
tity as age advances, and is more abundant in males than in females. As a rule, the posterior border of the lung is darker than the anterior.

The right lung usually weighs about 625 gm., the left 567 gm., but much variation is met with according to the amount of blood or serous fluid they may contain. The lungs are heavier in the male than in the female, their proportion to the body being, in the former, as 1 to 37, in the latter as 1 to 43.

Each lung is conical in shape, and presents for examination an apex, a base, three borders, and two surfaces.

The apex (apex pulmonis) is rounded, and extends into the root of the neck, reaching from 2.5 to 4 cm. above the level of the sternal end of the first rib. A sulcus produced by the subclavian artery as it curves in front of the pleura runs upward and laterward immediately below the apex.

The base (basis pulmonis) is broad, concave, and rests upon the convex surface of the diaphragm, which separates the right lung from the right lobe of the liver, and the left lung from the left lobe of the liver, the stomach, and the spleen. Since the diaphragm extends higher on the right than on the left side, the concavity on the base of the right lung is deeper than that on the left. Laterally and behind, the base is bounded by a thin, sharp margin which projects for some distance into the phrenicocostal sinus of the pleura, between the lower ribs and the costal attachment of the diaphragm. The base of the lung descends during inspiration and ascends during expiration.

![Diagram of lungs and heart](image)

The costal surface (facies costalis; external or thoracic surface) is smooth, convex, of considerable extent, and corresponds to the form of the cavity of the chest, being deeper behind than in front. It is in contact with the costal pleura, and presents, in specimens which have been hardened in situ, slight grooves corresponding with the overlying ribs.
The mediastinal surface (facies mediastinalis; inner surface) is in contact with the mediastinal pleura. It presents a deep concavity, the cardiac impression, which accommodates the pericardium; this is larger and deeper on the left than on the right lung, on account of the heart projecting farther to the left than to the right side of the median plane. Above and behind this concavity is a triangular depression named the hilum, where the structures which form the root of the lung enter and leave the viscus. These structures are invested by pleura, which, below the hilus and behind the pericardial impression, forms the pulmonary ligament. On the right lung (Fig. 972), immediately above the hilus, is an arched furrow which accommodates the azygos vein; while running upward, and then arching laterally, some little distance below the apex, is a wide groove for the superior vena cava and right innominate vein; behind this, and nearer the apex, is a furrow for the innominate artery. Behind the hilus and the attachment of the pulmonary ligament is a vertical groove for the esophagus; this groove becomes less distinct below, owing to the inclination of the lower part of the esophagus to the left of the middle line. In front and to the right of the lower part of the esophageal groove is a deep concavity for the extrapericardiac portion of the thoracic part of the inferior vena cava. On the left lung (Fig. 973), immediately above the hilus, is a well-marked curved furrow produced by the aortic arch, and running upward from this toward the apex is a groove accommodating the left subclavian artery; a slight impression in front of the latter and close to the margin of the lung lodges the left innominate vein. Behind the hilus and pulmonary ligament is a vertical furrow produced by the descending aorta, and in front of this, near the base of the lung, the lower part of the esophagus causes a shallow impression.
Borders.—The inferior border (margo inferior) is thin and sharp where it separates the base from the costal surface and extends into the phrenicocostal sinus; medially where it divides the base from the mediastinal surface it is blunt and rounded.

The posterior border (margo posterior) is broad and rounded, and is received into the deep concavity on either side of the vertebral column. It is much longer than the anterior border, and projects below, into the phrenicocostal sinus.

The anterior border (margo anterior) is thin and sharp, and overlaps the front of the pericardium. The anterior border of the right lung is almost vertical, and projects into the costomediastinal sinus; that of the left presents, below, an angular notch, the cardiac notch, in which the pericardium is exposed. Opposite this notch the anterior margin of the left lung is situated some little distance lateral to the line of reflection of the corresponding part of the pleura.

Fissures and Lobes of the Lungs.—The left lung is divided into two lobes, an upper and a lower, by an interlobular fissure, which extends from the costal to the mediastinal surface of the lung both above and below the hilus. As seen on the surface, this fissure begins on the mediastinal surface of the lung at the upper and posterior part of the hilus, and runs backward and upward to the posterior border, which it crosses at a point about 6 cm. below the apex. It then extends downward and forward over the costal surface, and reaches the lower border a little behind its anterior extremity, and its further course can be followed upward and backward across the mediastinal surface as far as the lower part of the hilus. The superior lobe lies above and in front of this fissure, and includes the apex, the anterior border, and a considerable part of the costal surface and the greater part of the mediastinal surface of the lung. The inferior lobe, the larger
of the two, is situated below and behind the fissure, and comprises almost the whole of the base, a large portion of the costal surface, and the greater part of the posterior border.

The right lung is divided into three lobes, superior, middle, and inferior, by two interlobular fissures. One of these separates the inferior from the middle and superior lobes, and corresponds closely with the fissure in the left lung. Its direction is, however, more vertical, and it cuts the lower border about 7.5 cm. behind its anterior extremity. The other fissure separates the superior from the middle lobe. It begins in the previous fissure near the posterior border of the lung, and, running horizontally forward, cuts the anterior border on a level with the sternal end of the fourth costal cartilage; on the mediastinal surface it may be traced backward to the hilus. The middle lobe, the smallest lobe of the right lung, is wedge-shaped, and includes the lower part of the anterior border and the anterior part of the base of the lung.

The right lung, although shorter by 2.5 cm. than the left, in consequence of the diaphragm rising higher on the right side to accommodate the liver, is broader, owing to the inclination of the heart to the left side; its total capacity is greater and it weighs more than the left lung.

The Root of the Lung (radix pulmonis).—A little above the middle of the mediastinal surface of each lung, and nearer its posterior than its anterior border, is its root, by which the lung is connected to the heart and the trachea. The root is formed by the bronchus, the pulmonary artery, the pulmonary veins, the bronchial arteries and veins, the pulmonary plexuses of nerves, lymphatic vessels, bronchial lymph glands, and areolar tissue, all of which are enclosed by a reflection of the pleura. The root of the right lung lies behind the superior vena cava and part of the right atrium, and below the azygos vein. That of the left lung passes beneath the aortic arch and in front of the descending aorta; the phrenic nerve, the pericardioophrenic artery and vein, and the anterior pulmonary plexus, lie in front of each, and the vagus and posterior pulmonary plexus behind each; below each is the pulmonary ligament.

The chief structures composing the root of each lung are arranged in a similar manner from before backward on both sides, viz., the upper of the two pulmonary veins in front; the pulmonary artery in the middle; and the bronchus, together with the bronchial vessels, behind. From above downward, on the two sides, their arrangement differs, thus:

On the right side their position is—eparterial bronchus, pulmonary artery, hyparterial bronchus, pulmonary veins, but on the left side their position is—pulmonary artery, bronchus, pulmonary veins. The lower of the two pulmonary veins, is situated below the bronchus, at the apex or lowest part of the hilus (Figs. 972, 973).

Divisions of the Bronchi.—Just as the lungs differ from each other in the number of their lobes, so the bronchi differ in their mode of subdivision.

The right bronchus gives off, about 2.5 cm. from the bifurcation of the trachea, a branch for the superior lobe. This branch arises above the level of the pulmonary artery, and is therefore named the eparterial bronchus. All the other divisions of the main stem come off below the pulmonary artery, and consequently are termed hyparterial bronchi. The first of these is distributed to the middle lobe, and the main tube then passes downward and backward into the inferior lobe, giving off in its course a series of large ventral and small dorsal branches. The ventral and dorsal branches arise alternately, and are usually eight in number—four of each kind. The branch to the middle lobe is regarded as the first of the ventral series.

The left bronchus passes below the level of the pulmonary artery before it divides, and hence all its branches are hyparterial; it may therefore be looked upon as
equivalent to that portion of the right bronchus which lies on the distal side of its eparterial branch. The first branch of the left bronchus arises about 5 cm. from the bifurcation of the trachea, and is distributed to the superior lobe. The main stem then enters the inferior lobe, where it divides into ventral and dorsal branches similar to those in the right lung. The branch to the superior lobe of the left lung is regarded as the first of the ventral ones.

Structure.—The lungs are composed of an external serous coat, a subserous areolar tissue, and the pulmonary substance or parenchyma.

The serous coat is the pulmonary pleura (page 1000); it is thin, transparent, and invests the entire organ as far as the root.

The subserous areolar tissue contains a large proportion of elastic fibers; it invests the entire surface of the lung, and extends inward between the lobules.

The parenchyma is composed of secondary lobules which, although closely connected together by an interlobular areolar tissue, are quite distinct from one another, and may be teased asunder without much difficulty in the fetus. The secondary lobules vary in size; those on the surface are large, of pyramidal form, the base turned toward the surface; those in the interior smaller, and of various forms. Each secondary lobule is composed of several primary lobules, the anatomical units of the lung. The primary lobule consists of an alveolar duct, the air spaces connected with it and their blood vessels, lymphatics and nerves.

The intrapulmonary bronchi divide and subdivide throughout the entire organ, the smallest subdivisions constituting the lobular bronchioles. The larger divisions consist of: (1) an outer coat of fibrous tissue in which are found at intervals irregular plates of hyaline cartilage, most developed at the points of division; (2) internal to the fibrous coat, a layer of circularly disposed smooth muscle fibers, the bronchial muscle; and (3) most internally, the mucous membrane, lined by cuboidal ciliated epithelium resting on a basement membrane. The primary bronchi contain numerous elastic fibers running longitudinally, and a certain amount of lymphoid tissue; it also contains the ducts of mucous glands, the acini of which lie in the fibrous coat. The lobular bronchioles differ from the larger tubes in containing no cartilage and in the fact that the ciliated epithelial cells are cubical in shape. The lobular bronchioles are about 0.2 mm. in diameter.

Each bronchiole divides into two or more respiratory bronchioles, with scattered alveoli, and each of these again divides into several alveolar ducts, with a greater number of alveoli connected with them. Each alveolar duct is connected with a variable number of irregular spherical spaces, which also possess alveoli, the alveoli. With each alveolus a variable number (2-3) of alveolar sacs are connected which bear on all parts of their circumference alveoli or air sacs. (Miller.)
The alveoli are lined by a delicate layer of simple squamous epithelium, the cells of which are united at their edges by cement substance. Between the squames are here and there smaller, polygonal, nucleated cells. Outside the epithelial lining is a little delicate connective tissue containing numerous elastic fibers and a close net-work of blood capillaries, and forming a common wall to adjacent alveoli (Fig. 975).

The fetal lung resembles a gland in that the alveoli have a small lumen and are lined by cubical epithelium (Fig. 976). After the first respiration the alveoli become distended, and the epithelium takes on the characters described above.