

UNIT H - RESPIRATORY SYSTEM

Cellular respiration, the making of ATP by mitochondria is the last process in a set of four processes, which relate to the body's treatment and use of oxygen. The first one is **breathing**, which is the inhaling (**inspiration**) and exhaling (**expiration**) of air. Inhaling gets the oxygen into the lungs. Gases are exchanged between the blood and the lungs; oxygen goes into the blood and carbon dioxide comes out. This process is called **external respiration** as opposed to **internal respiration**, which is gas exchange between the blood and tissues in order to deliver the oxygen to cells (and get CO₂ out). Once the cells have the oxygen, they conduct cellular respiration. CO₂ is a waste by-product that must be excreted. This unit deals thoroughly with the first three of these processes, namely getting oxygen to cells for cellular respiration.

RESPIRATORY STRUCTURES

Breathing is something the body does continuously, without thinking about it. Air flows through a sequence of structures from the nose to the lungs allowing for the exchange of "oxygen-poor" air for "oxygen-rich" air. The **nostrils** are one of the major entryways into the body. They are lined with a **mucosal** cell layer, which secretes mucus. They are also equipped with nose hairs. Combined, these specializations filter and trap particulate matter. The debris that is removed from the inhaled air in this manner is discharged through the nose. A rich blood supply in the sinuses allows the presence of large numbers of white blood cells, which offer another layer of protection.

The **pharynx** is the common passageway for air and food. It ends where the **epiglottis** covers the top of the **trachea** leaving only the **esophagus** available for the passage of swallowed food materials. When the epiglottis is open, air is able to pass through the **larynx** (voice box) and into the trachea. The larynx contains the **vocal cords**, two tendons that adjust the pitch of sounds according to how taut they are. (Vocalization is a function of the mouth and tongue.)

The trachea connects the pharynx to smaller air passageways leading to the lungs. It is held open and protected by the presence of C-shaped rings of **cartilage**. The open part of the "C" is at the back of the trachea, against the esophagus to facilitate swallowing. The trachea branches into **bronchi**, which also have cartilage around them to protect them against collapse. The trachea conducts air into the bronchi and the bronchi pass the air along

into increasingly smaller branches of the air passageways called **bronchioles**. The continual branching of the bronchioles forms the **bronchiole tree**. The bronchioles eventually end at **alveoli**.

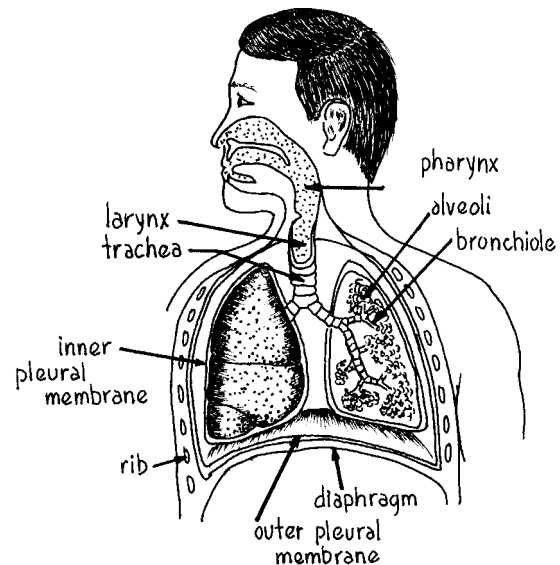


Figure H-1. Respiratory System Structures. The structures of the respiratory system function for breathing. The contraction of the diaphragm and intercostal muscles results in a "negative pressure" in the lungs, which draws air in. External respiration occurs and exhalation follows.

The alveoli are the blind sac-like endings at the end of the bronchioles. The average adult lung contains millions of alveoli. This provides a great deal of surface area for the diffusion of gases (external respiration). In addition to their quantity, they are specialized in a number of ways:

1. Alveolar walls are only one cell thick which aids the diffusion of gases.
2. They have a coating of **lipoproteins** on their inner surface, which helps maintain **surface tension**. This prevents them from collapsing and sticking together during **exhalation**.
3. They are equipped with **stretch receptors**. These nerve endings are sensitive to stretch. The alveoli expand during **inhalation**. The stretch receptors send impulses to the medulla oblongata of the brain when the alveoli are full enough (stretched). This triggers exhalation.
4. The alveolar surfaces are highly vascularized by the **pulmonary capillaries**. This ensures maximum diffusion of gases and helps ensure that the alveoli do not dry out, which would prevent the efficient diffusion of gases.