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Special thanks to:-

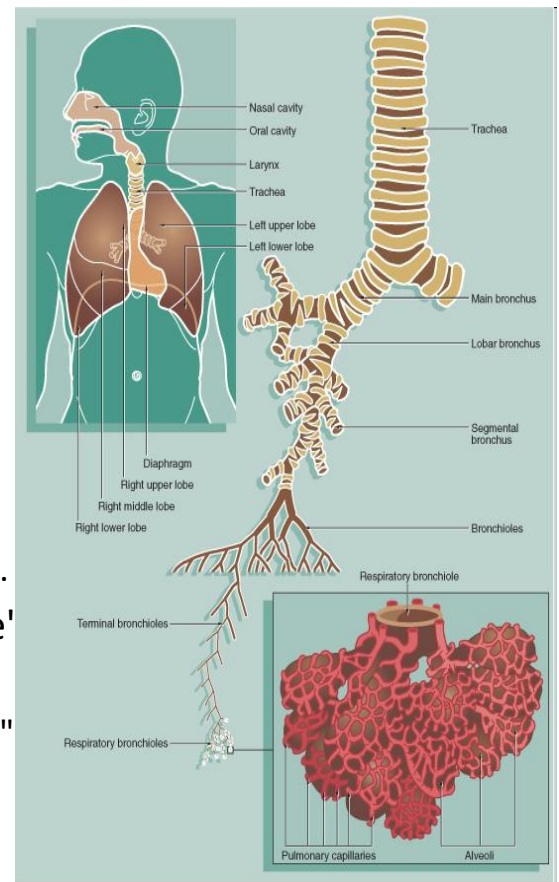
Histics team 428

PART NINE:

RESPIRATORY SYSTEM 1

Overview

- **Conducting Portion** formed of:
 - Nasal cavity
 - Nasopharynx
 - Larynx
 - Trachea
 - Primary bronchi "out of the lung".
We call it extra pulmonary bronchi.
 - Intrapulmonary bronchi:-
 - Secondary bronchi (lobar bronchi)
 - Tertiary bronchi (segmental bronchi)
 - Primary bronchioles "preterminal bronchioles".
 - Terminal bronchiole "secondary bronchiole"
- **Respiratory Portion** formed of:
 - Respiratory bronchioles "tertiary bronchiole"
 - Alveolar ducts
 - Alveolar sacs
 - Pulmonary alveoli.



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Notes

Function of Conducting Portion are Transports, filters, moistens and warms inspired air, humidification.

Function of Respiratory Portion Sites of gas exchange.

Nasal cavity

Divided by **nasal septum** into two halves.
Each half consists of:

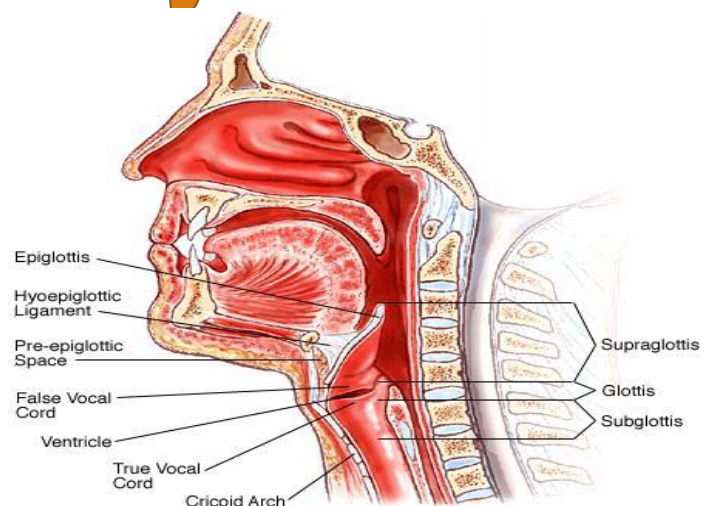
1- Anterior portion (vestibule).

Lining: is lined with thin skin

- A. Epidermis (Keratinized stratified Squamous epithelium).
- B. Dermis.

Contents:

- 1- **Vibrissae:** stiff hairs.



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- 2- Sebaceous glands.
- 3- Sweat glands.

Wall:

- 1- Hyaline cartilage.
- 2- Cancellous (spongy) bone.

2- Posterior portion (nasal fossae):-**A- Respiratory portion (area) of nasal cavity [Mucosa (mucous membrane)]:**

- 1- **Epithelium:** Pseudo-stratified ciliated columnar epithelium with **goblet cells** (Respiratory epithelium).
- 2- **Lamina propria (Subepithelial Connective Tissue):** contains:
 - Large arterial plexuses & venous sinuses (Highly vascularized Connective Tissue).
 - Many seromucous glands (acini).
 - Axons of olfactory nerve cells + Schwann cells.
 - Abundant lymphoid elements: Including occasional lymphoid nodules, plasma cells & mast cells.

B- Olfactory portion (area) of nasal cavity: “olfactory mucosa”**Site:**

- 1- Roof of nasal cavity.
- 2- Upper part of nasal septum.
- 3- over superior concha.

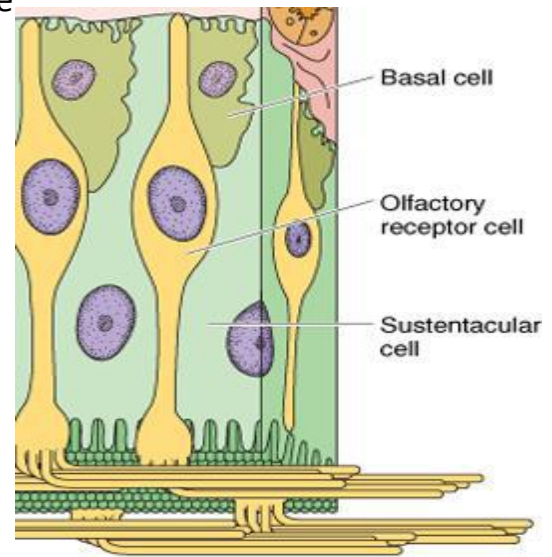
Structure:

- **Olfactory epithelium:** Pseudo-stratified columnar epithelium.
 - 1- **Olfactory cells** (olfactory nerve cells)
 - 2- **Sustentacular** (supporting) **cells.**
 - 3- **Basal cells.**
 - **Lamina propria:** contains:
 - 1- Highly (richly) vascularized loose to dense Connective Tissue.
 - 2- Contents:
 - Bowman’s glands (olfactory glands) : are serous acini.
 - Bundles of unmyelinated nerve fibers:
- Are axons of olfactory nerve cells + Schwann-like cells (glial cells).
- Rich vascular plexus.
 - Numerous lymphoid elements.

Olfactory Epithelium:

1- Olfactory cells:

- Are *bipolar neurons*, dendrite has olfactory vesicle
- Olfactory vesicle has 6-8 olfactory cilia and olfactory cilia are *nonmotile*. Microtubules of olfactory cilia: (9x2+2x1 then 9x1+2x1).
- Cell body with spherical nucleus.
- Axons are unmyelinated with Schwann cell-like olfactory ensheathing cells (glial cells).
- Axons penetrate the basal lamina.
- Axons will collect in the lamina propria to form bundles of nerve fibers.
- Bundles will collect to form the olfactory nerve.

**2- Sustentacular (supporting) cells:**

- Are columnar cells with:
- Apical striated border (microvilli).
- Oval Nucleus, in the upper third.
- Apical cytoplasm has secretory granules with yellow pigments.
- Have junctional complexes with olfactory Vesicles and other sustentacular cells.

- **Function:**

Physical support, nourishment & electrical insulation for olfactory cells.

3- Basal cells:

- **Horizontal cells:** Flat cells, lie against the B.M.

Function: Replicate to replace globose cells.

- **Globose cells:**

Short basophilic pyramidal cells.

Whose apical aspects do NOT reach the epithelial surface.

Function: Proliferate to replace both sustentacular & olfactory cells.

Paranasal sinuses: Lining:

1- Respiratory epithelium. 2- Lamina propria.

Clinical application: "Sinusitis".

Notes

Portion part composed from Contains 3 bony concha (each fossa): Superior, Middle, and Inferior Olfactory cell called olfactory nerve cells and connected to supporting cells by junctional complexes. Mucoperiosteum-lined spaces in sphenoid, frontal and maxilla bones and they communicate with the nasal cavity and have same lining. Anterior part of the nasal septum is hyaline cartilage Posterior part of the nasal septum is spongy bone

Larynx

The larynx contains:

(A) Mucosa:

1- Epithelium: (2 types)

a- Respiratory epithelium: Pseudostratified ciliated columnar epithelium with goblet cells.

b- Non keratinized stratified squamous epithelium: found in:

- Vocal folds.
- Superior surface of epiglottis

2- Lamina propria.

- There are 2 pairs of shelf-like mucosal folds:

1- Vestibular folds: "immovable":

L/M:

a- Respiratory epithelium.

b- Lamina propria:

Loose Connective Tissue . with seromucous glands
Lymphoid elements & adipose cells.

2- vocal folds (cords): have:

a- Epithelium: non keratinized stratified squamous.

b- Lamina propria.

c- **Vocal ligament:** bundles of parallel elastic fibers (dense regular elastic Connective Tissue).

b- **Vocal muscle:** Skeletal muscle.

N.B. No lymphoid nodules, No seromucous glands.

(B) Cartilages:

1- Hyaline cartilages:

Thyroid, cricoid, body of arytenoids.

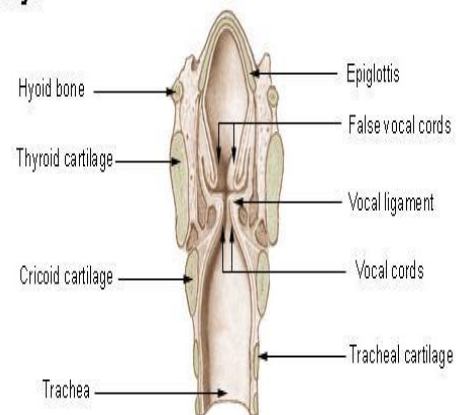
2- Elastic cartilages:

Epiglottis, corniculate, cuneiform, tips of arytenoids.

(C) Extrinsic and intrinsic muscles: all are skeletal.

(D) Ligaments.

Larynx



Trachea

The wall of trachea is formed of:

(A) Mucosa of trachea:

(1) Epithelium: Respiratory epithelium:

Pseudostratified ciliated columnar epithelium with goblet cells.

(2) Lamina propria:

Loose, fibroelastic C.T. containing:

- a- Lymphoid elements (e.g. lymphoid nodules & lymphocytes).
- b- Mucous & seromucous glands.

(3) Elastic lamina:

Dense layer (thick bundle) of elastic fibers.

It separates lamina propria from submucosa.

N.B. Mucosa is non-folded except posteriorly.

(B) Submucosa of trachea:

Contents:

- 1- Dense irregular fibroelastic Connective Tissue .
- 2- Numerous mucous & seromucous glands.
- 3- Lymphoid elements.
- 4- Rich blood & lymph supply.

N.B. Other textbooks reported that submucosa of trachea is loose Connective Tissue .

(C) Adventitia of trachea:

Contents:

- 1- Fibroelastic C.T.
- 2- C-shaped rings (10-12) of hyaline cartilage.

Trachealis muscle (bundle of SMF) connects the open ends of each C-shaped ring of cartilage.

Perichondrium of C-shaped rings of hyaline cartilage are connected together by dense fibroelastic Connective Tissue.

Respiratory epithelium:

“Pseudostratified ciliated columnar epithelium with **goblet cells**”

6 types of cells (all touch the basement membrane)

Types of cells:

- (1) Goblet cells (30%):** Produce mucinogen → hydrated→ mucin.
- (2) Ciliated columnar cells (30%).**
- (3) Basal cells(30%):**

Short cells, rest on the B.M., Do not reach the lumen.

Function: stem cells (proliferate to replace other cell types).

- (4) Brush cells (3%):**

Have microvilli.

Function: are sensory receptors or degranulated goblet cells.

(5) **Serous cells (3%):** secrete serous fluid.

(6) **DNES cells (K cells) (3-4%):**

Are neuroendocrine cells.

Contains basal secretory granules.

Amines, Peptides, Acetylcholine, ATP.

Notes

The two ends of C shaped of the trachea connected by smooth muscle

mucosa of trachea is nonfolded exceptt in the posterior part