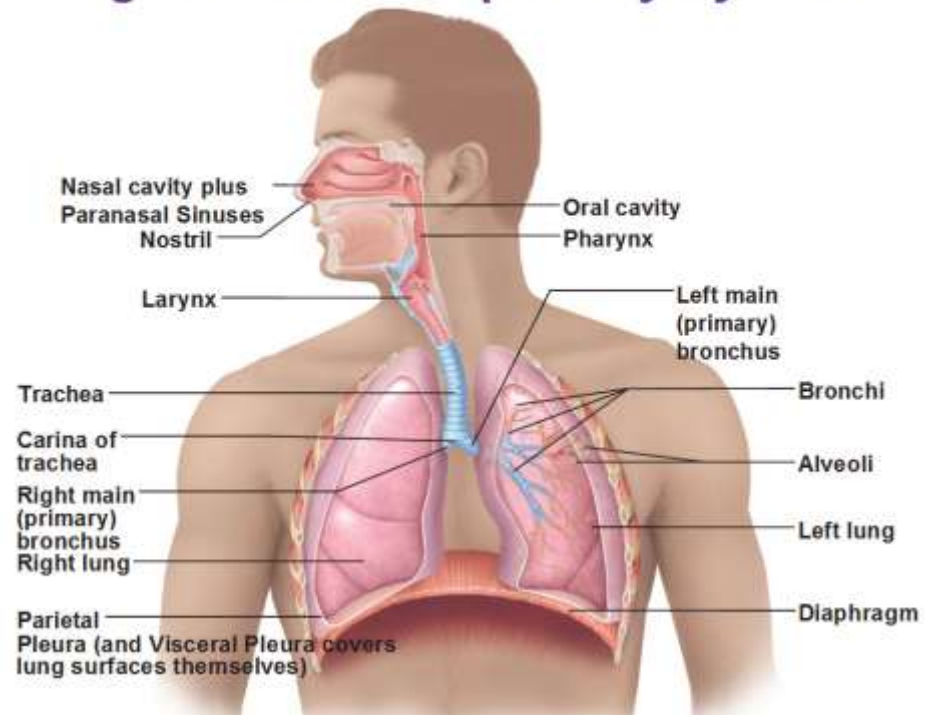


The Respiratory System

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Organs of the Respiratory System



Divisions of the Respiratory System

- **Structurally:** (according to embryological origin) part or structure that share in the embryological origin?
□ Upper respiratory system → mainly formed from conchae and tunic
■ Nose, pharynx and associated structures
□ Lower respiratory system
■ Larynx, trachea, bronchi and lungs
لـ نفس قصير تطور الجنين
- **Functionally:** → according to structure
□ Conducting zone – conducts air → structure delivery air
■ Nose, pharynx, larynx, trachea, bronchi, bronchioles and terminal bronchioles
↳ primary, secondary, tertiary
□ Respiratory zone – site of gas exchange → after end terminal bronchioles
■ Respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli
↳ the site that happen gas exchange

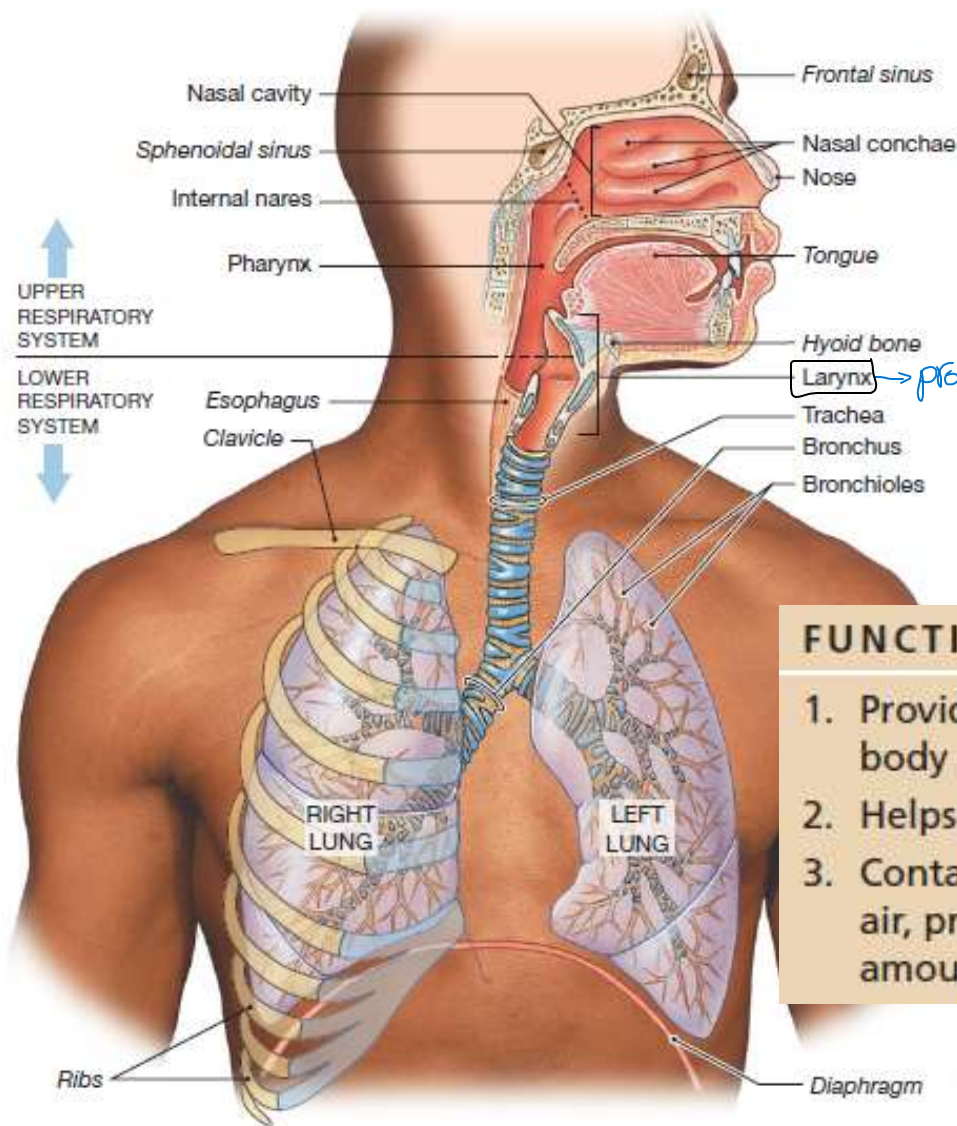


Fig.1: The respiratory system.

FUNCTIONS → respiratory system

1. Provides for gas exchange — intake of O_2 for delivery to body cells and removal of CO_2 produced by body cells. (Main Function) → by alveoli
2. Helps regulate blood pH.
3. Contains receptors for the sense of smell, filters inspired air, produces sounds (phonation), and excretes small amounts of water and heat. → regulate heat and water inside the body

The Nose → divide to external and internal nose

- Consists of the External nose and Internal nose.

- External nose – portion visible on face لے کر شے

- Formed of a ^① small bony part – the nasal bones (bridge of the nose) → two bone followed to ficial bone
- and a ^② larger cartilaginous part.
- ^③ All covered by muscles and skin. → bone and cartilage

- Its ^④ openings → two? are called the external nares or nostrils. → present in the end external nose

- The area just inside the nostrils is called the ^⑤ vestibule. Its lower half is lined by skin. → inside nostrils and part from nasal cavity
→ anterior part

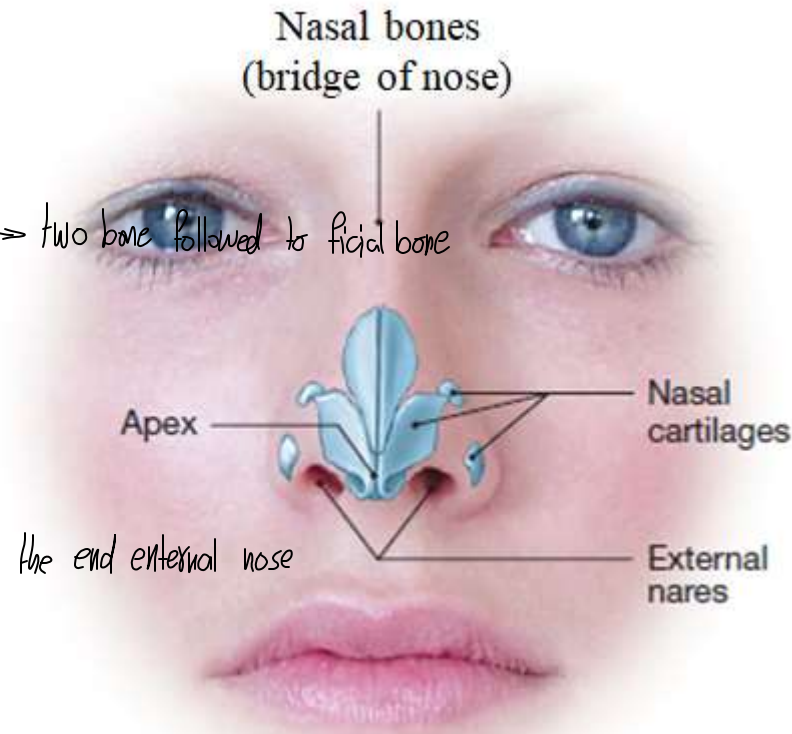


Fig.2: The external nose.

nasal septum composed from three parts:- ① superior part (perpendicular plate followed to ethmoid bone)
 ② inferior part (vomer bone) → posterior part
 ③ anterior part (cartilage)

- **Internal nose** – large cavity beyond the vestibule mostly lined by respiratory epithelium.
 - ↳ posterior
 - ↳ area inside nostrils

↳ because contain sudo-stratified column ciliated

- Extends from vestibule to the internal nares or choanae.

↳ beginning the pharynx

- Nasal cavity divided by nasal septum.

→ divide the nasal cavity to left and right
 function to the conchae?

The lateral surface of nose composed from superior and middle conchae that followed ethmoid bone

⇐ The lateral wall has projections that increase the surface area called conchae. Between these conchae and the

lateral wall are small passages called meatuses.

→ superior, middle, inferior

- Ducts from paranasal sinuses and nasolacrimal ducts

open into the meatuses of the internal nose.

→ part from lacrimal apparatus

↳ followed to facial bone

- Olfactory epithelium responsible for the sense of smell

lines the roof of the nasal cavity.

→ superior part of nasal cavity contain olfactory senses

↔ but ↔

↳ part from special senses

⇒ the part of the internal nose? ① anteriorly vestibules ② posteriorly internal nares (choanae) ③ laterally conchae (between lateral wall and conchae is meatuses)
 ④ nasal septum separate between left and right nasal cavity

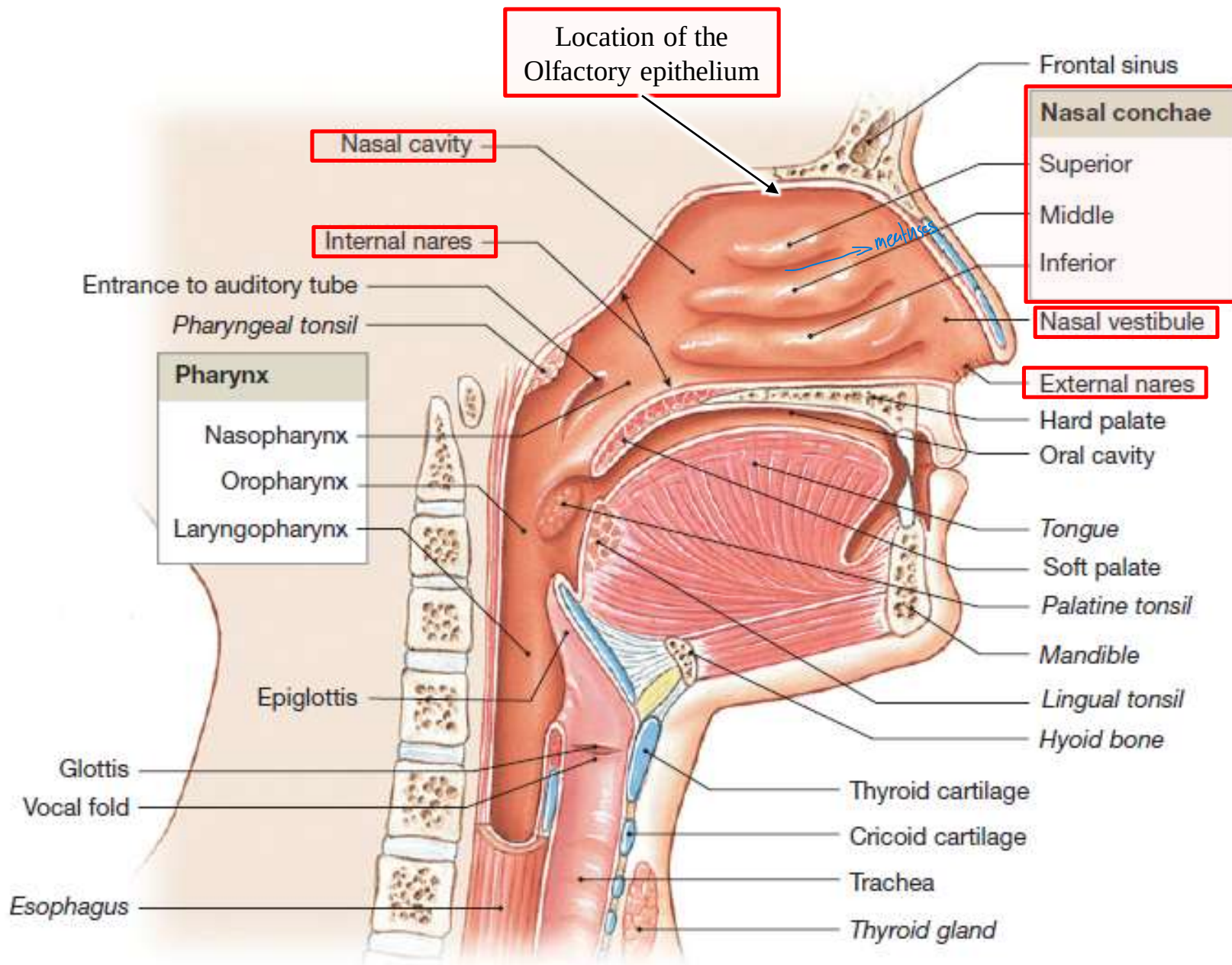


Fig.3: The internal nose (pink boxes).

Functions of the nose:

1. Warms air coming through the nose due to the rich capillaries of the mucosa of the nose.
2. Moistens incoming air by the mucus secreted by goblet cells of the mucosa.
3. Traps and removes dust particles by cilia and hair.
4. Affects quality of voice.
5. Olfactory epithelium responsible for the sense of smell.

The Pharynx

بالحوم → extend from internal nares (choanae) (end the internal nose) to cricoid cartilage (part of larynx)

→ in the end of inferior larynx
→ ring shaped cartilage

- **Funnel shaped** tube that starts at internal nares and extends to the level of the cricoid cartilage of larynx (**C6 vertebra**).
↪ cervical vertebra number 6 → the cricoid at the same level
- **Contraction of skeletal muscles assists in swallowing.**
بلع
- **Functions**

- Passageway for air and food → direct to oropharynx
- Resonating chamber → result of movement vocal cord inside larynx
- Houses tonsils → three type of tonsile

- **3 anatomical regions** → three part to pharynx

- Nasopharynx → تمرير الهواء
- Oropharynx → تمرير الهواء والغذاء
- Laryngopharynx

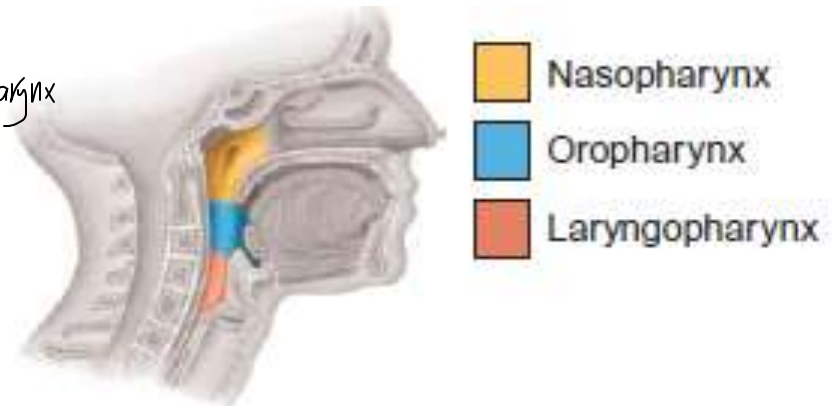


Fig.4: Regions of the pharynx.

The Nasopharynx

→ the first part of pharynx → extend from nasal cavity (internal nares) to oropharynx (end of oral cavity)

- Located **posterior** to the nasal cavities and **above the soft palate** → end the palatine bone posteriorly not bony and **inferiorly** opens into the oropharynx. It's a **passageway for air**. → Function? → Just

- Its lateral walls exhibit the **opening of the auditory (Eustachian) tubes**. → extend from middle ear, to maintain the pressure → laterally

- The posterior wall of the nasopharynx has a collection of **lymphoid tissue** called the **pharyngeal Tonsil (adenoid)**. → the first type from tonsil (posteriorly) ← ٢١٤٤

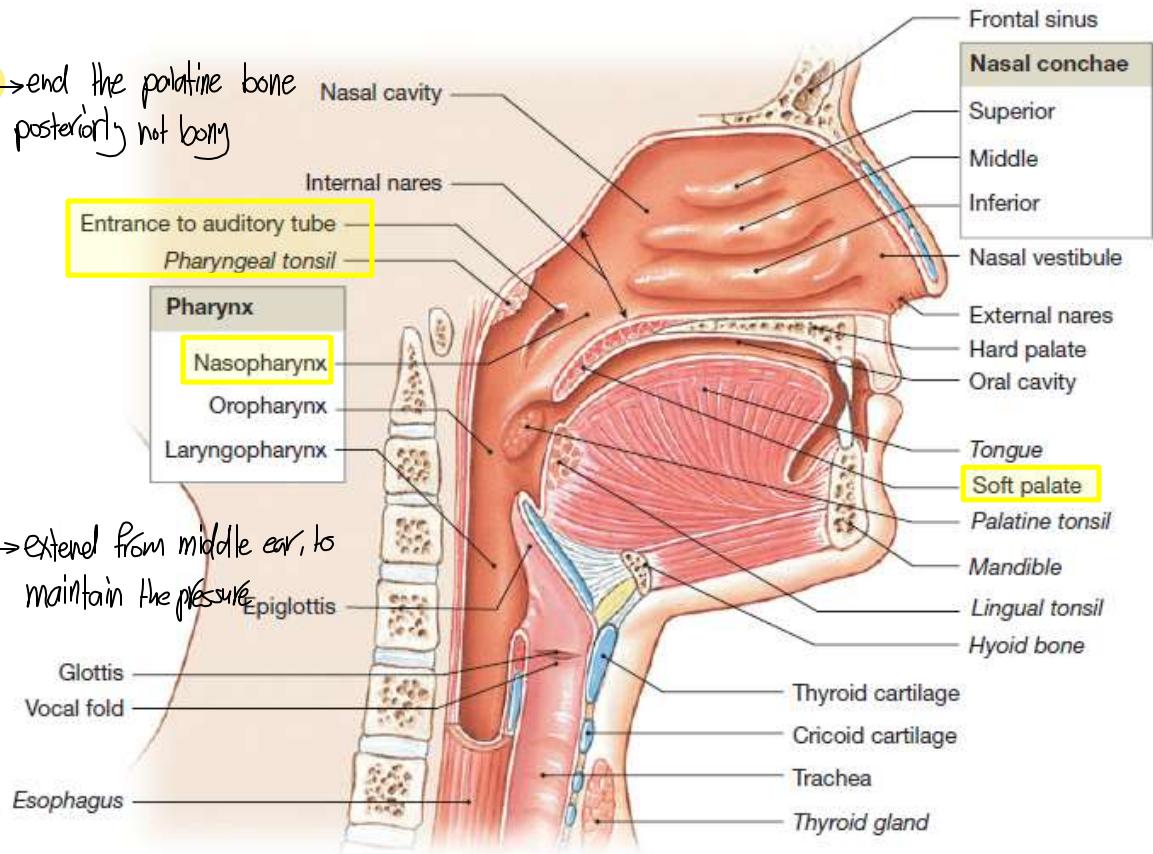


Fig.5: The nasopharynx (yellow boxes).

⇒ three type from tonsil? → four tonsil as a number
 ① pharyngeal tonsil (adenoid) ② lingual tonsil ③ two palatine tonsil

The Oropharynx → the second part of pharynx

- Located **posterior to the oral cavity** with which it communicates. It allows passage of both air and food. Inferiorly, it extends to the level of the **hyoid bone**. → only bone not articulate with any bone
- Anteriorly, in the posterior aspect of the tongue, there's the **lingual tonsil**. Anterolaterally, we have the **two palatine tonsils**. → when extending the tongue you will see them.

The Laryngopharynx → the third part from pharynx → extend from end of oropharynx (hyoid bone) to cricoid cartilage (the same level to cervical vertebrae)

- Located **posterior to the larynx** with which it communicates. It begins at the level of the hyoid bone and ends at the level of the cricoid cartilage (C6) where it becomes **continuous with esophagus**.

→ and beginning the trachea and esophagus. ← حركة الأكل نتيجة انقباض عضلات البلعوم

- Muscles of the pharynx play a part in the process of **deglutition**. These muscles are **supplied by** the pharyngeal plexus derived from the glossopharyngeal (IX) and vagus (X) nerves followed the cranial nerve.

→ 9

→ 10

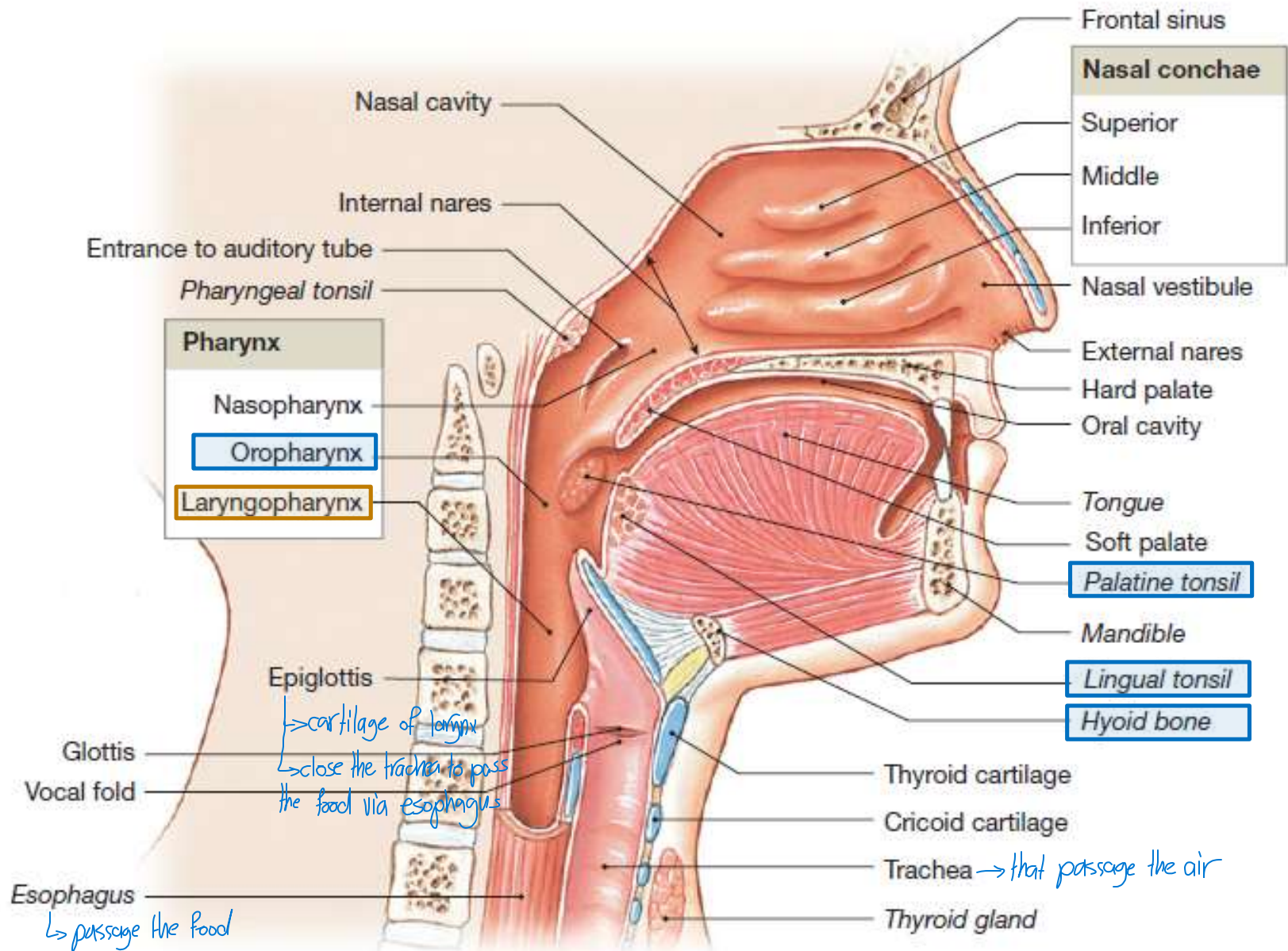


Fig.6: The oropharynx (blue boxes) and the laryngopharynx (brown box).

The Larynx → الحنجرة

- Short ^(canal) passageway connecting laryngopharynx with trachea that's responsible for the production of sound. Its inlet also provides a protective cover for the airway passages.
 ↳ vibration to the vocal voice
 ↳ not allow the food to passage to the lungs
- It lies in the midline of the neck opposite C4-C6 vertebrae. At the level of C6, it becomes continuous with the trachea. and esophagus posteriorly
- The larynx is formed of cartilages ^{→ six type} held together by ligaments and membranes and moved by muscles.
 ↳ specific (certain type of muscle)

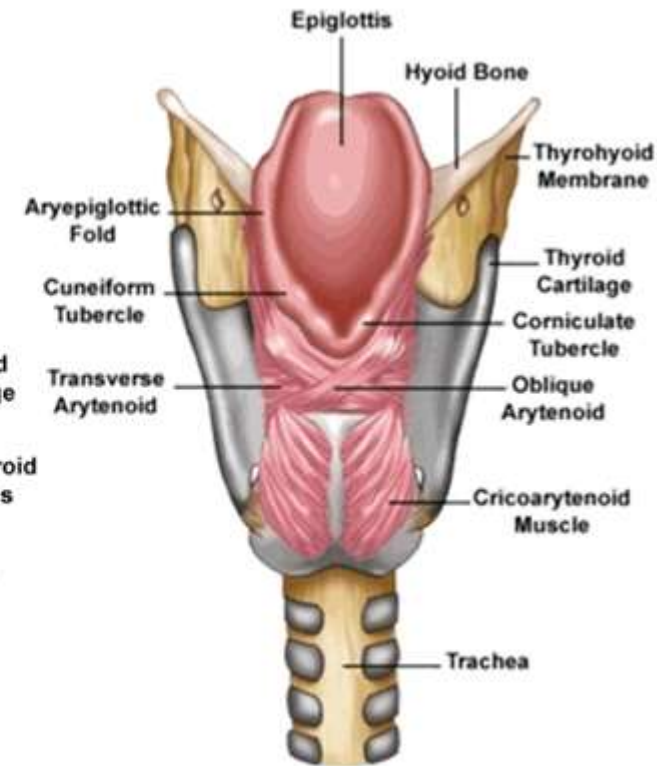
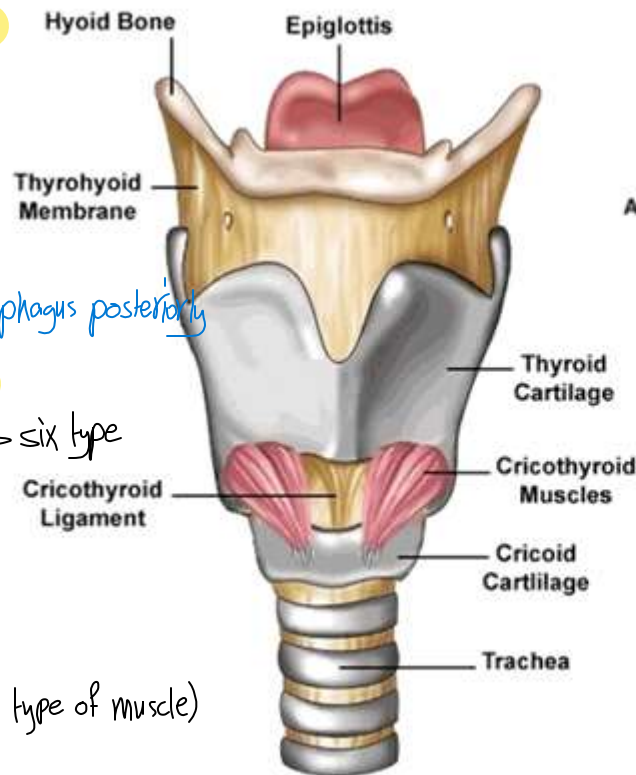


Fig.7: Structure of the larynx. Left, anterior view. Right, posterior views.

Cartilages of the Larynx → six types (three single, three pair) → nine as number

1. **Thyroid:** single V-shaped cartilage. → (تقافة آدم) → common carotid when arrive to thyroid divided into external and internal carotid.
The largest and forms prominence of the neck called Adam's Apple.
→ thyroid gland extend superiorly from thyroid cartilage of the larynx to the ring five of trachea.
2. **Cricoid:** a single ring shaped cartilage. The lower boundary of the larynx. → end laryngopharynx and beginning of the trachea.
3. **Epiglottis:** a leaf-shaped single cartilage that's present at the inlet of the larynx. Closes the larynx when the person swallows. → to prevent the food to pass in the larynx.
4. **Arytenoid:** a pair of pyramidal cartilages to which the vocal cords are attached. Movement of these cartilages leads to movement of the cords. → vibration → production voice.
5. **Corniculate** cartilages (pair).
6. **Cuneiform** cartilages (pair).

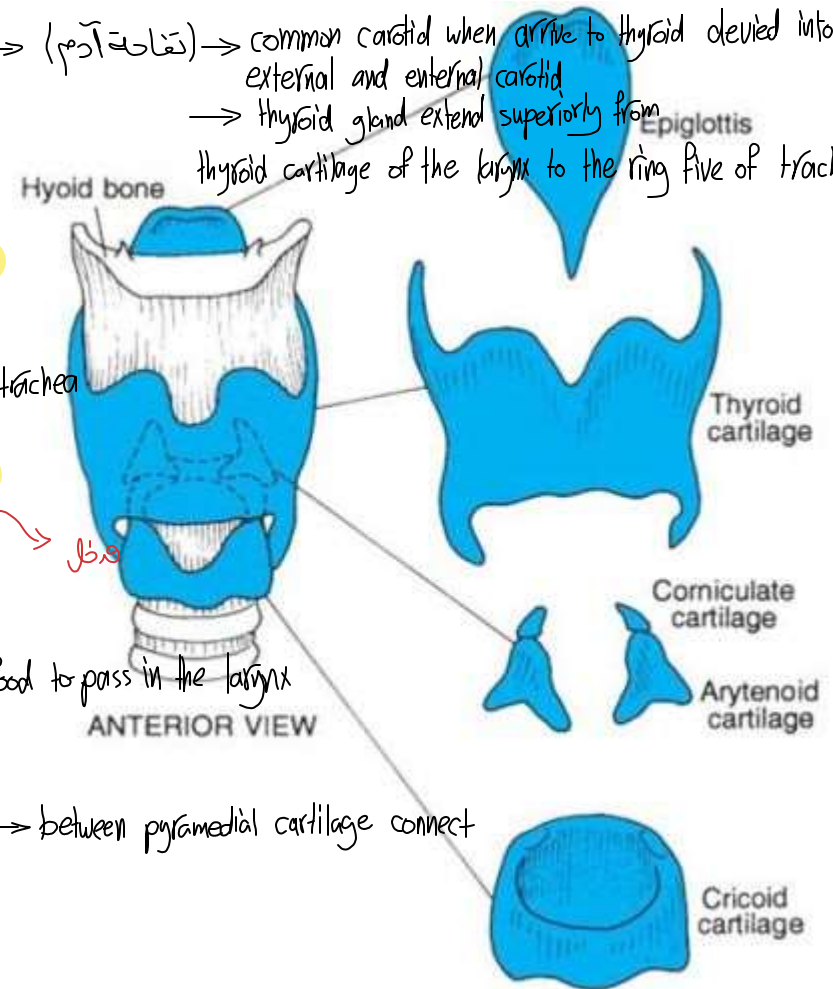


Fig.8: Cartilages of the larynx.

Structures of Sound Production

- Mucous membrane of larynx forms 2 folds:
 - **Vestibular folds** (false vocal cords) – superior pair
 - Function in holding breath.
 - **Vocal folds** (true vocal cords) – inferior pair
 - Contain elastic tissue.
 - Muscle contraction pulls elastic ligaments which stretch vocal folds.
 - Passing air vibrates the cords and produces sound.
 - Folds can move apart or together, elongate or shorten.
 - Muscles of the larynx are Intrinsic or Extrinsic. The intrinsic muscles are supplied by branches of the vagus (X) nerve.

The Trachea

→ قصبه هوائية → extend from cricoid cartilage of larynx at the level C6 to thoracic 5

- A Tubular passage of air that extends from the larynx to superior border of T5 where it divides into right and left primary bronchi. Between the two primary bronchi there's an angle called *carina*.
→ the site that the trachea divide into left and right primary bronchi
- 16-20 C-shaped hyaline cartilages are found in the wall to keep the trachea patent.
→ between two primary bronchi
→ close part anteriorly, open part posteriorly toward esophagus
- The open part of the C faces posteriorly towards the esophagus.
- The opening of the C is bridged by fibromuscular membrane for the elastic fibers of the smooth muscle trachealis.

The Bronchial Tree → branched in the lung

- Right and left primary bronchi pass to the corresponding lung.
 - right lung
 - left lung

- Divide to form bronchial tree:

- ① Secondary lobar bronchi → the primary bronchi in the beginning when enter the lung (one for each lobe),
- ② tertiary (segmental) bronchi → result divide secondary lobar bronchi,
- ③ bronchioles, → result divide segmental terminal bronchioles

- Structural changes with branching:

- Changes in the epithelium. → type
- Cartilage decreases. As it decreases, smooth muscle increases.

- Terminal bronchioles will form Respiratory bronchioles. At this point gas exchange begins to occur.

→ alveolar ducts → alveolar sacs → alveoli

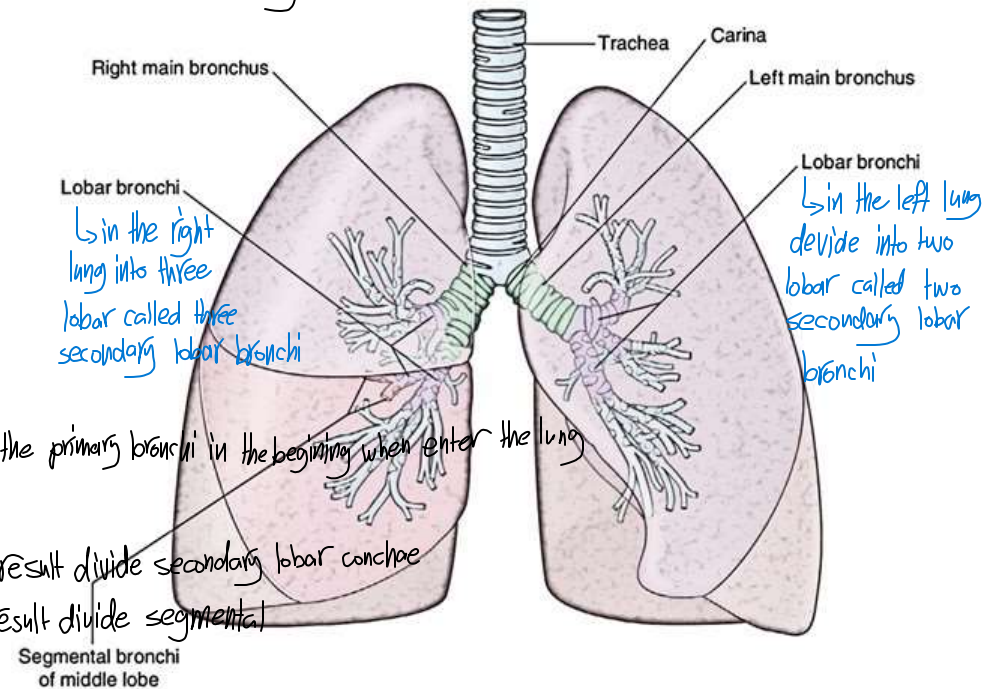


Fig.11: The bronchial tree.

The Lungs → two lung left and right → main function gas exchange

- Two cone shaped organs separated from each other by the heart and other structures in the mediastinum.
- Each lung is enclosed by the double-layered **pleura** (serous membrane): **Parietal pleura** (lines wall of thoracic cavity) and **visceral pleura** (covers the lungs). A space between them called the **pleural cavity** contains pleural fluid to reduces friction. → membrane surround each lungs, → function the fluid
- Lungs receive (1) deoxygenated blood from the pulmonary artery → from pulmonary trunk and (2) oxygenated blood from bronchial branches of the aorta. → from right ventricle
- The right lung is formed of three lobes; whereas, the left lung is formed of two. The left lung also has a **cardiac notch** in which the heart is situated. → depression to inside located inferomedially in the left lung within the heart is situated.

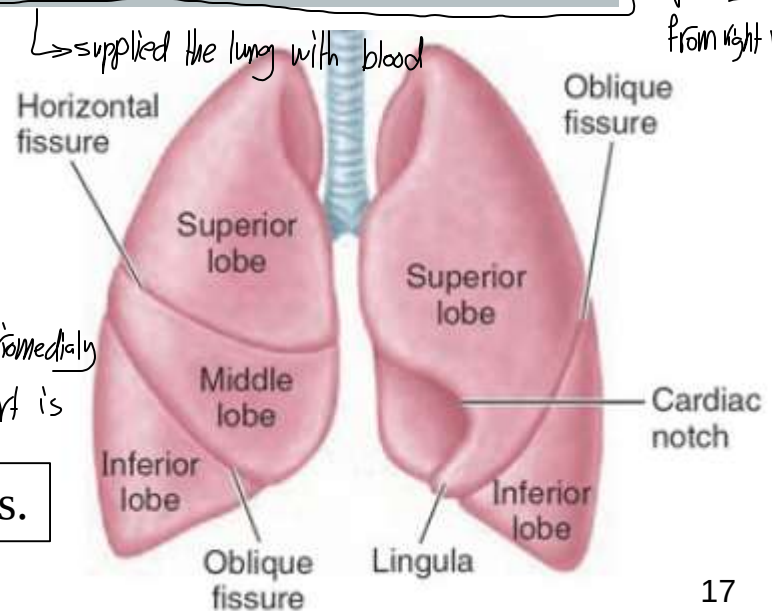


Fig.12: The lungs.

Alveoli

- Cup-shaped outpouching
- Alveolar cells:
 - Type I alveolar cells (simple squamous) — main site of gas exchange.
 → one *→ function*
 - Type II alveolar cells — secrete surfactant factor which reduces tendency to collapse.
 → two *→ function?* *→ to prevent alveoli to close themselves*
 - Macrophages
- **Respiratory membrane:** a very thin cellular membrane *→ function?* separating air from blood and ^① across which gas exchange occurs: *⇒ composed from four main structure?*
 - Alveolar wall – type I alveolar cells *→ because it's on the gas exchange*
 - Epithelium basement membrane
 - Capillary basement membrane
 - Capillary endothelium

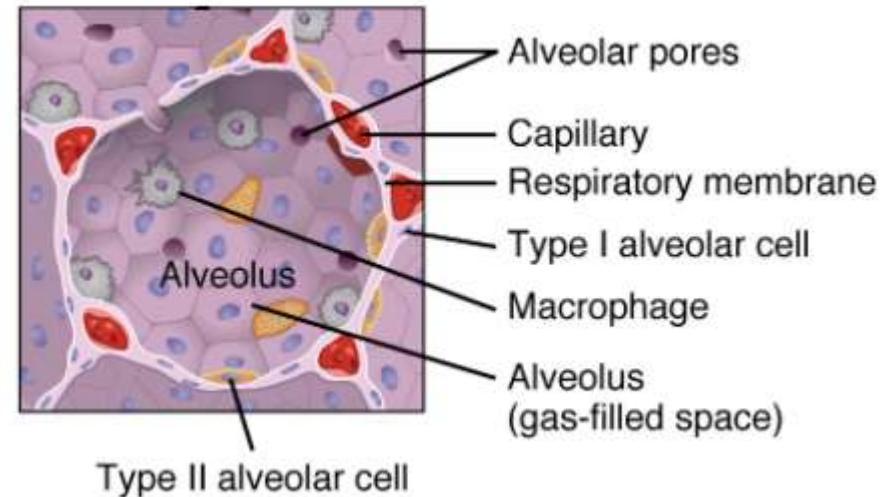


Fig.13: Above, alveolar cells.
Below, the respiratory membrane.

