

# Respiratory system

By:

Dr. Raja Ali

## Overview of Respiratory System:

### Nasal Cavity:

- Vestibule of the Nasal Cavity.
- Respiratory Region of the Nasal Cavity .
- Olfactory Region of the Nasal Cavity .
- Paranasal Sinuses .

### Pharynx.

### Larynx.

### Trachea .

- Mucosa.
- Submucosa.
- Fibrocartiligenous coat.
- Advantitia.

### Bronchi.

### Bronchioles.

### Bronchiolar Structure .

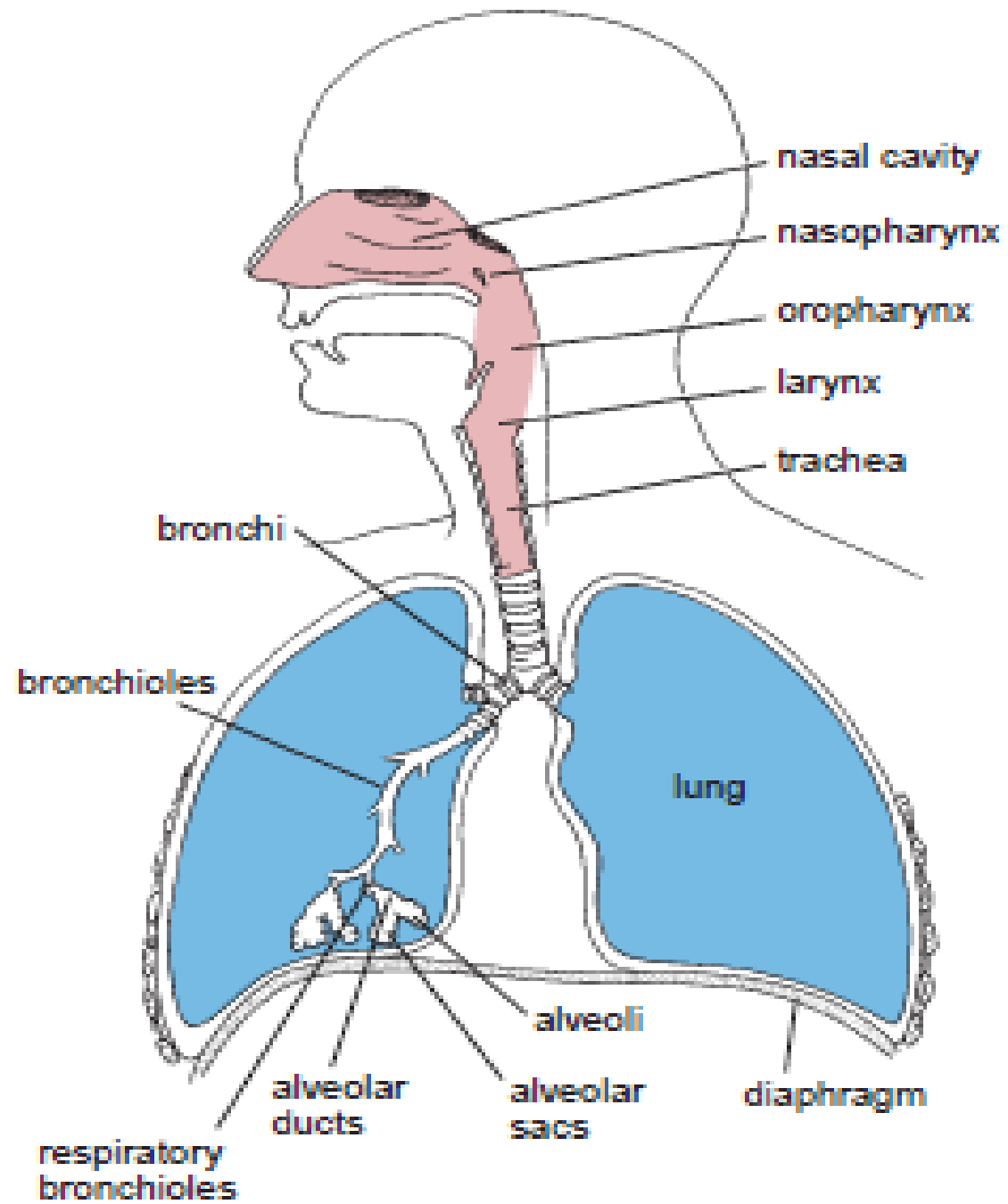
### Aleveoli. .

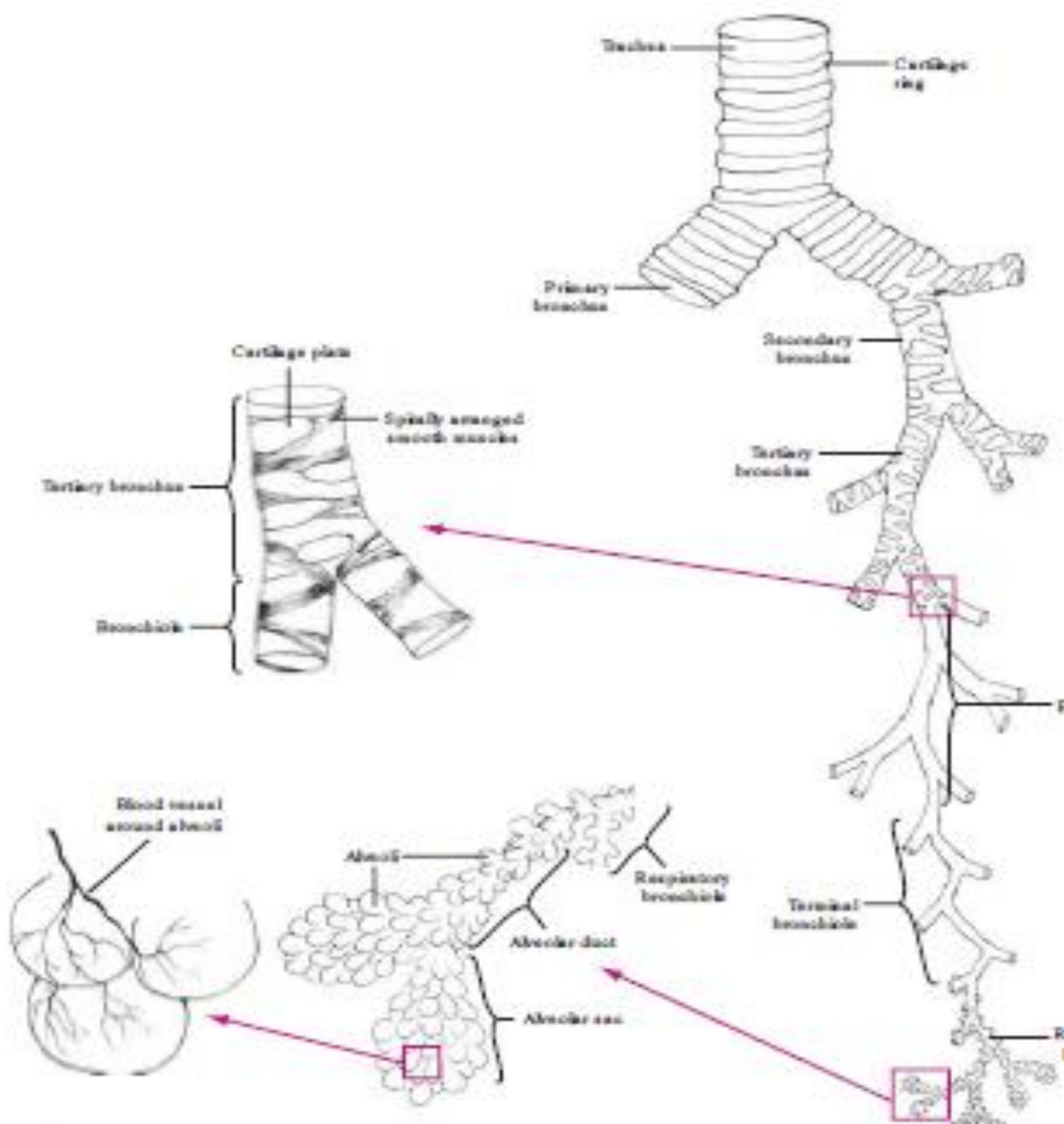
### Blood Supply .

### Lymphatic Vessels .

### Nerves .

- The structures which are responsible for the inhalation of air, exchange of gases between the air and blood and exhalation of carbon dioxide constitute the respiratory system.
- Apart from respiration, this system is also responsible for olfaction and sound production.
- The respiratory system consists of two parts—a conducting part (which carries air) and a respiratory part (where gas exchange takes place).
- The conducting part consists of nasal cavity, paranasal sinuses, nasopharynx, larynx, trachea, bronchi, bronchioles and terminal bronchioles .
- The respiratory part consists of respiratory bronchioles, alveolar ducts,





# GENERAL STRUCTURE OF THE CONDUCTING PORTION OF THE RESPIRATORY TRACT

\_ In general, the respiratory tract is made of four coats (Fig. 16.2), namely,

## 1. Mucosa

\_ It includes the epithelial lining and the underlying lamina propria. The epithelium is usually pseudostratified ciliated columnar epithelium with goblet cells.

## 2. Submucosa

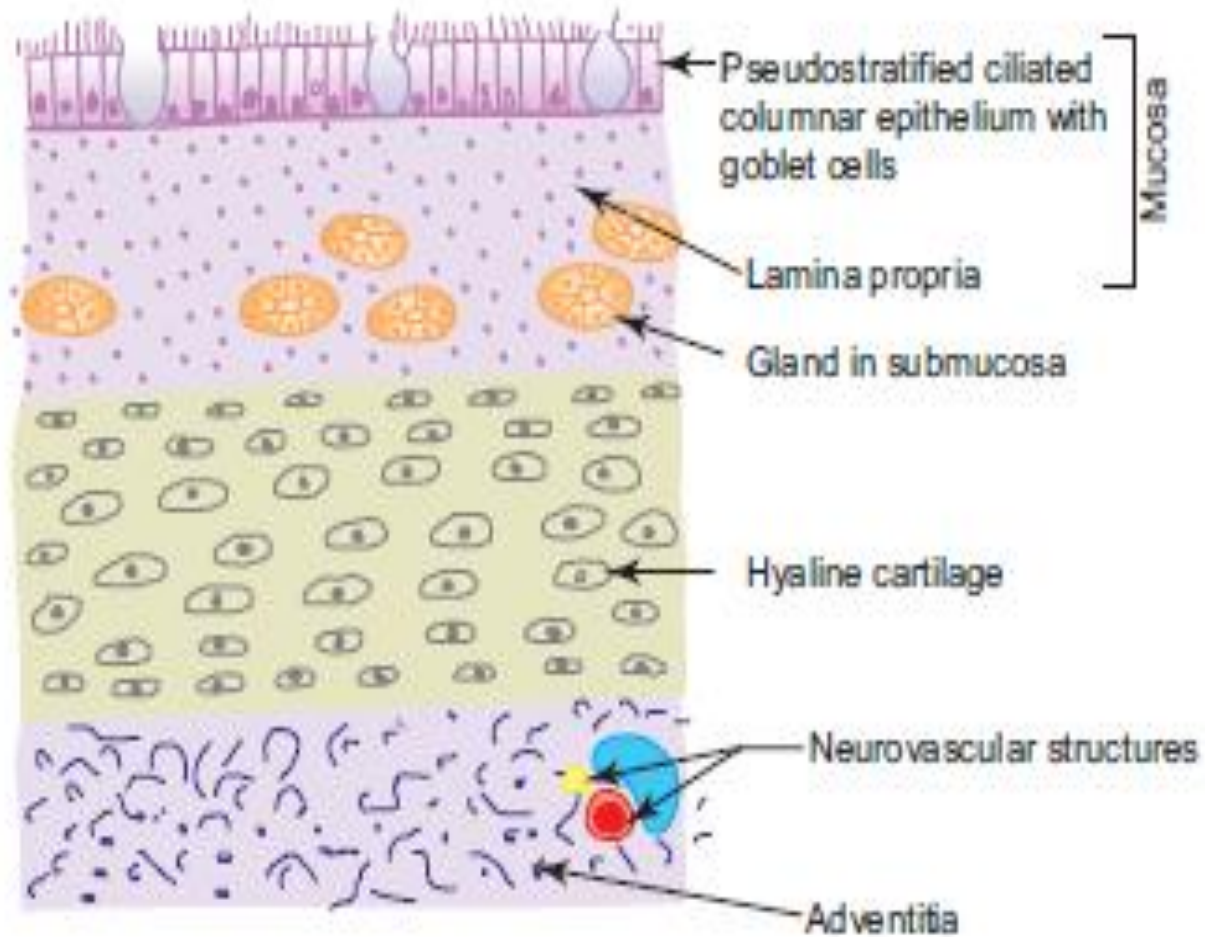
\_ It is a layer of loose connective tissue containing mixed glands.

## 3. Cartilage layer

\_ This layer is mostly formed by hyaline cartilage plus smooth muscle.

## 4. Adventitia

\_ It is a layer of fibroelastic connective tissue merging with the surrounding



## STRUCTURAL CHANGES IN THE CONDUCTING PORTION OF THE RESPIRATORY TRACT (FROM LARYNX TO BRONCHIOLE)

- \_ The epithelium gradually decreases in thickness (from pseudostratified columnar ciliated to simple cuboidal ciliated).
- \_ Goblet cells in the epithelium gradually reduce in number and completely disappear in the bronchiole.
- \_ Similarly, glands in the submucosa gradually decrease and completely disappear distally (no glands in the bronchioles).
- \_ Elastic fibres gradually increase in amount.
- \_ The cartilage gradually reduces and disappears distally (no cartilage in the bronchioles).
- \_ Smooth muscle fibres relatively increase.



## NASAL CAVITY

### GENERAL FEATURES

- \_ The nasal cavity is the beginning of the respiratory system.
- \_ It extends from the nostrils in front to the posterior nasal apertures behind.
- \_ Its framework is formed by bones and cartilages covered by mucous membrane.
- \_ It is divided into right and left halves by nasal septum.

### STRUCTURE

Histologically, \_ based on the lining epithelium, the nasal cavity is divisible into following three regions (Fig. 16.1):

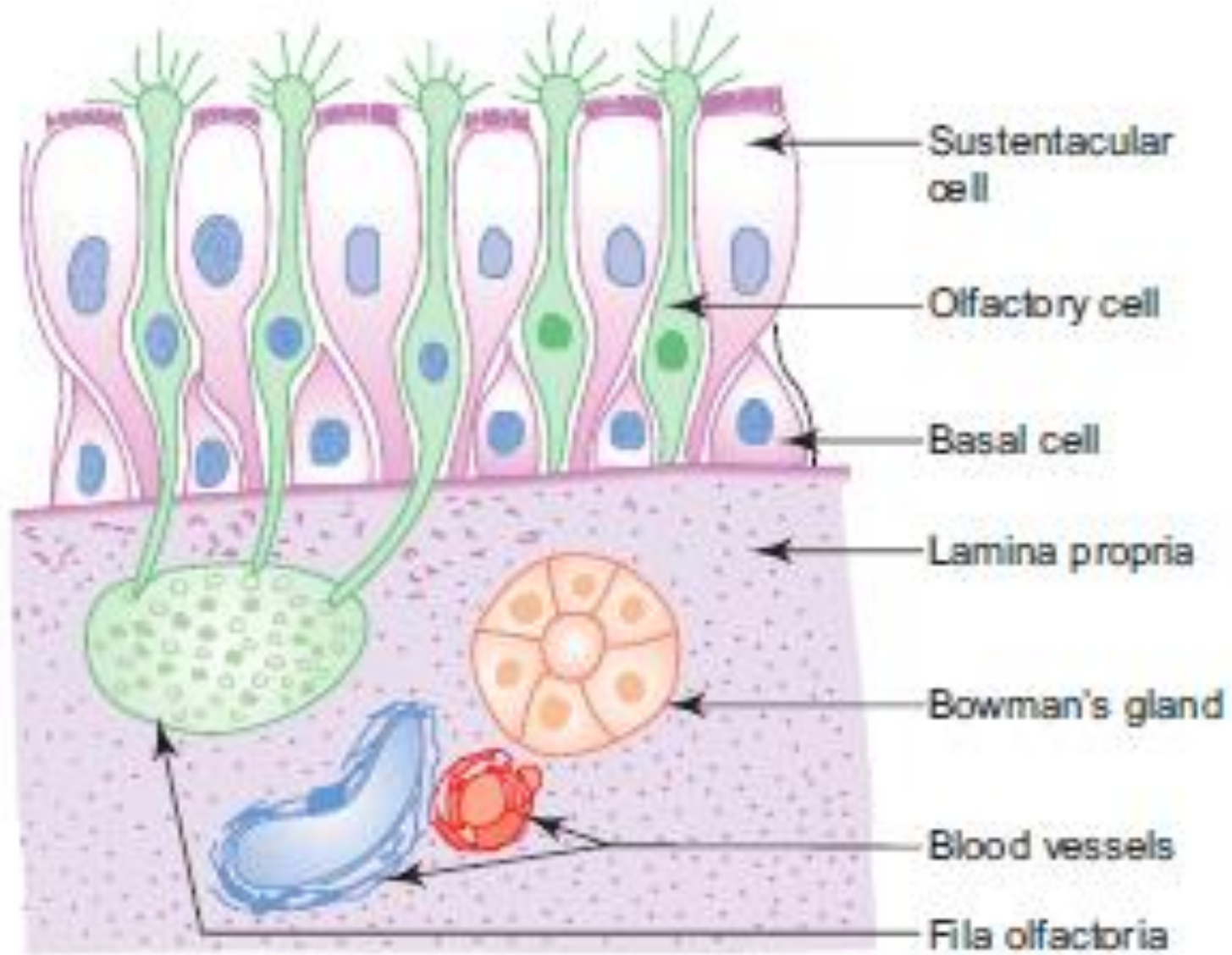
#### 1. Vestibule

- \_ It is the anterior dilated part of the nasal cavity lined by skin.
- \_ It contains thick short hairs called *vibrissae* which filter large particles from inspired air.

## Olfactory Region of the Nasal Cavity

The **olfactory region** is located on part of the dome of each nasal cavity is lined with a specialized **olfactory mucosa**. In living tissue, this mucosa is distinguished by its slight yellowish brown color caused by pigment in the **olfactory epithelium** and the associated **olfactory glands**.

The lamina propria of the olfactory mucosa is directly contiguous with the periosteum of the underlying bone. The olfactory epithelium contains very different cell types **fig**. Also, it lacks goblet cells.



The **olfactory epithelium** is composed of the following cell types:

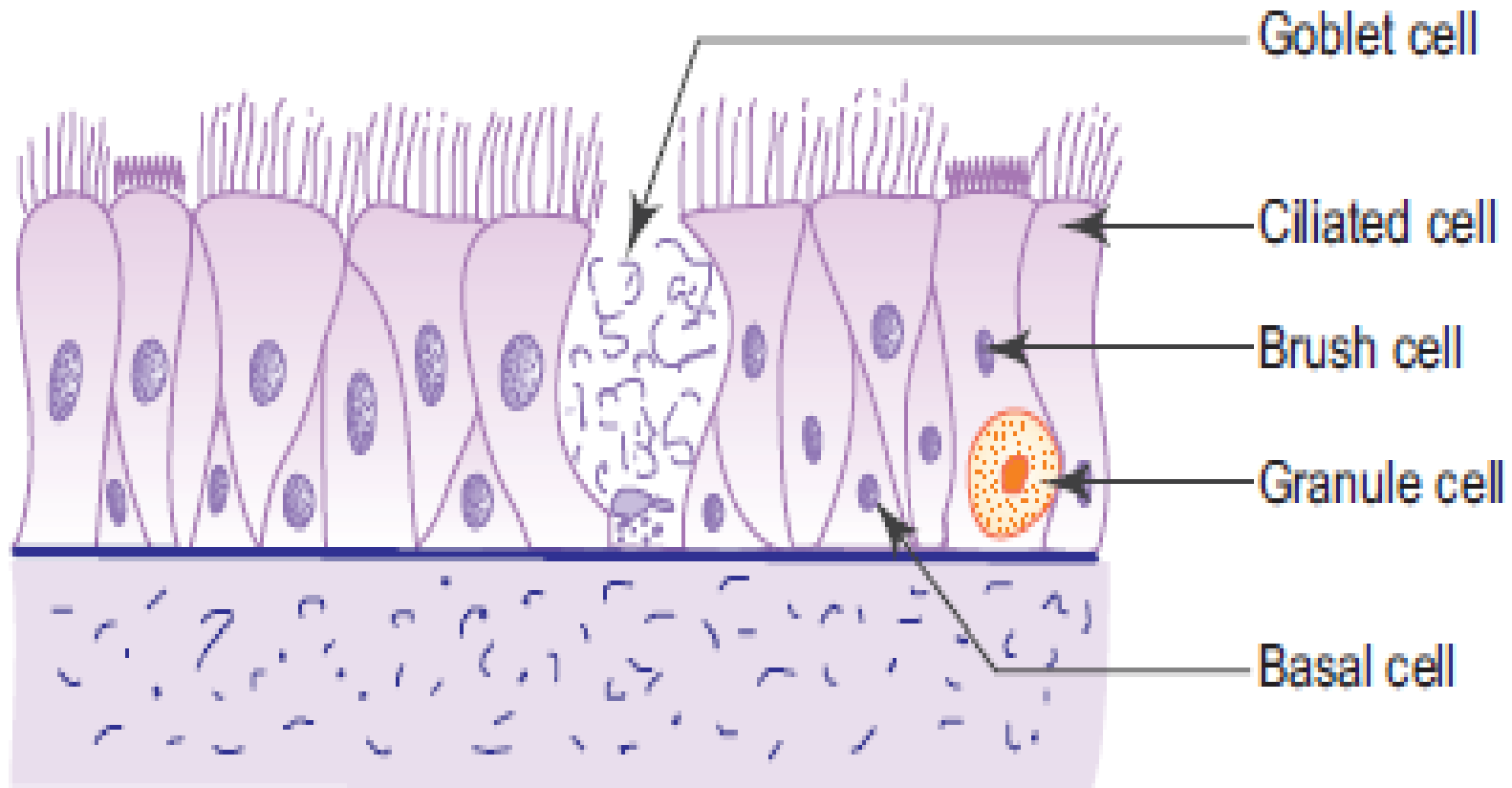
- **Olfactory receptor cells** are bipolar neurons that span the thickness of the epithelium and enter the central nervous system.
- **Supporting** or **sustentacular cells** are columnar cells that are similar to neuroglia cells and provide mechanical and metabolic support to the olfactory receptor cells.
  - **Basal cells** are stem cells from which new olfactory receptor cells and supporting cells differentiate.
  - **Brush cells** are the same cell type that occurs in the respiratory epithelium.  
Brush cells are columnar cells specialized for transduction of general sensation.

- ❖ The **olfactory glands (Bowman's glands)**, a characteristic feature of the mucosa, are branched tubuloalveolar serous glands that deliver their proteinaceous secretions via ducts onto the olfactory surface.
- ❖ The serous secretion of the olfactory glands serves as a trap and solvent for odoriferous substances.
- ❖ The identifying feature of the olfactory region of the nasal mucosa in a histologic preparation is the presence of the olfactory nerves in combination with olfactory glands in the lamina propria.

### 3. Respiratory region

— It occupies the rest of the area of the nasal cavity. It is covered by *respiratory mucosa* which is pink in colour and less thick compared to olfactory mucosa. The respiratory mucosa is firmly adherent to the underlying periosteum or perichondrium.

**Respiratory mucosa** consists of respiratory epithelium (pseudostratified ciliated columnar epithelium with goblet cells).



**Fig. 16.4** Respiratory epithelium.

— The respiratory epithelium is made of five cell types (Fig.). These are:

- (a) *Ciliated cells*—columnar cells with cilia on their free surfaces, the most abundant cell type, cilia beat towards the pharynx.
- (b) *Goblet cells*—flask-shaped mucus secreting cells.
- (c) *Brush cells*—columnar cells with microvilli on their free surfaces (may have sensory function).
- (d) *Basal cells*—small pyramidal cells, do not reach the surface, give rise to other cell types.
- (e) *Granule cells*—small round cells with many cytoplasmic granules (form part of the APUD cell series).

**The main function of the respiratory mucosa is conditioning of air, i.e. the inspired air is**

**– cleaned by the sticky mucus of dust particles,**

**– warmed by the vascular plexus in the lamina propria, and**

**– moistened by the secretory fluid provided by the glands.**



## PARANASAL SINUSES

- Paranasal sinuses are air-filled spaces in the bones around the nasal cavity.
- There are four pairs of paranasal sinuses—frontal, sphenoidal, ethmoidal and maxillary; they are present in the bones with the corresponding names.
- They open into the nasal cavity.
- They are lined by the respiratory mucosa.

# PHARYNX

## GENERAL FEATURES

\_ Pharynx is a fibromuscular tube extending from the base of the skull to the level of the sixth cervical vertebra where it becomes continuous with the oesophagus.

\_ It lies behind the nasal cavity (*nasopharynx*), oral cavity (*oropharynx*) and larynx (*laryngopharynx*).

## STRUCTURE

\_ Pharynx is composed of the following four coats:

### 1. Mucosa

\_ This comprises epithelium and lamina propria. The epithelium is pseudostratified ciliated columnar type in the nasopharynx and stratified squamous type in the oropharynx and laryngopharynx.

**\_ Aggregation of lymphatic nodules in the lamina propria of the posterior wall and around the opening of the auditory**

**tube in the nasopharynx results in the formation of *pharyngeal* and *tubal tonsils*, respectively. The palatine tonsil**

**present in the lateral wall of the oropharynx and the lingual tonsil in the pharyngeal part of tongue, are already**

**dealt with under lymphatic system.**

## **2. Submucosa**

**\_ It is formed by loose areolar connective tissue (**pharyngobasilar fascia**).**

## **3. Muscle coat**

**\_ This layer is formed by skeletal muscle arranged into inner longitudinal and outer circular layers. The circular layer**

**is formed by the constrictors of pharynx.**

## **4. Adventitia**

**\_ It is formed by fibroelastic connective tissue (**buccopharyngeal fascia**).**

*Thank You*