

The bronchial tubes and their branches are shown in this normal chest x-ray.
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Overview of the Respiratory System

Center for
Educational Outreach
Baylor College of Medicine



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Overview of the Respiratory System

Image Reference

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Key Words

respiratory system, human, lungs

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Major Components of the System

- The respiratory system is composed of a pair of lungs, along with the airways and respiratory muscles, and blood vessels.
- Hemoglobin is a pigment in red blood cells that helps to transport oxygen.

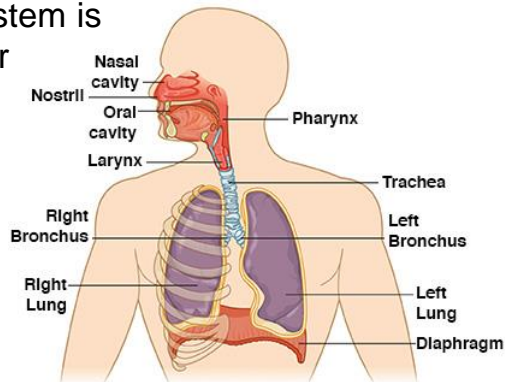


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Major Components of the System

Inhaled (or inspired) air travels through the oral or nasal cavities, pharynx, larynx, trachea, bronchi, bronchioles and alveoli. Inspiration is caused by contraction of the external intercostal muscles and diaphragm. Expiration occurs when these muscles relax.

Respiratory pigments, such as hemoglobin, enable the blood to carry more oxygen. Hemoglobin also helps to transport carbon dioxide.

References

- 1.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.
- 2.Raven, P.H. (2005). *Biology, 7th Edition*. New York, NY: McGraw-Hill.

Image Reference

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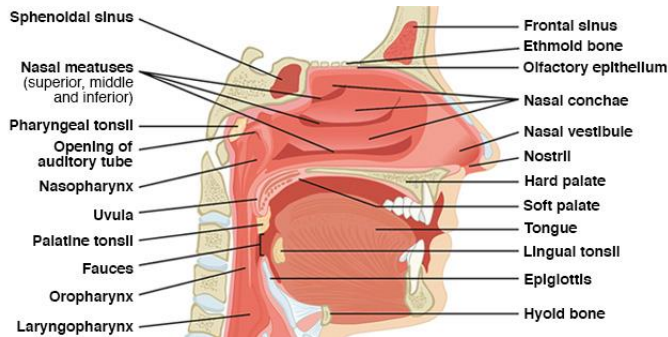
Key Words

respiratory system, human, lungs, nasal cavity, oral cavity, hemoglobin, pharynx, larynx, trachea, bronchus, lung, diaphragm

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Oral and Nasal Cavity

- The oral and/or nasal cavity receives air and delivers it through the respiratory tract.



- The nasal cavity also can “condition” air and remove particulate matter.



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Oral and Nasal Cavity

Air enters through the oral or nasal cavity, where it is humidified, warmed and filtered before entering the pharynx. Dust and other particulate matter is removed by short thick hairs in the nose.

References

1. Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.
2. Raven, P.H. (2005). *Biology, 7th Edition*. New York, NY: McGraw-Hill.

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Key Words

nasal cavity, oral cavity, respiratory tract, respiration, nasopharynx, nasal

meatus, pharynx, nasal

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Pharynx and Larynx

- The pharynx aids in vocalization, and also conveys air to the larynx.
- The larynx (voice box), situated just below the pharynx, protects the trachea and houses the vocal fold (vocal cords).

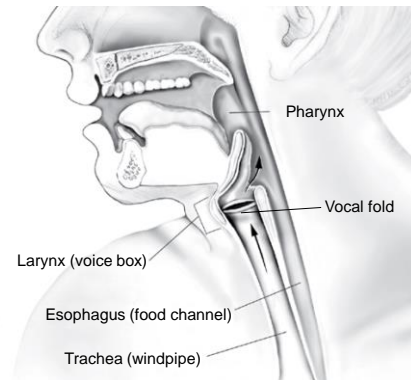


Illustration courtesy of the National Institute on Deafness and Other Communication Disorders, NIH.

Pharynx and Larynx

Air passes through the pharynx to the larynx. From there, it continues through an opening in the vocal cords (called the glottis) and proceeds into the trachea.

In many mammals, the larynx also functions as a voice box. It is important in producing pitch in human voices.

References

1. Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.
2. Raven, P.H. (2005). *Biology, 7th Edition*. New York, NY: McGraw-Hill.

Image Reference

Illustration courtesy of the National Institute on Deafness and Other Communication Disorders, NIH.

<http://www.nidcd.nih.gov/health/voice/pages/dysph.aspx>

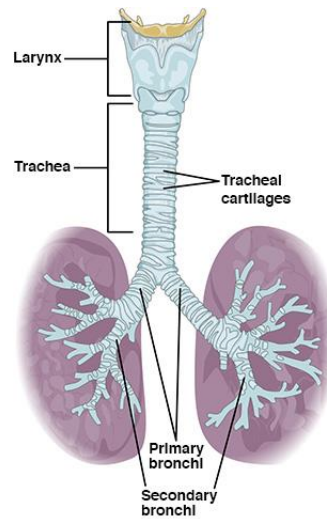
Key Words

respiratory system, pharynx, larynx, trachea, glottis

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Trachea

- The trachea is a tube that allows air to pass between the larynx and the lungs.
- Mucus in the trachea traps foreign particles that were not previously filtered out.



Trachea

The trachea is a tube, supported by C-shaped rings of cartilage, that connects the larynx with the lungs. It separates into right and left bronchi, one of which enters each lung. Inside the lungs, the bronchi further subdivide into bronchioles that deliver air into blind-ended sacs, called alveoli.

References

1. Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.
2. Raven, P.H. (2005). *Biology, 7th Edition*. New York, NY: McGraw-Hill.

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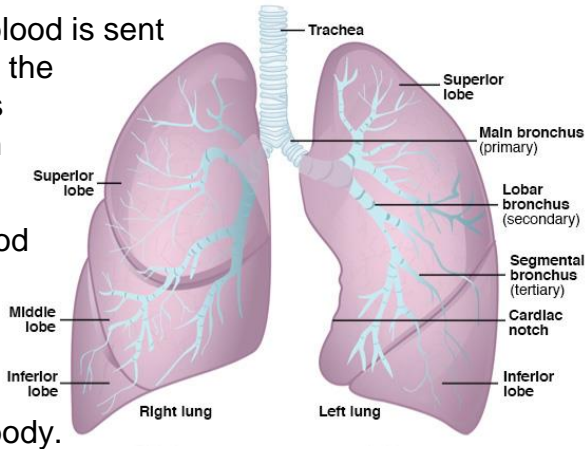
Key Words

respiratory system, lungs, bronchi, trachea, alveolus

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Lungs

- The lungs are the site of oxygen exchange.
- Deoxygenated blood is sent from the body to the heart, where it is pumped through the lungs.
- Oxygenated blood from the lungs is sent back to the heart for distribution throughout the body.



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Lungs

The lungs work in conjunction with the heart and circulatory system to bring oxygen to the body and carry CO₂ out of the body.

For more information about this process, please refer to the slide set “Overview of the Circulatory System” on BioEd Online.

References

1. Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.
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Image Reference

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Key Words

respiratory system, lung, lungs, blood, oxygenated blood, deoxygenated blood, bronchus,

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Inside the Lungs

Each lung is composed of:

- **Bronchi**
Primary passage ways;
singular, “bronchus”
- **Bronchioles**
Smaller, branching
passage ways
- **Alveoli**
Terminal ends where
gas exchange occurs;
singular, “alveolus”

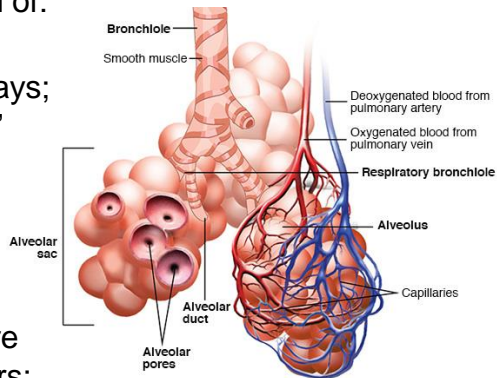


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Inside the Lungs

The lining of bronchioles contain cilia and mucous which trap contaminants and move them toward the esophagus, where they are swallowed.

Alveoli are surrounded by an extensive capillary network. All gas exchange between the air and blood occurs across the walls of the alveoli.

References

- 1.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.
- 2.Raven, P.H. (2005). *Biology, 7th Edition*. New York, NY: McGraw-Hill.

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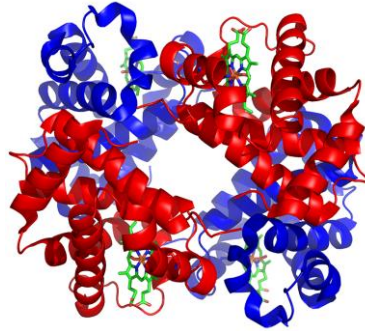
Key Words

respiratory system, lungs, bronchi, cilia, alveoli, bronchiole

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Hemoglobin

- Hemoglobin is the iron-containing oxygen-transport metalloprotein in red blood cells.
- In the lungs, hemoglobin picks up oxygen and forms oxyhemoglobin.
- As hemoglobin travels through the capillaries in the body, it releases oxygen and becomes deoxyhemoglobin.



Each hemoglobin unit can bind four oxygen molecules.



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Hemoglobin

Hemoglobin picks up oxygen in the lungs and transports it to other parts of the body. Oxygen-rich hemoglobin, known as oxyhemoglobin, has a bright red color. As oxyhemoglobin releases oxygen, it becomes deoxyhemoglobin, which imparts a bluish tinge to tissues.

Each hemoglobin molecule can bind four oxygen molecules. When oxygen binds to one subunit, it alters the conformation of the hemoglobin so that oxygen is more readily bound to the remaining unoccupied subunits. Once all subunits are bound and a subunit releases its oxygen molecule, the hemoglobin again changes conformation to more readily unload the remaining three oxygen molecules.

References

- 1.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.
- 2.Hemoglobin. Wikipedia CC-BY-SA 3.0.

<http://en.wikipedia.org/wiki/Hemoglobin>

3. Raven, P.H. (2005). *Biology, 7th Edition*. New York, NY: McGraw-Hill.

Image Reference

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http://commons.wikimedia.org/wiki/File:1GZX_Haemoglobin.png

Key Words

respiratory system, lungs, red blood cell, hemoglobin, oxygen deoxyhemoglobin

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Functions of the System

- The respiratory system provides the oxygen necessary for metabolism.
- Gas exchange occurs across specialized respiratory surfaces.
- Breathing serves to keep the body's blood gases and pH within normal range.



Functions of the System

Gas exchange uses a partial pressure gradient to diffuse gases from areas of high pressure to areas of lower pressure. In humans, air is inhaled through the nostrils, passes through the pharynx into the trachea, bronchi and bronchioles, and eventually reaches dead-end alveoli, where gas exchange occurs.

Humans ventilate their lungs through negative pressure breathing, which pulls air into the lungs. Breathing is under the reflex control of peripheral and central chemoreceptors, which maintain a breathing rate and depth needed to keep blood gases and pH levels within normal ranges. Neurons in the brainstem must be responsive to changes in blood oxygen and carbon dioxide levels to maintain homeostasis. Respiratory pigments, such as hemoglobin, increase the amount of oxygen that blood can carry.

References

1. Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition*. San Francisco, CA: Pearson Benjamin Cummings.

2. Raven, P.H. (2005). *Biology, 7th Edition*. New York, NY: McGraw-Hill.

Key Words

respiratory system, lungs, oxygen, gases, breathing

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