

General Histology

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The Respiratory System

The respiratory system includes the lungs and a system of tubes that link the sites of gas exchange with the external environment.

The respiratory system is divided into 2 principal regions (**Figure 1**):

1. **The Conducting Portion:** Consisting of the nasal cavity, nasopharynx, larynx, trachea, bronchi, bronchioles, and terminal bronchioles.
2. **The Respiratory Portion:** Consisting of respiratory bronchioles, alveolar ducts, and alveoli.

Alveoli:

Are specialized saclike structures that make up the greater part of the lungs. They are the main sites for the principal function of the lungs-the exchange of O₂ and CO₂ between inspired air and blood.

Human Respiratory System

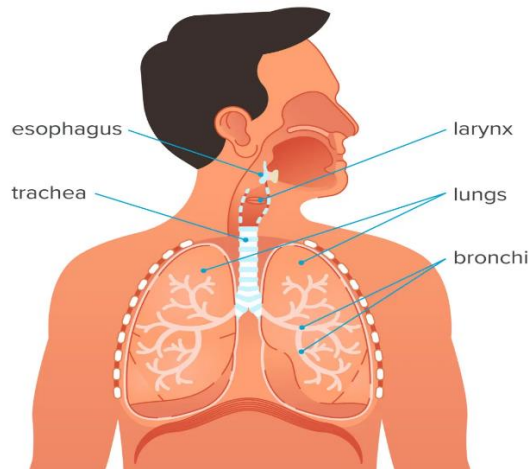


Figure 1. The main divisions of the respiratory tract.

1- **The Conducting Portion of the Respiratory System** Most of the conducting portion is lined with ciliated pseudostratified columnar epithelium that contains a rich population of goblet cells and is known as respiratory epithelium (Figure 2).

Typical respiratory epithelium consists of 5 cell types (as seen in the electron microscope):

A. Ciliated Columnar Cells: Constitute the most abundant type. Each cell has about 300 cilia on its apical surface (see Figure 2) and (Figure 3); beneath the cilia, in addition to basal bodies, are numerous small mitochondria which supply ATP for ciliary beating.

B. Mucous Goblet Cells: The next most abundant cells in the respiratory epithelium (see Figure 2). The apical portion of these cells contains the mucous droplets composed of glycoproteins.

C. Brush Cells: The remaining columnar cells (Figure 4) because of the numerous microvilli on their apical surface. Brush cells have afferent

nerve endings on their basal surfaces and are considered to be chemosensory receptors.

D. Basal (Short) Cells: Are small rounded cells that lie on the basal lamina but do not extend to the luminal surface of the epithelium. These cells are believed to be generative stem cells that undergo mitosis and subsequently differentiate into the other cell types.

E. Small Granule Cells: (or Kulchitsky Cells) are difficult to distinguish in routine preparations, but possess numerous dense core granules 100 to 300 nm in diameter. Like enteroendocrine cells of the gut, they are part of the diffuse neuroendocrine system (DNES).

Nasal Cavity Properties

The nasal cavity is the inner space of the nose (Figure 5).

It communicates with the exterior by two nares.

The nares are separated by the midline nasal septum, which consists of both bone and cartilage. The nasal septum also divides the internal nasal cavity into two parts. Each lateral wall of the nasal cavity has three projecting structures, or nasal conchae, which extend inward.

The middle and inferior conchae are covered with respiratory epithelium; the roof of the nasal cavities and the superior conchae are covered with specialized olfactory epithelium.

Beneath each concha are openings through which the paranasal sinuses or nasolacrimal ducts communicate with the nasal cavity. The posterior part of the nasal cavity communicates with the nasopharynx and then with the rest of the respiratory system.

Nasal Cavity Histology

The nasal cavity is lined by a respiratory mucosa like the rest of the respiratory system. Respiratory mucosa is different from oral mucosa lining the oral cavity but similar to that lining the trachea and bronchi. It consists of ciliated pseudostratified columnar epithelium (Figure 6).

Within the epithelium, and surrounded by mucous and serous glands, are goblet cells, which rest on the basement membrane. Fluids or mucus from the goblet cells and glands keep this mucosa moist, provide humidity, and trap any foreign materials from the inspired air. The moist mucus forms a superficial coating on the respiratory mucosa.

This coating is moved by ciliary action posteriorly to the nasopharynx, where it is either expectorated or swallowed. In this manner, foreign materials are trapped and removed. Because the lamina propria of the mucosa is extremely vascular, it also warms the incoming breathed air.

Smell (Olfaction) The olfactory chemoreceptors are located in the olfactory epithelium, a specialized area of the mucous membrane covering the superior conchae at the roof of the nasal cavity. In adult humans, it is about 10cm² in area and up to 100µm in thickness. This thick, pseudostratified columnar epithelium has three major cells (Figure 7):