

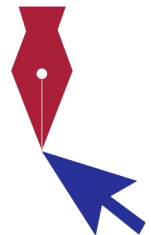
The Human Respiratory System

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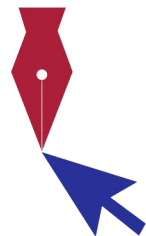


Respiration

- In biology, respiration has two meanings:
 - at the cellular level, it refers to the chemical reactions that take place in the mitochondria, which require oxygen, and are the principle source of energy for eukaryotic cells;
 - at the level of the whole organism, it refers to the process of taking in oxygen from the environment and giving carbon dioxide back to it.

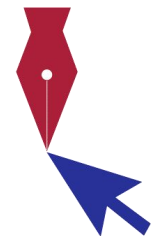
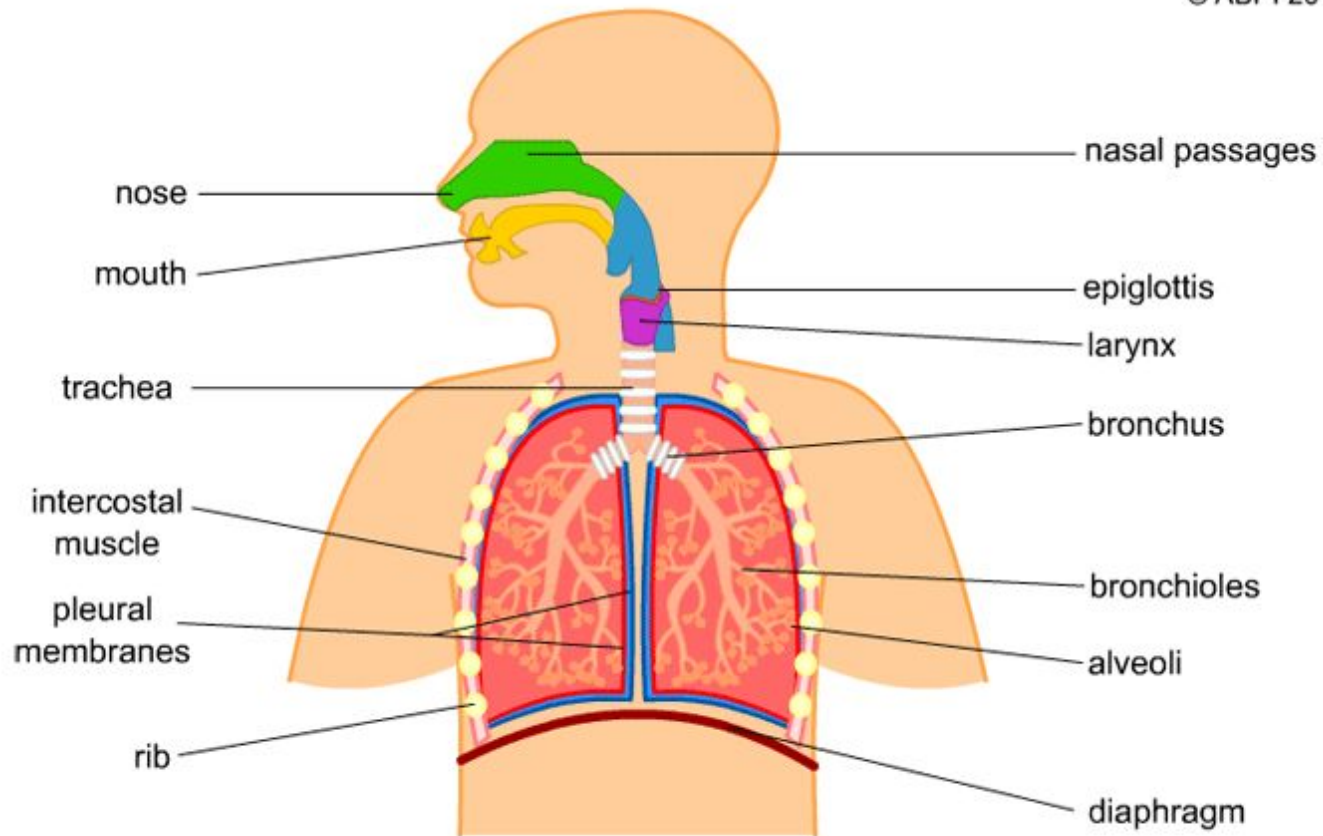


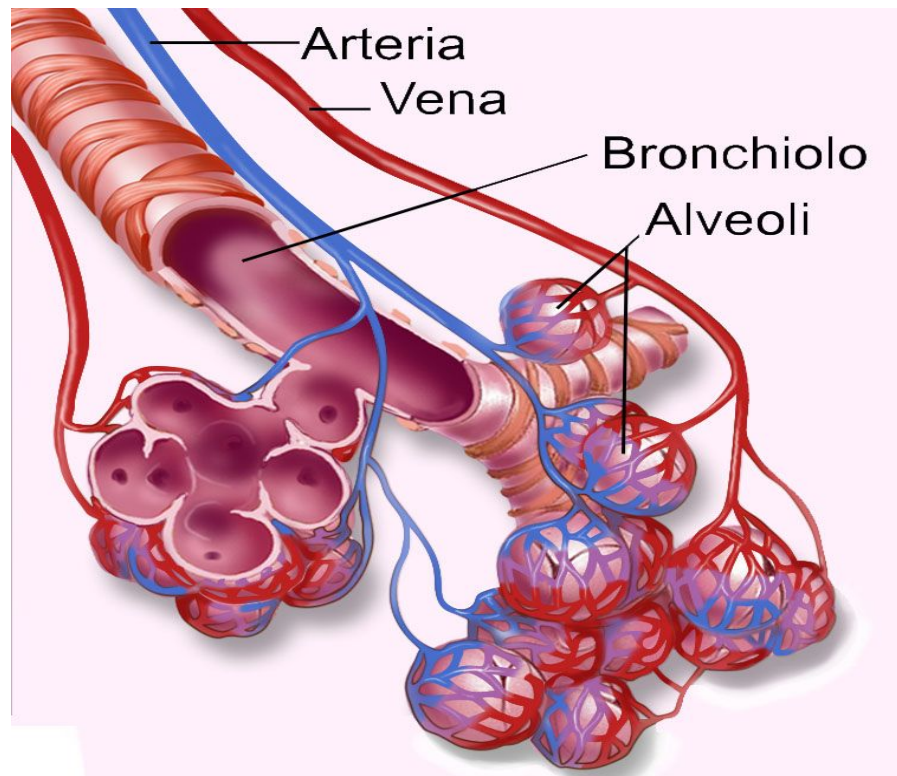
- Cells need oxygen to generate ATP in their mitochondria
- Of all organs, your liver has the greatest need: 81 litres of oxygen a day, while your brain requires 76 litres.
- A top marathoner uses about 500 litres of oxygen in the course of a race.
- The main physiological difference between a sedentary person and a runner is the number of mitochondria per cell, which increases with training



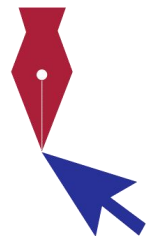
The human respiratory system

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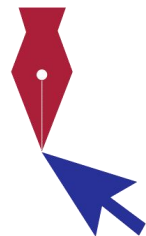


A pair of human lungs has some 300 million alveoli, where gas exchange takes place, providing a respiratory surface of about 70 square metres.

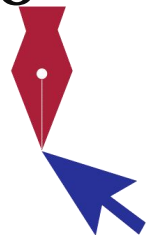


The human respiratory system

- ∞ Air enters through the nose or mouth and passes into the pharynx, past the larynx, and down the trachea, bronchi and bronchioles to the alveoli in the lungs.
- ∞ Gas exchange takes place in the alveoli. The barrier between the air in an alveolus and the blood in its capillaries is only 0.5 micrometre.
- ∞ Oxygen and carbon dioxide diffuse into and out of the bloodstream through the capillaries surrounding the walls of the alveoli.

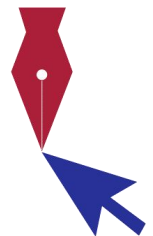


- The trachea, bronchi and bronchioles, which serve mainly to transport air by bulk flow, are lined with epithelial cells.
- These include both mucus-secreting and ciliated cells.
- The mucus coats the epithelium of the respiratory system and traps foreign particles.
- The cilia beat continuously, pushing mucus and foreign particles toward the pharynx, to be expelled.



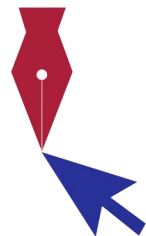
Mechanics of respiration

- Air flows into or out of the lungs when the air pressure within the alveoli differs from the pressure of the external air (atmospheric pressure).
- The pressure in the lungs is varied by changes in the volume of the thoracic cavity, caused by the contraction and relaxation of the diaphragm and of intercostal (“between-the-ribs”) muscles.

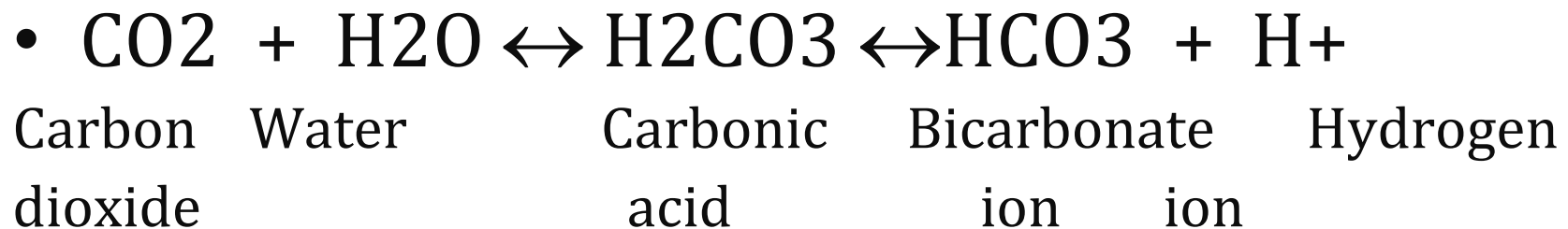


Transport and exchange of gases

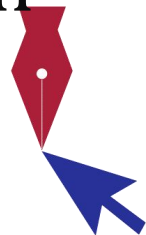
- Oxygen is almost insoluble in blood plasma.
- The blood transports oxygen thanks to respiratory pigments which, in vertebrates, are called hemoglobin. Each hemoglobin molecule can bind four molecules of oxygen.
- In the capillaries of the alveoli, where the partial pressure of oxygen is high, most of the hemoglobin is combined with oxygen.
- In the tissues, where the partial pressure is lower, oxygen is released from the hemoglobin molecules into the plasma and diffuses into the tissues.



- Carbon dioxide is more soluble than oxygen and some of it is dissolved in the blood.
- However, most CO₂ reacts with water to form carbonic acid, a weak acid that dissociates to form bicarbonate (HCO₃⁻) and hydrogen (H⁺) ions:



- The reaction can go in either direction, depending on the partial pressure of carbon dioxide in the blood.



Control of Respiration

- The rate and depth of respiration are controlled by respiratory neurons in the brainstem which activate motor neurons in the spinal cord that cause the diaphragm and intercostal muscles to contract.
- In addition, chemoreceptor cells, located in the carotid arteries, signal the respiratory neurons when the concentration of oxygen decreases.
- Centres in the brain and chemoreceptors simultaneously monitor the concentration of dissolved carbon dioxide and hydrogen.
- The system is highly sensitive to the slightest changes in the chemical composition of the blood (particularly hydrogen ion, which reflects the concentration of carbon dioxide)







WARNING
This is what dying of lung cancer looks like.
Barb Tarbox died at 42 of lung cancer caused by smoking.
You can quit. We can help.
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internet/url.ca

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Greg Southam
The Edmonton Journal
Health Canada



SMOKING CAUSES PERIPHERAL VASCULAR DISEASE GANGRENE
Winfield Blue 25

SMOKING CAUSES BLINDNESS
Winfield Gold 25

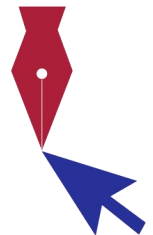


Terrie, 52
North Carolina



Cancer of the lungs and bronchi

- Italy has the 4^o highest rate of deaths from cancer of the lungs **in the world**.
- The delicate tissues of the alveoli of the lungs are normally protected from infectious microorganisms and harmful substances by the action of ciliated epithelial cells lining the trachea and bronchi. Cigarette smoke paralyses the cilia, allowing foreign invaders to enter the cells and initiate serious damage and disease.



Exposure to cigarette smoke

- In addition to impairing the respiratory system's natural defences, cigarette smoke exposes the tissues of the lungs to at least **43 known carcinogens**.

- Long-term exposure causes:

chronic bronchitis, characterized by a reduction in the diameter of passageways and excessive mucus production;

emphysema, where the fragile alveoli walls break down and are replaced by inelastic scar tissue



Man versus Mountain

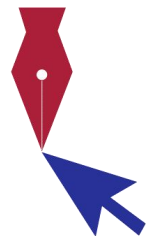


Until recently, about 6,000 metres was considered to be the limit for human survival.

In 1978, Reinhold Messner & Peter Habeler were the first to climb Mt. Everest 8,848 without oxygen, raising new questions about physiological adaptability.

WHAT HAPPENS TO OUR BREATHING AT THAT ALTITUDE??

- Messner described feeling “as though I would burst apart”. He said he felt that his mind was dead. At 8,800m, they collapsed every 10 to 15 feet and lay in the snow. At the summit, he was quoted as saying, “ I am nothing more than a single narrow gasping lung, floating over the mists and summits.”



The American Medical Research Expedition's findings.

- Survival at extreme altitudes depends on hyperventilation – extremely deep breathing.
- The partial pressure of oxygen in the blood is less than one third the partial pressure at sea level and work capacity is severely diminished.
- Striking changes in metabolism and brain function. (extreme loss of body weight)
- Verbal learning and short-term memory declined.
- <http://www.himalayanclub.org/journal/american-medical-research-expedition-to-everest-1981/>



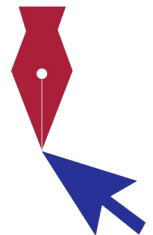
Functions and common, everyday, less technical terms

Epiglottis	a small piece of flesh at the back of your tongue that closes your trachea when you swallow food.
Trachea	windpipe , the tube at the back of your throat that air travels down.
Pharynx	part of your throat that leads from your mouth to your oesophagus.
Oesophagus	the tube that carries food from your mouth to your stomach.
Larynx	voicebox , the organ in your throat that contains vocal chords, which produce sound



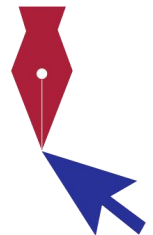
Verbs necessary to know to be able to talk about the respiratory system

- To flow
- To coat
- To generate
- To diffuse
- To provide
- To line
- To push
- To expel
- To dissolve
- To allow
- To signal
- To reflect
- To impair
- To locate
- To require
- To paralyse
- To take place
- To differ from
- To break down



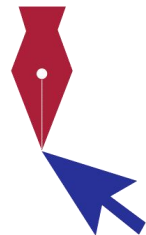
Anomalous plurals

- pharynx
- larynx
- bronchus
- medium
- criterion
- (hypo)thesis
- crisis
- syllabus
- datum
- phenomenon
- pharynges
- larynges
- bronchi
- media
- criteria
- (hypo)theses
- crises
- syllabi (but also syllabuses)
- data
- phenomena



Some brainteasers

- If you were suffering from a cold, would you purchase a new remedy that promises to suppress the secretion of mucus in the respiratory tract and relieve the symptoms? Why (not)?
- Is it possible to commit suicide by deliberately holding your breath?
- How would you recognise the symptoms and what assistance would you give to a victim of carbon monoxide poisoning?
- What would you tell a person/ a family member who insists on smoking while in your company?
- What would you do to help a friend who you suspect is suffering from alpine sickness?



BBC science: human body and mind

<http://www.bbc.co.uk/science/humanbody/>

http://www.bbc.co.uk/science/humanbody/body/index_interactivebody.shtml

Play the interactive games to revise the position of organs, muscles and bones .



