The Human Respiration System
Nasal Passage

Overall function is to filter, warm and moisten air as it enters the body.

The nasal passages are the primary site of air movement – we tend to be “nose breathers.”
Nasal Passage

Specialized structures within the nasal passage include:

**Turbinates** – bony protrusions that are covered with **mucous membranes** that moisten air and **hair cells** that help trap debris taken in with air.

**Capillaries** – close to surface of skin layer, help to warm air as it enters the body.
Nasal Passage

1. Chemicals drifting in air come close to the nose.
2. Once in the nasal passage, the chemicals contact special receptor cells. A person has around five million of these cells. Dogs have 200 million.
3. The cells react to the chemicals, somewhat as your eye cells react to a light or your ear cells to a sound. The reaction is an electrochemical response.
4. Nerves carry the impulses to your brain. Your brain can identify the odor of roughly 4,000 different molecules (particles that make up chemicals).

- Middle Turbinate
- Septum
- Inferior Turbinate
Oral Cavity (mouth)

Air can also enter and leave the body through the mouth.

The mouth can warm and moisten air, but it lacks hair cells and the same mucous layer that helps to remove debris from the air before it enters the airways.

Mouth breathers lose that filtration.
Pharynx

This is the chamber (back of the throat) that connects the oral and nasal passages.

This part of the body carries food to the digestive system, and carries air to the respiratory system.
Pharynx
Epiglottis

This is a small, cartilaginous flap that helps to direct food from the pharynx to the esophagus and away from the trachea (wind pipe).

The epiglottis remain open when breathing, but closes as food passes through the pharynx to the digestive system.
Epiglottis
Larynx

Also known as the “voice box.”

Made up of cartilage and small flexible membranes that vibrate as air moves over them to produce sound.
Larynx
Trachea

Also known as the “windpipe.”

This tube carries air into and out of the bronchi.

It is lined with ciliated epithelium that produce mucous to help trap debris inhaled with air.
Trachea

The cilia move mucous up toward the pharynx, where it can be swallowed or expelled as phlegm.

Animation
Trachea
Trachea

The trachea is surrounded by semi-circular rings of cartilage.

These cartilaginous rings protect the trachea from collapse if the throat is hit from the front.
Bronchus

The bronchi (plural of bronchus) are the two terminal branches of the trachea.

These short tubes carry air between the lungs and the trachea.

One bronchus branches into each of the two lungs
Bronchus

The bronchi have cartilaginous rings and ciliated mucosal epithelium similar to that in the trachea.

A and F represent the mainstem bronchi. The bronchi branch into smaller tubes as they spread into each lobe of the lungs. These branches are also called bronchi. These further divide into smaller bronchioles.
Bronchioles

These are the smaller branches that come off of the bronchi that enter each lobe of each lung.

The bronchioles branch out into the lungs to deliver oxygen to an increased surface area.
Bronchioles

In areas closer to the bronchi, the bronchioles have mucosal epithelium, but this is lost as the bronchioles branch deeper into the lungs.
Bronchioles
Alveoli

The alveoli are found at the end of the bronchioles. They are found only in mammalian lungs.

These are tiny structures that exchange gases between the lung and the blood. Oxygen enters the blood and carbon dioxide leaves the blood through these structures.
Alveoli

Gaseous Exchange in the Alveus of Man
Alveoli

An alveolus has a epithelial layer that is only one cell layer thick, and which is lined with a moisture layer.

Gases must be dissolved in this moisture layer before they are able to diffuse across the cell membranes of the alveolar cells.
Gas Exchange

- lungs
- circulation
- cells

- oxygen
- carbon dioxide
Gas Exchange

The purpose of the mammalian respiratory system is to bring oxygen into the body for use in cells, and to release carbon dioxide.

In order to do this, the respiratory system must be closely linked to the circulatory system. This is why alveoli are surrounded by small blood vessels called capillaries.
Alveoli and capillaries
Diaphragm

The diaphragm is a thin, muscular structure found below and outside the lungs. It is a type of skeletal muscle.

It separates the chest cavity from the abdominal cavity.

The diaphragm relaxes and contracts to change the size (volume) of the chest cavity. This results in inhalation and exhalation.
Diaphragm

The diaphragm is shaped like a parachute.
The diaphragm and rib muscles work together to change the size of the chest cavity. Note how both move when inhaling and exhaling.