The Respiratory System

The respiratory system may be divided into:
The upper respiratory tract:
- consists of the parts outside the chest cavity: the air passages of the nose, nasal cavities, pharynx, larynx, and upper trachea.
The lower respiratory tract:
- consists of the parts found within the chest cavity: the lower trachea and the lungs themselves, which include the bronchial tubes and alveoli.
Also part of the respiratory system are the:
- Pleural membranes and the respiratory muscles that form the chest cavity: the diaphragm and intercostal muscles.

NOSE AND NASAL CAVITIES:
Air enters and leaves the respiratory system through the nose, which is made of bone and cartilage covered with skin. Just inside the nostrils are hairs, which help block the entry of dust.
The nasal mucosa (lining) is ciliated epithelium, with goblet cells that produce mucus.
As air passes through the nasal cavities it is warmed and humidified, so that air that reaches the lungs is warm and moist.
Bacteria and particles of air pollution are trapped on the mucus; the cilia continuously sweep the mucus toward the pharynx.
Most of this mucus is eventually swallowed, and most bacteria present will be destroyed by the hydrochloric acid in the gastric juice.
In the upper nasal cavities are the olfactory receptors, which detect vaporized chemicals that have been inhaled.
- paranasal sinuses, air cavities in the maxillae, frontal, sphenoid, and ethmoid bones.
Functions of Paranasal Sinuses:
1. Humidify inhaled air.
2. Warming inhaled air.
3. Clean inhaled air.
4. Sound resonance.
5. Lighten weight of skull.
PHARYNX AND LARYNX :

Functions of Pharynx:
1. Air passage between nasal cavity and larynx.
2. Passage way for swallowed food and drink between oral cavity and esophagus.

Functions of Larynx:
1. Prevents food and drink from entering trachea.
2. Conducts air.
3. Produces sound.

TRACHEA, BRONCHIAL TREE AND ALVEOLI

The trachea is about 4 to 5 inches (10 to 13 cm) long and extends from the larynx to the primary bronchi. The wall of the trachea contains 16 to 20 C-shaped pieces of cartilage, which keep the trachea open. The gaps in these incomplete cartilage rings are posterior, to permit the expansion of the esophagus when food is swallowed. The mucosa of the trachea is ciliated epithelium with goblet cells. As in the larynx, the cilia sweep upward toward the pharynx. The right and left primary bronchi are the branches of the trachea that enter the lungs. Their structure is just like that of the trachea, with C-shaped cartilages and ciliated epithelium. Within the lungs, each primary bronchus branches into Bronchial Tree.

Structures of Bronchial Tree:
1. Primary bronchus
2. Secondary bronchus.
3. Tertiary bronchus.
4. Small bronchus.
5. Bronchiole.
6. Terminal bronchiole.
7. Respiratory bronchiole.
8. Alveolar duct.
Functions of Bronchioles

1. Conduct air.

2. Smooth muscle in the walls allows for bronchoconstriction and bronchodilation.

Structures of Alveolar Duct and Alveoli:

1. Type I Alveolar cell called Squamous alveolar cell.
2. Type II alveolar cell.
3. Alveolar macrophage called dust cell.
4. Elastic fibers.
5. Smooth muscle.
6. Capillaries.

Each lung contains about 150 million alveoli, its Function: the alveolus is the site of gas exchange "the functional unit of respiration"

pulmonary surfactant:-
A lipoprotein secreted by alveolar type II cells, also called septal cells. Surfactant mixes with the tissue fluid within the alveoli and decreases its surface tension, permitting inflation of the alveoli.
FIGURE 23-10 The Bronchi and Lobules of the Lung. (a) The branching pattern of bronchi in the left lung, simplified. (b) The structure of a single pulmonary lobule, part of a bronchopulmonary segment.
LUNGS AND PLEURAL MEMBRANES:

The lungs are cone shape organs located on either side of the heart in the chest cavity and are encircled and protected by the rib cage. The base of each lung rests on the diaphragm below; the apex (superior tip) is at the level of the clavicle. On the medial surface of each lung is an indentation called the hilum, where the primary bronchus and the pulmonary artery and veins enter the lung.

The pleural membranes are the serous membranes of the thoracic cavity. The parietal pleura lines the chest wall, and the visceral pleura is on the surface of the lungs. Between the pleural membranes is serous fluid, which prevents friction and keeps the two membranes together during breathing.

<table>
<thead>
<tr>
<th>Conducting zone</th>
<th>Name of branches</th>
<th>Number of tubes in branch</th>
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</thead>
<tbody>
<tr>
<td>Trachea</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Bronchi</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Bronchioles</td>
<td></td>
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<tr>
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<td>16</td>
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<tr>
<td>Respiratory bronchioles</td>
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<tr>
<td>Alveolar ducts</td>
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<td>Alveolar sacs</td>
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<tr>
<td></td>
<td></td>
<td>$0 \times 10^6$</td>
</tr>
</tbody>
</table>

**FIGURE 35-1** (Continued) © The branching patterns of the airway during the transition from conducting to respiratory airway are drawn (not all divisions are drawn, and drawings are not to scale).