at the margins. Two or more of the cartilages often unite, partially or completely, and they are sometimes bifurcated at their extremities. They are highly elastic, but may become calcified in advanced life. In the right bronchus the cartilages vary in number from six to eight; in the left, from nine to twelve. They are shorter and narrower than those of the trachea, but have the same shape and arrangement. The peculiar tracheal cartilages are the first and the last (Fig. 961).

The first cartilage is broader than the rest, and often divided at one end; it is connected by the epiotraheal ligament with the lower border of the cricoid cartilage, with which, or with the succeeding cartilage, it is sometimes blended.

The last cartilage is thick and broad in the middle, in consequence of its lower border being prolonged into a triangular hook-shaped process, which curves downward and backward between the two bronchi. It ends on each side in an imperfect ring, which encloses the commencement of the bronchus. The cartilage above the last is somewhat broader than the others at its center.

The Fibrous Membrane.—The cartilages are enclosed in an elastic fibrous membrane, which consists of two layers; one, the thicker, passing over the outer surface of the ring, the other over the inner surface: at the upper and lower margins of the cartilages the two layers blend together to form a single membrane, which connects the rings one with another. They are thus invested by the membrane. In the space behind, between the ends of the rings, the membrane forms a single layer.

The muscular tissue consists of two layers of non-striated muscle, longitudinal and transverse. The longitudinal fibers are external, and consist of a few scattered bundles. The transverse fibers (Trachealis muscle) are internal, and form a thin layer which extends transversely between the ends of the cartilages.

Mucous Membrane.—The mucous membrane is continuous above with that of the larynx, and below with that of the bronchi. It consists of areolar and lymphoid tissue, and presents a well-marked basement membrane, supporting a stratified epithelium, the surface layer of which is columnar and ciliated, while the deeper layers are composed of oval or rounded cells. Beneath the basement membrane there is a distinct layer of longitudinal elastic fibers with a small amount of intervening areolar tissue. The submucous layer is composed of a loose mesh-work of connective tissue, containing large bloodvessels, nerves, and mucous glands; the ducts of the latter pierce the overlying layers and open on the surface (Fig. 964).

Veins and Nerves.—The trachea is supplied with blood by the inferior thyroid arteries. The veins end in the thyroid venous plexus. The nerves are derived from the vagus and the recurrent nerves, and from the sympathetic; they are distributed to the Trachealis muscles and between the epithelial cells.

**THE PLEURA**

Each lung is invested by an exceedingly delicate serous membrane, the pleura, which is arranged in the form of a closed invaginated sac. A portion of the serous membrane covers the surface of the lung and dips into the fissures between its lobes; it is called the pulmonary pleura. The rest of the membrane lines the inner surface of the chest wall, covers the diaphragm, and is reflected over the structures occupying the middle of the thorax; this portion is termed the parietal pleura. The two layers are continuous with one another around and below the root of the lung.
in health they are in actual contact with one another, but the potential space between them is known as the pleural cavity. When the lung collapses or when air or fluid collects between the two layers the cavity becomes apparent. The right and left pleural sacs are entirely separate from one another; between them are all the thoracic viscera except the lungs, and they only touch each other for a short distance in front; opposite the second and third pieces of the sternum the interval between the two sacs is termed the mediastinum.

Different portions of the parietal pleura have received special names which indicate their position: thus, that portion which lines the inner surfaces of the ribs and Intercostales is the costal pleura; that clothing the convex surface of the diaphragm is the diaphragmatic pleura; that which rises into the neck, over the summit of the lung, is the cupula of the pleura (cervical pleura); and that which is applied to the other thoracic viscera is the mediastinal pleura.

**Fig. 965.**—Front view of thorax, showing the relations of the pleura and lungs to the chest wall. Pleura in blue; lungs in purple.

**Reflections of the Pleura** (Figs. 965, 966).—Commencing at the sternum, the pleura passes laterward, lines the inner surfaces of the costal cartilages, ribs, and Intercostales, and at the back part of the thorax passes over the sympathetic trunk and its branches, and is reflected upon the sides of the bodies of the vertebrae, where it is separated by a narrow interval, the posterior mediastinum, from the opposite pleura. From the vertebral column the pleura passes to the side of the pericardium, which it covers to a slight extent; it then covers the back part of the root of the lung, from the lower border of which a triangular sheet descends vertically toward the diaphragm. This sheet is the posterior layer of a wide fold known as the pulmonary ligament. From the back of the lung root, the pleura
may be traced over the costal surface of the lung, the apex and base, and also over the sides of the fissures between the lobes, on to its mediastinal surface and the front part of its root. It is continued from the lower margin of the root as the anterior layer of the pulmonary ligament, and from this it is reflected on to the pericardium (pericardial pleura), and from it to the back of the sternum. Above the level of the root of the lung, however, the mediastinal pleura passes uninterruptedly from the vertebral column to the sternum over the structures in the superior mediastinum. Below, it covers the upper surface of the diaphragm and extends, in front, as low as the costal cartilage of the seventh rib; at the side of the chest, to the lower border of the tenth rib on the left side and to the upper border of the same rib on the right side; and behind, it reaches as low as the twelfth rib, and sometimes even to the transverse process of the first lumbar vertebra. Above, its cupula projects through the superior opening of the thorax into the neck, extending from 2.5 to 5 cm. above the sternal end of the first rib; this portion of the sac is strengthened by a dome-like expansion of fascia (Sibson's fascia), attached in front to the inner border of the first rib, and behind to the anterior border of the transverse process of the seventh cervical vertebra. This is covered and strengthened by a few spreading muscular fibers derived from the Scaleni.

In the front of the chest, where the parietal pleura is reflected backward to the pericardium, the two pleural sacs are in contact for a short distance. At the upper part of the chest, behind the manubrium, they are separated by an angular interval; the line of reflection being represented by a line drawn from the sternoclavicular articulation to the mid-point of the junction of the manubrium with the body of the sternum. From this point the two pleurae descend in close contact to the level of the fourth costal cartilages, and the line of reflection on the right side is continued downward in nearly a straight line to the xiphoid process, and then turns lateralward, while on the left side the line of reflection diverges lateralward and is continued downward, close to the left border of the sternum, as far as the sixth costal cartilage. The inferior limit of the pleura is on a considerably lower level than the corresponding limit of the lung, but does not extend to the attachment of the diaphragm, so that below the line of reflection of the pleura from the chest wall on to the diaphragm the latter is in direct contact with the rib cartilages and the Intercostales interni. Moreover, in ordinary inspiration the thin inferior margin of the lung does not extend as low as the line of the pleural reflection, with the result that the costal and diaphragmatic pleurae are here in contact, the intervening narrow slit being termed the phrenicocostal sinus. A similar condition
exists behind the sternum and rib cartilages, where the anterior thin margin of
the lung falls short of the line of pleural reflection, and where the slit-like cavity
between the two layers of pleura forms what is called the costomediastinal sinus.

The line along which the right pleura is reflected from the chest-wall to the
diaphragm starts in front, immediately below the seventh sternocostal joint, and
runs downward and backward behind the seventh costal cartilage so as to cross
the tenth rib in the mid-axillary line, from which it is prolonged to the spinous
process of the twelfth thoracic vertebra. The reflection of the left pleura follows
at first the ascending part of the sixth costal cartilage, and in the rest of its course
is slightly lower than that of the right side.

The free surface of the pleura is smooth, polished, and moistened by a serous
fluid; its attached surface is intimately adherent to the lung, and to the pulmonary
vessels as they emerge from the pericardium; it is also adherent to the upper sur-
face of the diaphragm: throughout the rest of its extent it is easily separable from
the adjacent parts.

The right pleural sac is shorter, wider, and reaches higher in the neck than the
left.

**Pulmonary Ligament (ligamentum pulmonale; ligamentum latum pulmonis).**—
From the above description it will be seen that the root of the lung is covered in
front, above, and behind by pleura, and that at its lower border the investing
layers come into contact. Here they form a sort of mesenteric fold, the pulmonary
ligament, which extends between the lower part of the mediastinal surface of the
lung and the pericardium. Just above the diaphragm the ligament ends in a free
faliform border. It serves to retain the lower part of the lung in position.

**Structure of Pleura.**—Like other serous membranes, the pleura is covered by a single layer
of flattened, nucleated cells, united at their edges by cement substance. These cells are modified
connective-tissue corpuscles, and rest on a basement membrane. Beneath the basement mem-
brane there are net-works of yellow elastic and white fibers, imbedded in ground substance which
also contains connective-tissue cells. Blood vessels, lymphatics, and nerves are distributed in
the substance of the pleura.

**Vessels and Nerves.**—The **arteries of the pleura** are derived from the intercostal, internal
mammary, musculophrenic, thymic, pericardiac, and bronchial vessels. The **veins** correspond
to the arteries. The **lymphatics** are described on page 719. The **nerves** are derived from the
phrenic and sympathetic (Luschka). Kölliker states that nerves accompany the ramifications
of the bronchial arteries in the pulmonary pleura.

**THE MEDIASTINUM (INTERPLEURAL SPACE).**

The **mediastinum** lies between the right and left pleure in and near the median
sagittal plane of the chest. It extends from the sternum in front to the vertebral
column behind, and contains all the thoracic viscera excepting the lungs. It may
be divided for purposes of description into two parts: an upper portion, above the
upper level of the pericardium, which is named the **superior mediastinum**; and a
lower portion, below the upper level of the pericardium. This lower portion is
again subdivided into three parts, viz., that in front of the pericardium, the
**anterior mediastinum**; that containing the pericardium and its contents, the **middle
mediastinum**; and that behind the pericardium, the **posterior mediastinum**.

The **Superior Mediastinum** (Fig. 967) is that portion of the interpleural space
which lies between the manubrium sterni in front, and the upper thoracic verte-
brea behind. It is bounded below by a slightly oblique plane passing backward
from the junction of the manubrium and body of the sternum to the lower part
of the body of the fourth thoracic vertebra, and laterally by the pleure. It con-
tains the origins of the Sternohodyoidei and Sternothyreoidei and the lower ends of
the Longi coli; the aortic arch; the innominate artery and the thoracic portions
of the left common carotid and the left subclavian arteries; the innominate veins

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