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The respiratory tract is the pathway through which oxygen enters the body. It begins at the nostrils of the nose, continuing into the nasal cavity. From here it passes through the pharynx, larynx, trachea, bronchi, bronchioles and ends in the alveoli. The airway as a whole can be divided into two segments which are the conducting segment (from the nostrils to the terminal bronchiole) and the respiratory segment (from the respiratory bronchioles to the alveoli).

HISTOLOGY OF THE CONDUCTING PORTION OF THE RESPIRATORY SYSTEM

The conduction portion of the lung begins at the trachea and extends to the terminal bronchioles. Outside the lungs, the conduction system consists of the nasal cavities, nasopharynx, larynx, and trachea. Within the lungs, the conducting portion spits into paired main bronchi. The bronchi begin as a branching pattern, splitting next into lobar (secondary) bronchial branches and then again into segmental (tertiary) bronchi. The tertiary bronchi continue to divide into small bronchioles where the first change in histology takes place as cartilage is no longer present in the bronchioles. The end of the conduction portion of the lungs is at the final segment called the terminal bronchioles. The terminal bronchioles open into the respiratory bronchioles. This is the start of the respiration portion of the lung.

The conducting portion provides the pathway for the movement and conditioning of the air entering the lung. Specialized cells collaborate to warm, moisturize, and remove particles that enter. These cells are the respiratory epithelium and comprise the entire respiratory tree. Most of the respiratory epithelium is ciliated pseudostratified columnar epithelium. The following five types of cells are in this region:

1. Ciliated cells
2. Goblet cells
3. Basal cells
4. Brush cells
5. Neuroendocrine cells

The ciliated cells are the most abundant. They control the actions of the mucociliary escalator, a primary defense mechanism of the lungs that removes debris. While the mucus provided by the goblet cells traps inhaled particles, the cilia beat to move the material towards the pharynx to swallow or cough out.

Goblet cells, so named for their goblet-shaped appearance, are filled with mucin granules at their apical surface with the nucleus remaining towards the basilar layer. Goblet cells decrease in number as the respiratory tree gets progressively smaller and are eventually replaced by club cells (previously Clara cells) when they reach the respiratory bronchioles.

The basal cells connect to the basement membrane and provide the attachment layer of the ciliated cells and goblet cells. They may be thought of as the stem cells of the respiratory epithelium as they maintain the ability to potentiate ciliated cells and goblet cells.

Brush cells, occasionally referred to as type III pneumocyte cells are sparsely distributed in all areas of respiratory mucosa. Brush cells may be columnar or flask-like and are identified by their short microvillus covered apical layer–resembling a push broom or appropriately, a brush. No function has been officially assigned to the brush cells though there are many proposed mechanisms. One popular proposal suggests they have a chemoreceptor function, monitoring air quality, due to their association with unmyelinated nerve endings.

The bronchial mucosa also contains a small cluster of neuroendocrine cells, also known as Kulchitsky cells. They have neurosecretory type granules and can secrete several factors. This includes catecholamine and polypeptide hormones, such as serotonin, calcitonin, and gastrin-releasing factors (bombesin). Like brush cells, these neuroendocrine cells make up only a small portion of mucosal epithelium, around 3%.

Within the bronchial submucosa are submucosal glands. These glands are composed of a mixture of serous and mucinous cells, similar to salivary gland tissue.  The secretions are emptied into ducts and then on the bronchial mucosa. Older individuals may show oncocytic metaplasia of these glands.  Smooth muscle bundles are present at all levels of the airway to allow for regulation of airflow. There are progressively fewer smooth muscle fibers progressing from bronchi to alveoli.

When the corona virus gets into the conducting portion of the lungs, the lining of the respiratory tree becomes injured, causing inflammation. This in turn irritates the nerves in the lining of the airway. Just a speck of dust can stimulate a cough.

But if this gets worse, it goes past just the lining of the airway and goes to the gas exchange units, which are at the end of the air passages.

If they become infected they respond by pouring out inflammatory material into the air sacs that are at the bottom of our lungs.