

## I. Upper Respiratory Tract

### A. Nasal Cavity

#### 1. Vestibule:

- **Lining:** "skin epithelium (keratinized stratified squamous epithelium)".
- **Cells/Structures:** "vibrissae (thick hairs)", "sebaceous glands".

#### 2. Respiratory Area:

- **Lining:** "respiratory epithelium (pseudostratified ciliated columnar epithelium with goblet cells)".
- **Structures:** "submucosa contains venous plexuses and glands".

#### 3. Olfactory Region:

- **Lining:** "olfactory (respiratory) epithelium".
- **Cells:** "bipolar olfactory cells, supporting (sustentacular) and basal cells".
- **Glands:** "bowman's glands".

### B. Paranasal Sinuses

- **Lining:** "thin mucosa composed of pseudostratified ciliated columnar epithelium with few goblet cells".
  - **Structures:** "few glands", "closely adherent to the periosteum".
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## II. Conducting Portion (Lower Respiratory Tract)

### A. Trachea

- **Lining:** Not explicitly stated for trachea alone, but part of the "Conduction portion" lined by "pseudostratified ciliated columnar with goblet cells".
- **Supportive Layer:** "Hyaline cartilage... C-shaped and absent posteriorly. The posterior gap is bridged by the trachealis smooth muscle".

### B. Bronchi (Primary, Secondary, Tertiary)

- **Lining:** Pseudostratified ciliated columnar epithelium (implied from "respiratory tract" and structural changes).

- **Supportive Layer:** "plates of cartilage (small pieces of hyaline cartilage), these plates become fewer as we go distally".
- **Special Structure:** "Aggregated in bronchi as BALT (bronchus-associated lymphoid tissue)".

### C. Bronchioles

#### 1. General:

- **Lining Transition:** "transitions from ciliated pseudostratified columnar (in large bronchioles) to ciliated simple columnar, eventually becoming ciliated simple cuboidal".
- **Note:** "Bronchioles lack both glands and cartilage. Goblet cells are few... and are replaced by clara cells."
- **Smooth Muscle:** "more smooth muscles than other parts, arranged in spiral and helical patterns".

#### 2. Terminal Bronchioles:

- **Lining:** "simple ciliated columnar or cuboidal cells".
- **Structure:** "prominent mucosal folding due to the presence of spiral and circular smooth muscle and elastic fibers".
- **Cells:** Contain **Clara cells**.

#### 3. Clara Cells:

- **Location:** "within the terminal and initial respiratory bronchioles".
- **Type:** "Simple cuboidal cells without cilia".
- **Function:** "contain secretory granules... protect against bacterial inflammation... contribute to surfactant production... form neuroepithelial bodies... function as chemoreceptors".

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## III. Respiratory Portion

### A. Respiratory Bronchioles

- **Lining:** "begins as simple cuboidal epithelium (containing both ciliated and non-ciliated Clara cells) and transitions distally into simple squamous epithelium".

- **Structure:** "feature an interrupted wall (open lumen) as they open into alveolar ducts". "mucosal folding decreases... reduction in smooth muscle, which eventually appears only as 'knobs' or 'tags'".

## B. Alveolar Ducts & Alveoli

- **Structure:** "matrix is rich in reticular and elastic fibers". "Between these alveoli, elastic fibers provide the necessary recoil".
- **Alveoli:**
  - **Structure:** "saclike evaginations". "tissue between individual alveoli is known as the interalveolar septum/wall".
  - **Alveolar Pores:** "adjacent alveoli are connected by alveolar pores, which measure 10–15  $\mu\text{m}$  in diameter".

## C. Cells of the Alveoli & Interstitium

### 1. Type I Alveolar Cells:

- **Type:** "simple squamous epithelial cells".
- **Coverage:** "cover roughly 97% of the alveolar surface".
- **Features:** "remarkably thin... organelles clustered around the nucleus... contain numerous pinocytotic vesicles... connected via desmosomes... joined by occluding junctions".

### 2. Type II Alveolar Cells (Septal Cells):

- **Type:** "cuboidal cells".
- **Coverage:** "cover only 3%" of surface, but "more numerous" in cell count (~16%).
- **Location:** "more abundant at the corners and within the septal walls".
- **Function:** "secrete surfactant". "capable of mitosis and can differentiate to replace both Type II and Type I cells".
- **Feature:** "characterized by a 'foamy' cytoplasmic appearance due to the presence of lamellar bodies".

### 3. Alveolar Macrophages (Dust Cells):

- **Location:** "within the interalveolar septa and on the pleural surface". Also in "bronchoalveolar fluid".

- **Appearance:** "appear as distinct black dots".
- **Function:** "phagocytose bacteria, viruses, and foreign particles". Can "migrate up the respiratory tract".
- **Abundance:** "the most abundant cell type in the lung tissue—even outnumbering Type I alveolar cells".

#### 4. **Capillary Endothelial Cells:**

- **Type:** "non-fenestrated... simple squamous epithelial cells".
- **Feature:** "presence of numerous pinocytic vesicles". "adjacent to red blood cells".
- **Part of:** "blood-air barrier".

#### 5. **Interstitial Cells:**

- **Composition:** "fibroblasts, macrophages (dust cells), leukocytes and mast cells, in addition to reticular and elastic fibers".
- **Also present:** "Endothelial cells are also present within the alveolar walls and septa".

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## IV. Other Cells Mentioned in Respiratory Epithelium

*(From Upper Respiratory Tract / Trachea / Bronchi slides)*

- **Basal cells:** "act as reserve (stem) cells and undergo mitosis".
- **Brush cells:** "Characterized by microvilli on their apical surface and has sensory receptors".
- **Serous cells:** "Contain secretory granules".
- **Diffuse neuroendocrine (DNES) / granular cells / Kulchitsky cells:** "regulate secretory functions".