

Respiratory system

A. Phases of respiration ([gas exchange](#))

1. Pulmonary ventilation - [breathing](#)
2. [External respiration](#) - gas exchange between lungs and blood
3. [Internal respiration](#) - gas exchange between blood and body cells
4. Cell respiration: occurs in the [mitochondria](#)

B. Respiratory Anatomy

1. Nose
 - a. [nostrils](#) - 2 openings
 - b. [nasal cavity](#) - space behind the nose
 - c. [nasal septum](#) - bone and cartilage that separates nasal cavity in right and left
 - d. [nasalconchae](#) - scroll shaped bones (turbinate bones) covered in mucus membranes; 3 per side; increase the surface area and create an air turbulence in the nasal cavity
 - e. Air must be modified before it reaches the lungs:
 - i. Air must be cleaned: [mucous membranes](#)
 - ii. Air must be moistened: [mucous membranes](#)
 - iii. Air must be warmed: [capillaries](#)
2. Paranasal sinuses - air-filled spaces in [ethmoid](#), [frontal](#), [sphenoid](#), and [maxillary](#) bones that reduce bone weight and act as resonance chambers
3. Pharynx ([throat](#)) - passage for both [gases](#) and [food](#) (so its part of both [respiratory](#) and [digestive](#) systems)
4. Larynx ([voice box](#))
 - a. functions:
 - i. breathing
 - ii. [sound](#) production *g l o t t i s*
 - iii. protecting the trachea ([epiglottis](#))
 - b. made up of muscles, cartilage pieces, and elastic tissue
 - c. sound is created when air is forced by vocal cords... quality of sound depends on:
 - i. [pitch](#) - tension on cords
 - ii. intensity - force of air over cords ([loudness](#))
 - iii. timbre ([quality](#)) harmonics set up from resonating sound waves
5. Trachea ([windpipe](#))
 - a. Made up of alternating bands of [cartilage](#) and [membrane](#)
 - b. Cartilage bands are C-shaped for ease of [swallowing](#)
 - c. Lined with [mucus membranes](#) and [cilia](#)
6. Bronchial Tree - branched airways from trachea to air sacs in lungs
 - a. [bronchi](#) - largest branch
 - b. [bronchioles](#) - smaller branches
 - c. made up of alternating bands of [cartilage](#) and [membrane](#)

7. Lungs

- a. Made up of about [800 million](#) air sacs per lung
- b. Each air sac consists of pouches called [alveoli](#)
- c. Each air sac surrounded by [capillaries](#) where gas exchange occurs
- d. Enclosed by the diaphragm and thoracic cavity
- e. [Pleura](#) - two layers of airtight membranes
 - i. [Visceral pleura](#) - covers each lung
 - ii. [Parietal pleura](#) - lines thoracic cavity
 - iii. [Pleural cavity](#) - space between two membranes that allows the lungs to expand; contains [serous fluid](#) for lubrication

C. Breathing - occurs because of lower pressure in the thorax

- a. [Inspiration](#) (inhalation)
 - i. the [diaphragm](#) and external intercostal muscles contract, increasing the volume & decreasing the pressure in the thoracic cavity
 - ii. nature abhors a vacuum, so external air enters to [equalize](#) the pressure
- b. [Expiration](#) (exhalation)
 - i. compressed abdominal organs spring back and push against the diaphragm
 - ii. the volume in the thoracic cavity [decreases](#), so the pressure [increases](#) and the air is pushed out

D. Factors affecting breathing

1. Increased carbon dioxide in blood - breathing [increases](#)
2. Low blood oxygen - breathing [increases](#)
3. Lower blood pH ([acidity](#) increases) - breathing increases
4. [Limbic](#) system stimulation (emotional anxiety) - breathing increases
5. [Temperature](#) increases - breathing increases; lower temperature decreases breathing, and sudden cold may cause brief [apnea](#)
6. [Pain](#) - brief period of apnea, then:
 - a. prolonged [somatic](#) pain increases breathing
 - b. prolonged [visceral](#) pain decreases breathing
7. [Irritation](#) of airways - immediate apnea, followed by [coughing](#) or [sneezing](#)
8. Blood Pressure - a [rise](#) in BP decreases breathing; a [drop](#) in BP increases breathing