THE ANATOMY OF THE RESPIRATORY, BLOOD-VASCULAR AND LYMPHATIC SYSTEMS

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CUNNINGHAM'S TEXT-BOOK OF ANATOMY
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THE RESPIRATORY, BLOOD-VASCULAR AND LYMPHATIC SYSTEMS

FOREWORD

It is hoped that many students of anatomy will welcome the reappearance of separate bound sections of Cunningham's Text-Book of Anatomy which were last issued in this form fifty years ago. Unlike their predecessors, the volumes now issued are each complete in themselves and may be used independently of the rest of the text as the sections have been arranged so that each of the principal anatomical systems is complete within a single volume. The full index to the Text-Book has been included in each volume as an aid to cross-reference from one volume to another since it is felt that many students will use two or more of these separate volumes. As a further aid to quick reference, a Table facing the first page of the index gives the pagination of each section of the book.

It is hoped that not only will the smaller volumes be found more convenient to handle, but that where only one or two sections are required, the considerable saving in the purchase price will be appreciated. The text is that of the ninth edition of the complete work and it will be seen that the page numbers remain the same. Pages 1 to 16, which form an introductory chapter to the complete Text-Book, have been omitted from Volume I, Human Embryology, in which the text commences on page 17. The contents of the separate volumes are as follows :

Volume I HUMAN EMBRYOLOGY.

Volume II THE LOCOMOTOR SYSTEM.
Containing (i) Osteology. (ii) Arthrology. (iii) Myology.

Volume III THE DIGESTIVE AND UROGENITAL SYSTEMS, THE DUCTLESS GLANDS, SKIN AND SENSORY ORGANS.

Volume IV THE RESPIRATORY, BLOOD-VASCULAR AND LYMPHATIC SYSTEMS.

Volume V THE NERVOUS SYSTEM
Containing (i) Central Nervous System. (ii) Peripheral Nervous System. (iii) Autonomic Nervous System.

Volume VI SURFACE AND SURGICAL ANATOMY.
With an appendix on Radiographic Anatomy.

The complete Text-Book will remain available as a single volume and the present volumes are intended principally for those who do not require the whole text.

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RESPIRATORY SYSTEM

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Professor of Anatomy, University of Toronto

THE **Respiratory System** (Fig. 578) comprises the *larynx*, *trachea*, *bronchi*, and *lungs*. The larynx and trachea are the successive parts of a median air-passage. The trachea bifurcates below into two smaller air-passages, called the right and the left bronchus, which conduct air to the right and the left lung respectively. A serous membrane, called the *pleura*, envelops each lung and lines the portion of the thoracic cavity which contains that lung.

The larynx opens into the inferior part of the pharynx, and the air that passes into and out of the air-passages traverses the pharynx and the nasal cavities, and also the oral cavity if the mouth is open. The connexion between the digestive and respiratory systems is explained by the fact that the respiratory system develops as an outgrowth from the ventral wall of the primitive fore-gut of the embryo.

LARYNX

The larynx is a mechanism specially adapted to protect the opening of the air-passage, to close it against the entrance of solids, liquids, and even air if necessary, and to control the expiration of air from the lungs, thus providing an organ of voice in Man. Above, it opens into the pharynx; below, its cavity is continuous with the lumen of the trachea or windpipe.

Position and Relations of Larynx.—In the natural position of the neck the larynx is situated anterior to the bodies of the fourth, fifth, and sixth cervical vertebræ. Its highest point, represented by the tip of the epiglottis, extends to the upper border of the body of the third cervical vertebra, whilst its lowest limit (the lower border of the cricoid cartilage) usually extends to the lower border of the body of the sixth cervical vertebra. From the vertebral column the larynx is separated not only by the prevertebral muscles and the prevertebral fascia but also by the posterior wall of the pharynx—indeed, the posterior surface of the larynx forms the inferior part of the anterior wall of the pharynx, and it is covered with the pharyngeal mucosa.

The larynx lies below the hyoid bone and the tongue, in the interval between the great vessels of the neck, and it forms a more or less marked projection on the front of the neck. In the median plane it is separated from the surface merely by skin and two layers of fascia; laterally it is overlapped by the the sterno-mastoid muscle, and is covered with the two strata of thin ribbon-like muscles that are attached to the thyroid cartilage and the hyoid bone. It is clasped by the upper parts of the lobes of the thyroid gland.

The position of the larynx is influenced by movements of the head and neck. Thus, it is elevated when the head moves backwards and is depressed when the chin is carried downwards towards the chest, but its relation to the vertebræ is scarcely changed. During deglutition the larynx moves upwards. The pharyngeal muscles attached to it, and more especially the palato-pharyngeus muscles, are responsible for bringing about these movements. In the production of vowel-sounds the pharynx undergoes marked alterations in outline, and the larynx accommodates itself to these in position and

in the relation of its thyroid to its cricoid portions. In singing, there are no changes of position other than those essential to vowel-production. In untrained singers the pharyngeal and laryngeal movements are erratic and lacking in orderly control.

In the fœtus, shortly before birth, the larynx lies nearer the head. The tip of the epiglottis then corresponds in level to the atlas, and the lower border of the larynx to the

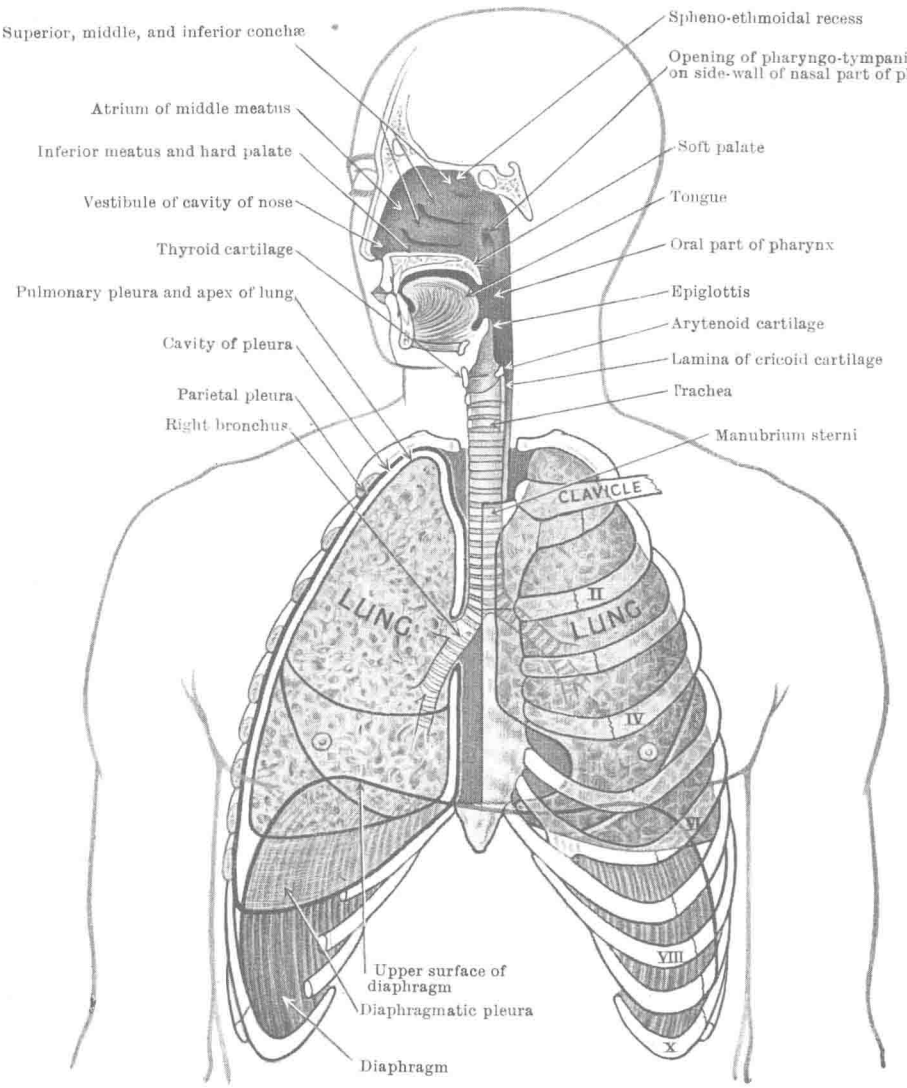

FIG. 578.—DIAGRAM OF GENERAL ARRANGEMENT OF RESPIRATORY SYSTEM.
The lung, pleura, and ribs of the right side are represented as cut.

lower border of the body of the fourth cervical vertebra. From four years onwards, in both sexes, the larynx maintains a fairly constant position in the neck—namely, the adult position given on the previous page. The elasticity of the trachea ensures practical uniformity of laryngeal relations in all positions of the head and neck.

General Construction of Larynx.—The framework is composed of several cartilages which are connected by synovial joints and also by extensive elastic membranes. Two elastic cords, which stretch from the anterior to the posterior wall of the larynx, form the groundwork of the vocal folds. Many muscles operate upon

the cartilages of the larynx, bringing about changes in the relative positions of the vocal folds, and producing different degrees of tension in those folds. The cavity of the larynx is lined with mucous membrane, under which, in certain localities, are collected masses of mucous glands.

CARTILAGES OF LARYNX

There are three single cartilages and three pairs of cartilages in the laryngeal wall. They are named as follows:—

Single cartilages	Paired cartilages
Thyroid.	Arytenoid.
Cricoid.	Corniculate.
Epiglottic.	Cuneiform.

The **thyroid cartilage**, the largest of the laryngeal cartilages, is formed of two quadrilateral plates, called the **laminæ**, which are fused together in front in the median plane. The laminæ diverge posteriorly to enclose a wide angular space open behind. The *anterior borders* of the laminæ are fused only in their inferior parts. Above they diverge to produce a deep, narrow, V-shaped, median notch called the **thyroid notch.** The median prominence just below the notch is known as the **laryngeal prominence** (Adam's apple).

The **angle** formed by the meeting of the two laminæ of the thyroid cartilage presents considerable individual variation and shows marked differences in the two sexes and at different periods of life. In the adult male the average angle is about 90°; in the adult female about 120°. In the fœtus the larynx is relatively large compared with the trachea and is flattened antero-posteriorly. In the infant the laminæ meet in a gentle curve, convex forwards.

The *posterior border* of each lamina of the thyroid cartilage is thick and rounded and is prolonged beyond the superior and inferior borders in the form of two slender cylindrical processes, termed horns or cornua. The **superior horn** is the longer. It is directed upwards, with a slight dorso-medial inclination, and its end or tip, which is rounded is joined to the tip of the greater horn of the hyoid bone by the lateral thyro-hyoid ligament. The **inferior horn** is shorter and stouter. It curves downwards with a slight inclination towards the median plane. On the medial face of its extremity there is a circular, flat facet which articulates with a similar facet on the lateral surface of the cricoid cartilage.

The *superior border* of each lamina is, for the most part, slightly convex. In front it dips suddenly to become continuous with the margin of the thyroid notch, and, behind, as it joins the superior horn, it exhibits a shallow concavity. The *inferior border* is divided by a rudimentary **inferior tubercle** into a short, concave, posterior part and a longer anterior part, also concave, but to a lesser degree.

The *lateral surface* of each lamina is divided into two unequal areas by the **oblique line** which runs from a prominence (the **superior tubercle**) situated immediately antero-inferior to the root of the superior horn, forwards and downwards to end in the inferior tubercle. The area behind the oblique line is much smaller than that in front and is covered by the inferior constrictor muscle of the pharynx. The anterior area is, for the most part, covered by the thyro-hyoid muscle. To the oblique line are attached the sterno-thyroid, thyro-hyoid, and inferior constrictor muscles.

The *medial surface* of the lamina is smooth and slightly concave.

The **cricoid cartilage** is shaped like a signet-ring. Its posterior part or *lamina* is a broad, thick plate, more or less quadrilateral in form. In front and laterally the circumference of the ring is completed by a curved band called the *arch.* The lumen of the ring is circular below but elliptical above. The upper border of the **lamina** presents a broad, shallow, median notch. On each side of the notch there is an obliquely placed oval facet which articulates with the base of the arytenoid cartilage. The posterior surface of the lamina is divided by a median ridge into two depressed areas which give attachment to the posterior crico-arytenoid muscles. The **arch** of the cricoid is narrow and band-like in front, but laterally its upper border rises rapidly to join the upper border of the lamina.

The *inferior border* of the cricoid is nearly horizontal, although it commonly presents three slight, downward projections, one being on each side and one median. It is connected to the first ring of the trachea by an elastic membrane—the crico-tracheal ligament. On the *lateral surface* of the cricoid cartilage, at the place where the arch joins the lamina, a vertical ridge runs downwards from the arytenoid articular facet. On this, a short distance from the inferior border of the cartilage, a prominent circular facet articulates with the inferior horn of the thyroid cartilage (Fig. 582). The *inner surface* of the cricoid cartilage is smooth, and is lined with mucous membrane.

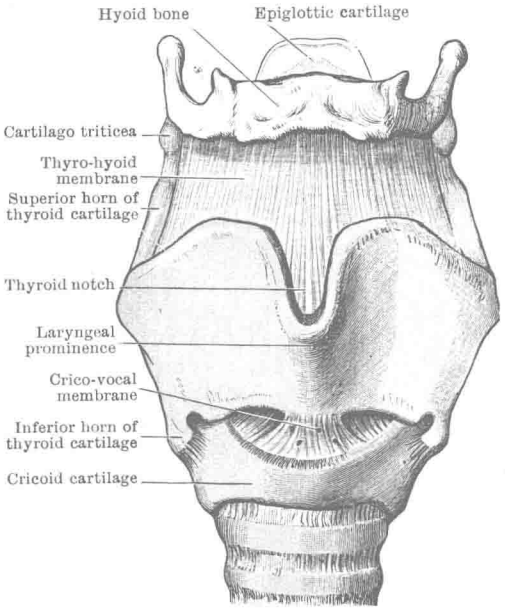

FIG. 579.—ANTERIOR ASPECT OF CARTILAGES AND LIGAMENTS OF LARYNX.

The arch of the cricoid cartilage lies below the inferior border of the thyroid cartilage. The lamina is received into the interval between the posterior portions of the laminæ of the thyroid cartilage.

The **arytenoid cartilages** rest, one on each side of the median plane, upon the upper border of the lamina of the cricoid cartilage, in the interval between the posterior portions of the laminæ of the thyroid cartilage. Each has the form of a three-sided pyramid, the pointed **apex** of which curves postero-medially. It supports the corniculate cartilage. The **base** is triangular in outline. It is prolonged forwards into a small, sharp-pointed **vocal process** which gives attachment to the vocal ligament or supporting band of the vocal fold; and it is prolonged laterally into a stout, prominent angle, called the **muscular process**, which gives attachment to the lateral crico-arytenoid muscle in front and to the posterior crico-arytenoid muscle behind. Near the muscular process the base bears an elongated, concave **articular facet** for articulation with the upper border of the lamina of the cricoid cartilage. The *medial surface*, which is the smallest of the three, is triangular, flat, and vertical. It faces the corresponding surface of the opposite cartilage, from which it is separated by a narrow interval, and it is clothed with the lining mucous membrane of the larynx. The *posterior surface* is smooth and is concave in the vertical direction. It lodges and gives attachment to the transverse arytenoid muscle. The *antero-lateral surface* is the most extensive of the three (Fig. 582). Its middle part is marked by a deep depression in which a mass of mucous glands is lodged. Into this surface the vocalis and thyro-arytenoid muscles are inserted, whilst a small tubercle a short distance above the base gives attachment to the vestibular ligament—the feeble supporting ligament of the vestibular fold. The three surfaces of the arytenoid cartilages are separated from one another by an anterior, a

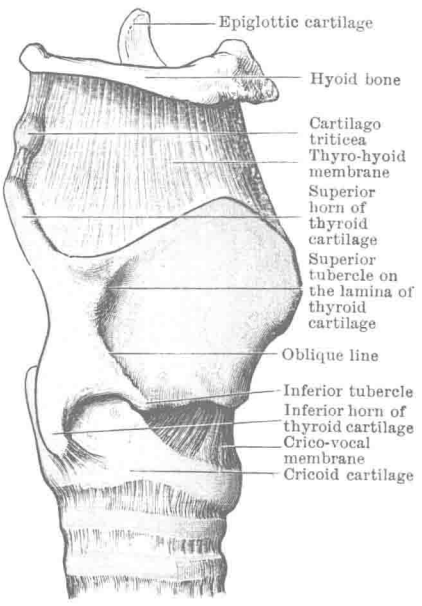

FIG. 580.—PROFILE VIEW OF CARTILAGES AND LIGAMENTS OF LARYNX.

posterior, and a lateral border. The *lateral border* is the longest, and it pursues a sinuous course from the apex to the muscular process at the base. A small nodule of elastic cartilage, called the **sesamoid cartilage**, commonly found on the lateral border of the arytenoid cartilage, is held in position by the investing perichondrium. The *anterior border* of the arytenoid cartilage is vertical and, at its base, reaches the vocal process.

The **corniculate cartilages** are a pair of small conical nodules of elastic fibro-cartilage; each surmounts the apex of an arytenoid and prolongs its upper, curved end in a postero-medial direction. Each corniculate cartilage is enclosed within the posterior part of the corresponding ary-epiglottic fold of mucous membrane.

The **cuneiform cartilages**, which may be very large, are not always present. They are a pair of rod-shaped pieces of elastic fibro-cartilage, each of which occupies a place in the corresponding ary-epiglottic fold immediately anterior to the arytenoid and corniculate cartilages. On the laryngeal surface of each cartilage a collection of mucous glands stands out in relief under the mucous membrane (Fig. 585).

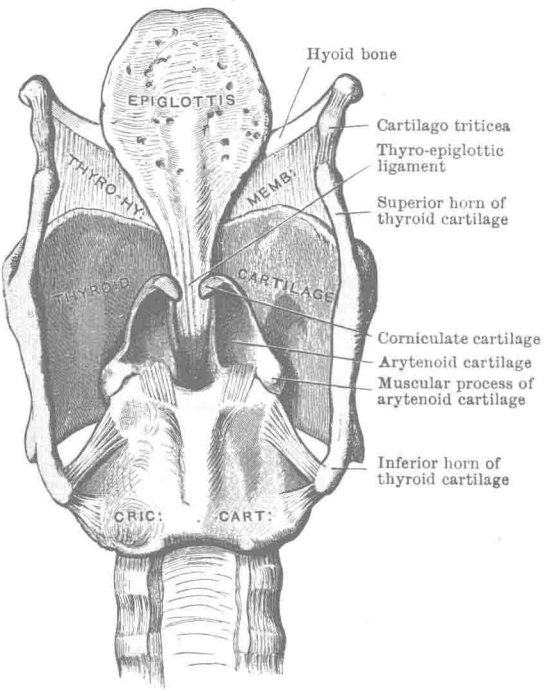

FIG. 581.—POSTERIOR ASPECT OF CARTILAGES AND LIGAMENTS OF LARYNX.

Epiglottis.—The **epiglottis** is supported by a thin, leaf-like lamina of elastic fibro-cartilage, called the **epiglottic cartilage**, which is placed behind the root of the tongue and the body of the hyoid bone, and in front of the aperture of the larynx. When divested of the mucous membrane that covers it behind and also covers its upper part in front, the epiglottic cartilage has the outline of a bicycle-saddle. It is extensively pitted and has numerous foramina. Glands are lodged in the pits; blood-vessels and nerves pass through the foramina. The *broad end* of the epiglottic cartilage is directed upwards, and it is free. Its *margins* are, to a large extent, enclosed within the ary-epiglottic folds. The *anterior surface*, free only in its upper part which is covered with mucous membrane, looks towards the pharyngeal part of the tongue. The *posterior surface*, covered throughout its whole extent by the lining mucous membrane of the laryngeal cavity, looks towards the vestibule of the larynx. The *inferior extremity* or *stalk of the epiglottic cartilage* is pointed and is attached by a strong fibrous band—the thyro-epiglottic ligament—low down on the posterior surface of the thyroid cartilage below the median notch.

Structure and Ossification of Cartilages of Larynx.—The thyroid and cricoid cartilages and the greater part of the arytenoid cartilages are composed of hyaline cartilage. The apical parts and vocal processes of the arytenoid cartilages, and the corniculate, cuneiform and the epiglottic cartilages, are formed of elastic fibro-cartilage, and at no period of life do they exhibit any tendency towards ossific change. The thyroid, cricoid, and basal portions of the arytenoids, as life advances, may be more or less completely transformed into bone and so become visible in radiographs (Pl. LXI, p. 696). This transformation bears no constant relation to age and is already present in some subjects in the third decade. The commonest sites of ossification are the posterior and lower margins of the thyroid and the lamina of the cricoid cartilages; and in old age the thyroid, cricoid, and the hyaline parts of the arytenoids may be completely ossified.

ARTICULATIONS, LIGAMENTS, AND MEMBRANES OF LARYNX

Crico-Thyroid Joints.—These joints are formed by the apposition of the circular facets on the tips of the inferior horns of the thyroid cartilage to the elevated circular facets on the sides of the cricoid cartilage. Each joint has a ligamentous capsule lined with synovial membrane. Among the posterior fibres of the capsule there is a strengthening band. The movement that takes place at the crico-thyroid joints is mainly rotatory, the thyroid cartilage rotating around a transverse axis that passes through the centres of the two joints. Some gliding is possible here, especially in an antero-posterior direction.

Crico-Arytenoid Joints.—Each of these joints has a ligamentous capsule lined with synovial membrane. The cricoid articular surface is convex, whereas that of the arytenoid is concave; both are elongated or elliptical in form, and they are applied to each other so that the long axis of the one intersects or crosses that of the other at an acute angle. In no position of the joint do the two facets accurately coincide—a portion of the cricoid facet is always left uncovered. The capsule of the joint is strengthened behind by a band which, being inserted into the postero-medial part of the base of the arytenoid cartilage, effectually arrests excessive forward movement of that cartilage.

The movements that take place at the crico-arytenoid joints are gliding and rotatory. During easy, quiet breathing the arytenoid rests upon the lateral part of the cricoid facet. It can glide forwards and backwards upon the cricoid facet, and pass towards or from the median plane and its fellow of the opposite side. When it glides forwards the vocal process is tilted downwards towards the cricoid ring, and when it glides backwards it is tilted upwards. In the rotatory movement the arytenoid cartilage revolves around a vertical axis; by this movement the vocal process is swung laterally or medially so as to open or close the rima glottidis.

Between the arytenoid and corniculate cartilages there is a more or less rudimentary joint with a capsule, some fibres of which reach the cricoid cartilage. This joint commonly has no synovial lining.

Thyro-Hyoid Membrane.—This is a broad, membranous, and slightly elastic sheet which occupies the interval between the hyoid bone and the thyroid cartilage. The median part, composed largely of elastic fibres, is thickened to form the **median thyro-hyoid ligament**. This ligament is attached below to the margins of the thyroid notch, and above to the upper border of the body of the hyoid bone. In order to reach the upper border, the ligament ascends behind the body; and between the ligament and the body a *bursa* is interposed. On each side of the median ligament, the thyro-hyoid membrane is thin and loose. It is attached, below, to the upper border of the thyroid cartilage, and, above, to the upper border of the greater horn of the hyoid bone. It is pierced by the internal laryngeal nerve and by the superior laryngeal vessels. On each side the thickened cord-like lateral margin of the membrane, or **lateral thyro-hyoid ligament**, is composed chiefly of elastic fibres. It extends from the tip of the greater horn of the hyoid bone to the tip of the superior horn of the thyroid cartilage. In each lateral ligament the *cartilago triticea*, a small, oval cartilaginous or bony nodule, usually develops (Figs. 579-581).

The median thyro-hyoid ligament lies in front of the epiglottis, from which it is separated by a fatty pad (Fig. 585). The lateral part of the membrane is clothed on its deep aspect with pharyngeal mucosa (Fig. 584).

Crico-Vocal Membrane.—The crico-vocal membrane is attached below to the entire upper border of the arch of the cricoid cartilage from one arytenoid facet to the other. The median part, or **crico-thyroid ligament**, tense, strong, elastic, and of triangular shape, has its apex inserted into the lower border of the thyroid cartilage at the junction of the laminæ. From this attachment the lateral part of the crico-vocal membrane extends backwards to be inserted into the inferior border of the vocal process of the arytenoid cartilage. Between the anterior and posterior attachments the upper border of this part of the crico-vocal membrane is thickened and free and forms the **vocal ligament**—the supporting ligament of the vocal fold.

The crico-thyroid ligament, pierced by minute vessels and crossed by the crico-thyroid branch of the superior thyroid artery, directly unites the cricoid and thyroid cartilages. The lateral part of the membrane narrows the lumen of the larynx; it is clothed on its medial surface with the lining mucosa and on its lateral surface by the lateral crico-arytenoid muscle, which separates it from the thyroid lamina.

The **vocal ligament**, just defined as the upper border of the crico-vocal membrane, is attached in front, close to its fellow of the opposite side, to the middle of the angular depression between the two laminæ of the thyroid cartilage, and behind to the tip and upper border of the vocal process of the arytenoid cartilage. The vocal ligament is composed of elastic fibres, and embedded in its anterior extremity there is, commonly, a minute nodule of elastic fibro-cartilage. Its medial border is sharp and free, and it is clothed with mucous membrane which here is very thin and tightly bound to the ligament.

The **vestibular ligament** supports the vestibular fold. It is weak and indefinite, but is slightly longer than the vocal ligament. In front it is attached to the angular depression between the two laminæ of the thyroid cartilage above the vocal ligament and close to the attachment of the thyro-epiglottic ligament; it extends backwards to its insertion into a tubercle on the antero-lateral surface of the arytenoid cartilage a short distance above the vocal process. It is composed of fibrous and elastic tissue continuous with the areolar tissue in the ary-epiglottic fold, and it is covered with loosely attached mucosa.

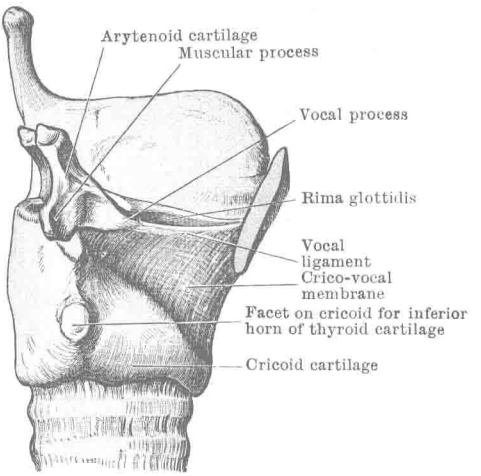

FIG. 582. — DISSECTION TO SHOW CRICO-VOCAL MEMBRANE. The right lamina of the thyroid cartilage has been removed.

The **epiglottis** is bound by ligaments to the base of the tongue, to the wall of the pharynx, to the hyoid bone, and to the thyroid cartilage. The **glosso-epiglottic fold** is a prominent median fold of mucous membrane that extends from the free part of the anterior surface of the epiglottis to the back of the tongue. The **pharyngo-epiglottic folds** are a pair of folds of mucous membrane that pass from the lateral margins of the epiglottis to the lateral walls of the pharynx at the sides of the tongue; they enclose a certain amount of elastic tissue. By these three folds the depression between the back of the tongue and the epiglottis is marked off into a pair of fossæ, termed the **epiglottic valleculæ**, which are invariably filled in swallowing soft, semi-solid masses of food. It is, therefore, in them that foreign bodies, such as small fish-bones, should first be sought. A pair of **ary-epiglottic folds** also pass from the lateral margins of the epiglottis to the arytenoid cartilages. These very prominent folds of mucous membrane extend backwards and downwards and help to form the rim of the laryngeal inlet (Fig. 583). Between the ary-epiglottic fold and the lamina of the thyroid cartilage is the lateral food-gutter in which the opaque shadow of barium can be clearly seen on X-ray examination during the act of swallowing (Pl. LXIV, Fig. 1, p. 697).

The **hyo-epiglottic ligament** is a short, broad elastic band, partly broken up by adipose tissue, that connects the anterior surface of the epiglottic cartilage to the upper border of the hyoid bone (Fig. 585). The **thyro-epiglottic ligament** is strong and thick, and is composed mainly of elastic tissue; it extends downwards from the stalk of the epiglottic cartilage to be attached to the angle between the two laminæ of the thyroid cartilage below the median notch (Fig. 581).

The triangular interval between the anterior surface of the epiglottis and the median thyro-hyoid ligament is imperfectly closed above by the hyo-epiglottic ligament and contains a pad of soft fat (Fig. 585).

CAVITY OF LARYNX

The **cavity of the larynx** is smaller than might be expected from an inspection of the exterior of the larynx. It is divided into three portions by two horizontal folds of mucous membrane that project medially from each lateral wall of the cavity. The upper pair of folds are the **vestibular folds**; the lower, more definite pair are the **vocal folds** (Figs. 583, 584, 585). By controlling the exhalation of air, the vocal folds are of significance in voice-production. Changes in their relative position and in their tension are brought about by the action of muscles and by the recoil of elastic ligaments.

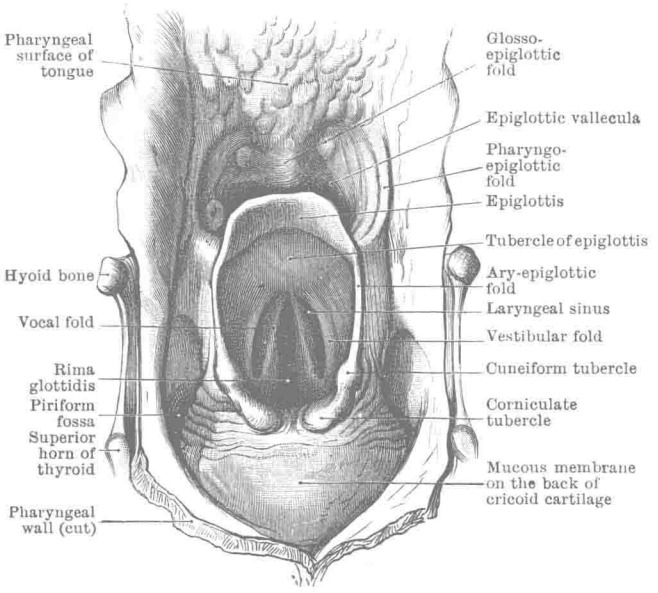

FIG. 583.—LARYNGEAL INLET, EXPOSED BY REMOVAL OF POSTERIOR WALL OF PHARYNX AND VIEWED FROM ABOVE.

The **inlet of the larynx** opens off the pharynx, is obliquely set, and is more or less triangular in outline. The base of the triangle is anterior and is formed by the free border of the epiglottis. The apex is lower than the base and lies in the interval between the two arytenoid cartilages. The sides are formed by the **ary-epiglottic folds**. The two layers of mucous membrane that compose the ary-epiglottic folds enclose some areolar tissue, sphincteric muscle-fibres belonging to the ary-epiglottic muscles, and, posteriorly, the cuneiform and corniculate cartilages. These cartilages produce rounded prominences on the fold called the *cuneiform* and *corniculate tubercles*. When the ary-epiglottic sphincter is in action, these tubercles are approximated to the epiglottic tubercle and so assist it to complete the closure of the laryngeal inlet.

On each side of the laryngeal inlet there is a small pocket of the pharynx termed the **piriform fossa**. This fossa is part of the lateral food-gutter that leads from the oral pharynx, behind the tongue, and round the laryngeal inlet to the entrance of the gullet (Fig. 583; Pl. LXIV, Fig. 1, p. 697). Foreign bodies may be caught in this pocket. It is bounded on the medial side by the arytenoid cartilage and the ary-epiglottic fold, and on the lateral side by the thyroid lamina and thyro-hyoid membrane. Stretching across the anterior border of the fossa in a fold of mucous membrane is the internal laryngeal nerve.

The **vestibule of the larynx** is the **uppermost compartment** of the laryngeal cavity. It extends from the laryngeal inlet to the vestibular folds. Its inferior part is compressed from side to side, hence its width diminishes from above downwards, and, owing to the obliquity of the laryngeal inlet, its vertical height is less behind than in front. *In front* it is bounded by the posterior surface of the epiglottis. Its upper part is shaped like the spout of a jug, being concave from side to side and convex from above downwards; its lower part is concave and it tapers towards the anterior ends of the vestibular folds, but above these there is a marked swelling, called the **tubercle of the epiglottis**, which overlies the upper part of the thyro-epiglottic ligament. Each *side-wall* of the vestibule of the larynx is formed by the ary-epiglottic fold. For the most part it is smooth and slightly concave. Posteriorly it diminishes considerably in vertical depth where the cuneiform and corniculate elevations appear—the latter behind the former (Figs. 583, 585). The *posterior wall* of the

laryngeal vestibule corresponds to the interval between the upper parts of the arytenoid cartilages. Its width depends largely on the position of these cartilages; when they are placed near each other the loose mucous membrane that covers the posterior wall is thrown into longitudinal folds.

The **middle compartment of the larynx,** much the smallest of the three, is the space between the level of the vestibular folds above and that of the vocal folds below (Figs. 584, 585). Each side-wall of this compartment, called the *sinus of the larynx,* bulges laterally in the shape of a canoe laid on its side, undercutting the vestibular fold more than the vocal fold. The *saccule of the larynx* opens by a slit-like mouth into the anterior part of the sinus. The saccule is a diverticulum of mucous membrane that extends upwards between the vestibular

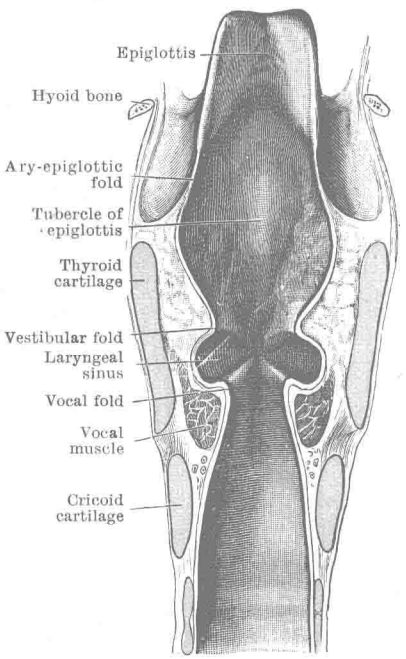

FIG. 584.—CORONAL SECTION THROUGH LARYNX TO SHOW ITS COMPARTMENTS.

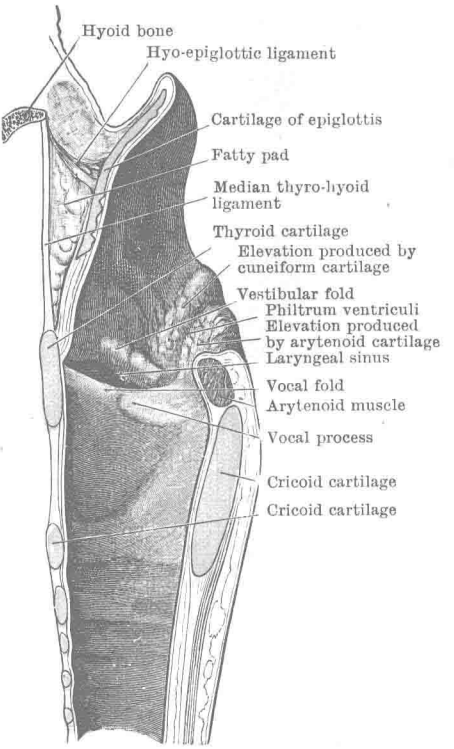

FIG. 585.—MEDIAN SECTION THROUGH LARYNX TO SHOW SIDE-WALL OF ITS RIGHT HALF.

fold medially and the thyro-arytenoid muscle laterally. It ends blindly, usually at the upper border of the thyroid cartilage, but it may protrude outwards through the thyro-hyoid membrane. The laryngeal saccule is very much larger in many of the Primates, and it may attain an enormous size in the great apes and extend even into the axilla (Negus, 1929, 1949; Brash, 1947).

The **vestibular folds** or "false vocal cords" are two prominent folds of mucous membrane that extenp antero-posteriorly, one on each side-wall of the laryngeal cavity. In front they reach the angle between the two laminæ of the thyroid cartilage, but behind they do not extend so far as the posterior wall of the larynx; each ends at the lower end of the elongated elevation produced by the cuneiform cartilage. The vestibular fold is soft and rather flaccid, and it presents a free border which is slightly arched—the concavity looking downwards. Deep to the mucosa of that fold there are: (1) the vestibular ligament; (2) numerous glands which are chiefly aggregated in its middle part; and (3) a few muscle-fibres.

The interval between the two vestibular folds is termed the **rima vestibuli** and is considerably wider than the interval between the two vocal folds. It follows that when the cavity of the larynx is examined from above, with the laryngoscope, all four folds are distinctly visible (Fig. 591).