

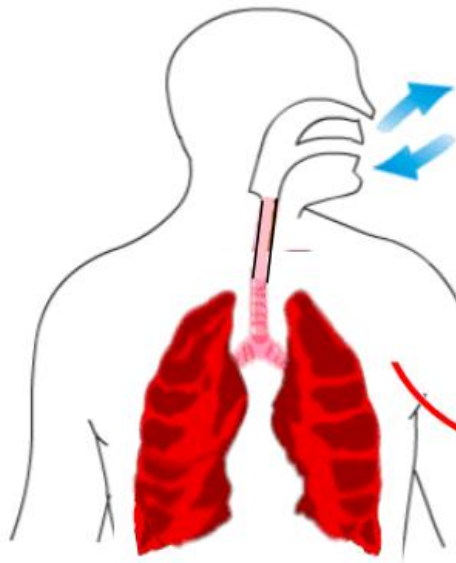
# Gas Exchange (Core)

Stephen Taylor

Bandung International School

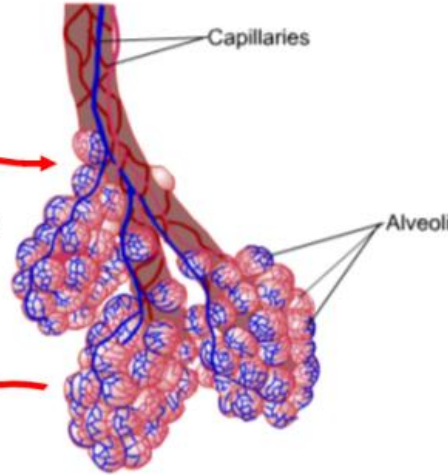
# Breathing is not Respiration!

<http://www.kfu.edu.sa/Colleges/College22/physiology/Respiratory%20basics.swf>



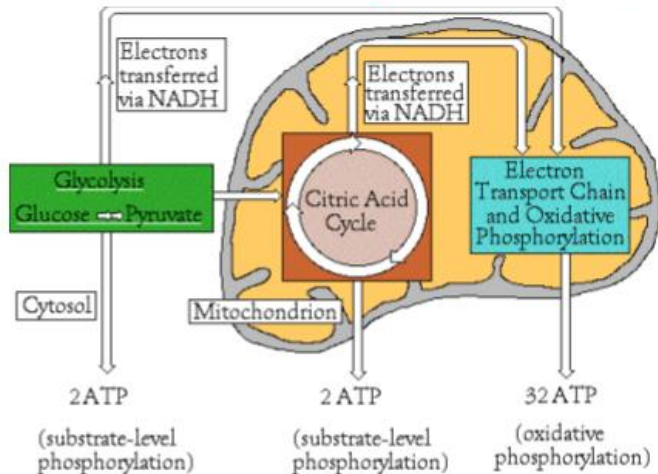
## Ventilation

Movement of air into and out of the lungs in two stages: inspiration and expiration. This is controlled by movement of the diaphragm and ribcage.



## Gas Exchange

The exchange (diffusion) of oxygen and carbon dioxide to and from the blood at the alveoli and the respiring tissues.



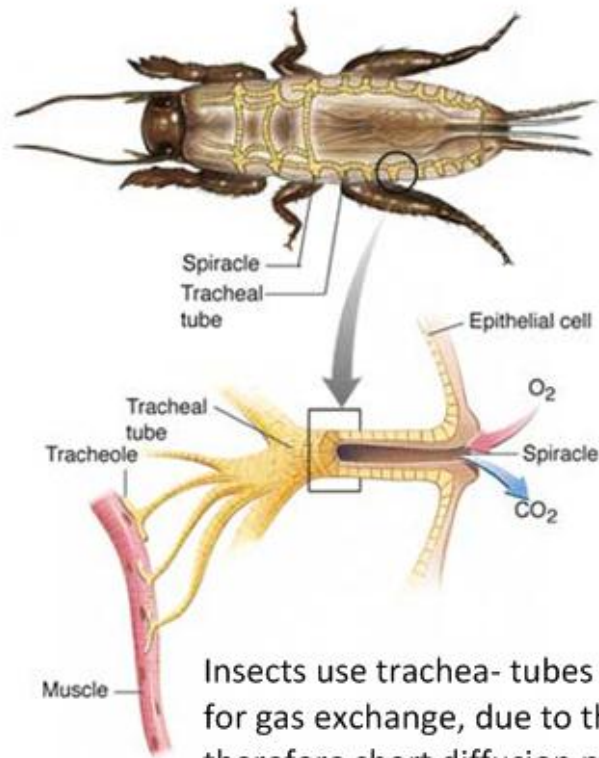
## Cell Respiration

This is production of ATP at the cellular level (mitochondria). Aerobic respiration uses oxygen, whereas anaerobic does not.

<http://home.earthlink.net/~dayvdanls/FormingATP.GIF>

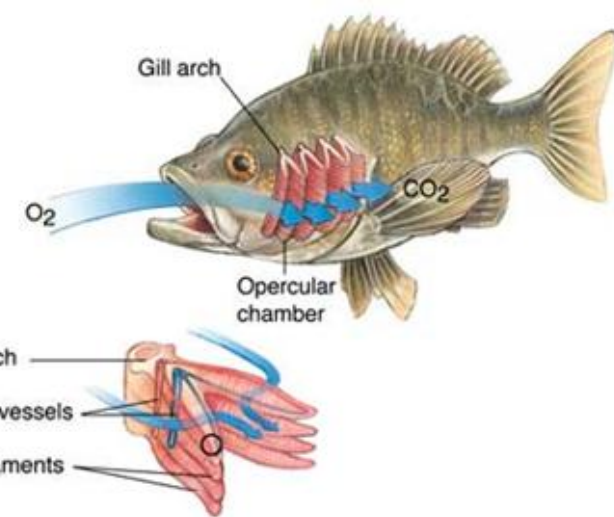
# The Ventilation System

Small organisms, such as flatworms, protists and bacteria, can exchange gases directly with their surroundings through diffusion. **Larger organisms** have adaptations that reflect their environments.



Insects use trachea- tubes from the exoskeleton - for gas exchange, due to their small size and therefore short diffusion path.

<http://163.16.28.248/bio/activelearner/44/ch44c3.html>



Gills extract  $O_2$  from and remove  $CO_2$  to water  
<http://163.16.28.248/bio/activelearner/44/ch44c5.html>

Land-based animals (and waterborne mammals), including humans, have evolved **internal ventilation systems** which allow for gas exchange with the blood.

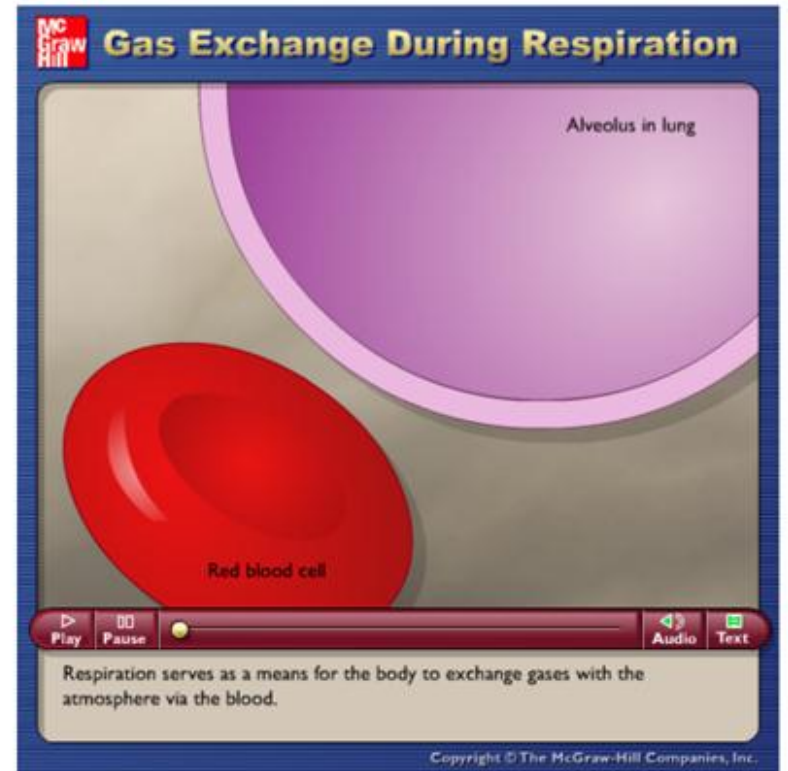
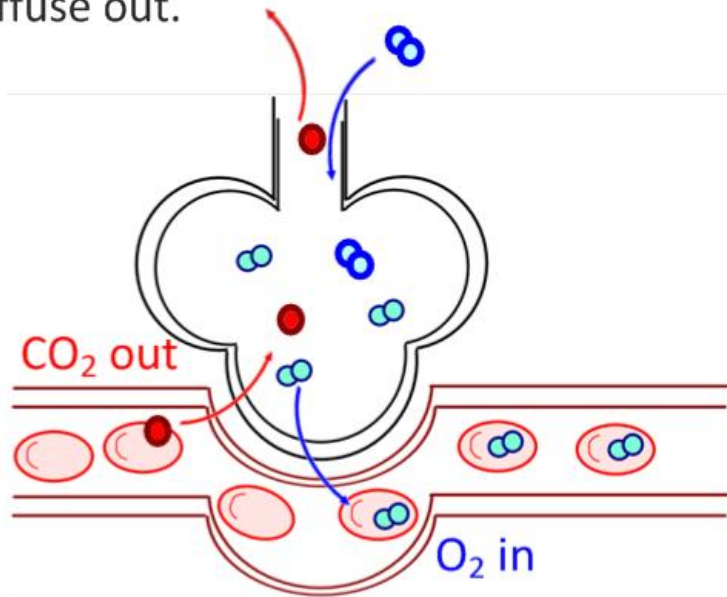
*Think about how structure, function and evolution are demonstrated in this topic.*

# The Ventilation System

For gas exchange to be efficient, **high concentration gradients** must be maintained in the alveoli.

**Breathing in** increases the concentration gradient of **oxygen** between the alveoli and blood - so it diffuses into the blood.

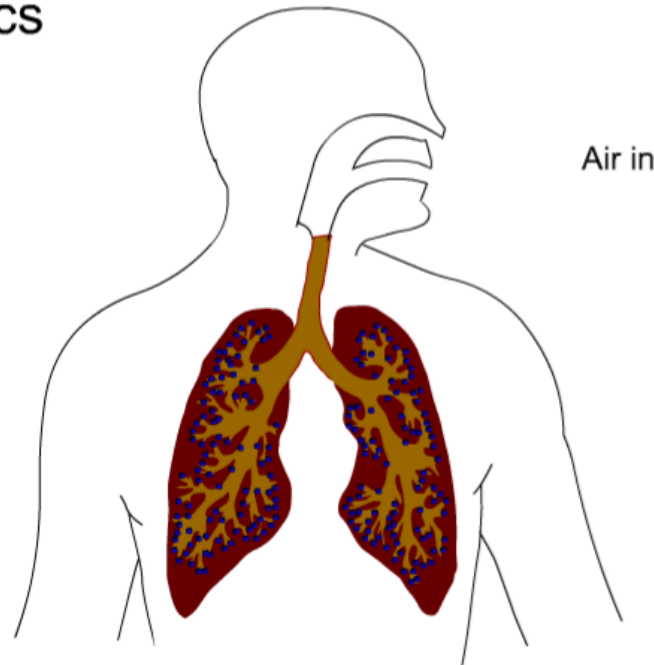
**Breathing out** removes **CO<sub>2</sub>** (and unused O<sub>2</sub>), increasing the concentration gradient of CO<sub>2</sub> between blood and alveolus - so CO<sub>2</sub> will diffuse out.



[http://highered.mcgrawhill.com/sites/0072495855/student\\_view0/chapter25/animation\\_gas\\_exchange\\_during\\_respiration.html](http://highered.mcgrawhill.com/sites/0072495855/student_view0/chapter25/animation_gas_exchange_during_respiration.html)

If the alveoli were not ventilated, equilibrium would be reached and not gas could be exchanged.

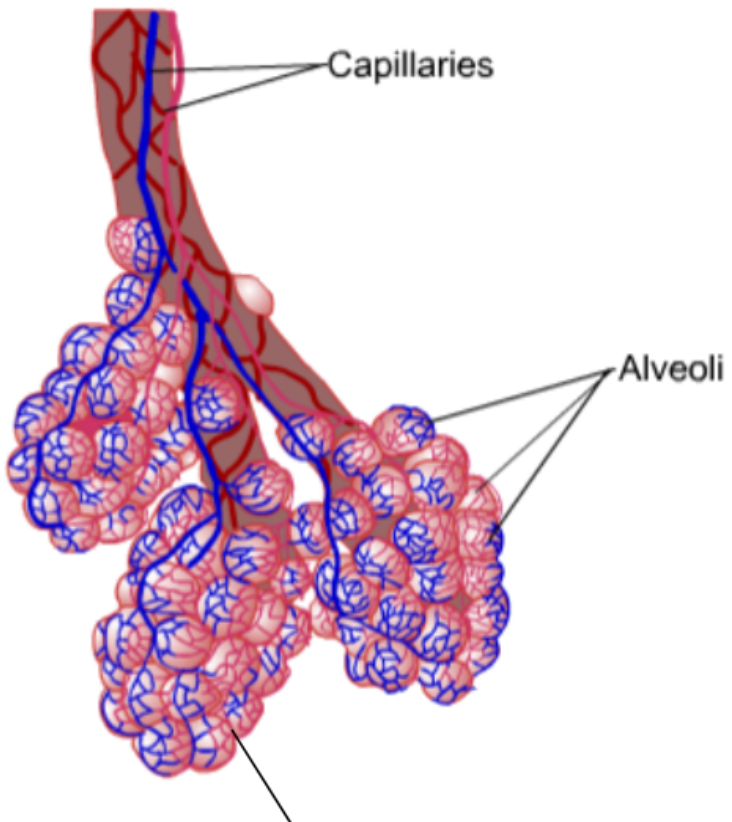
## Respiratory Basics



<http://www.kfu.edu.sa/Colleges/College22/physiology/Respiratory%20basics.swf>



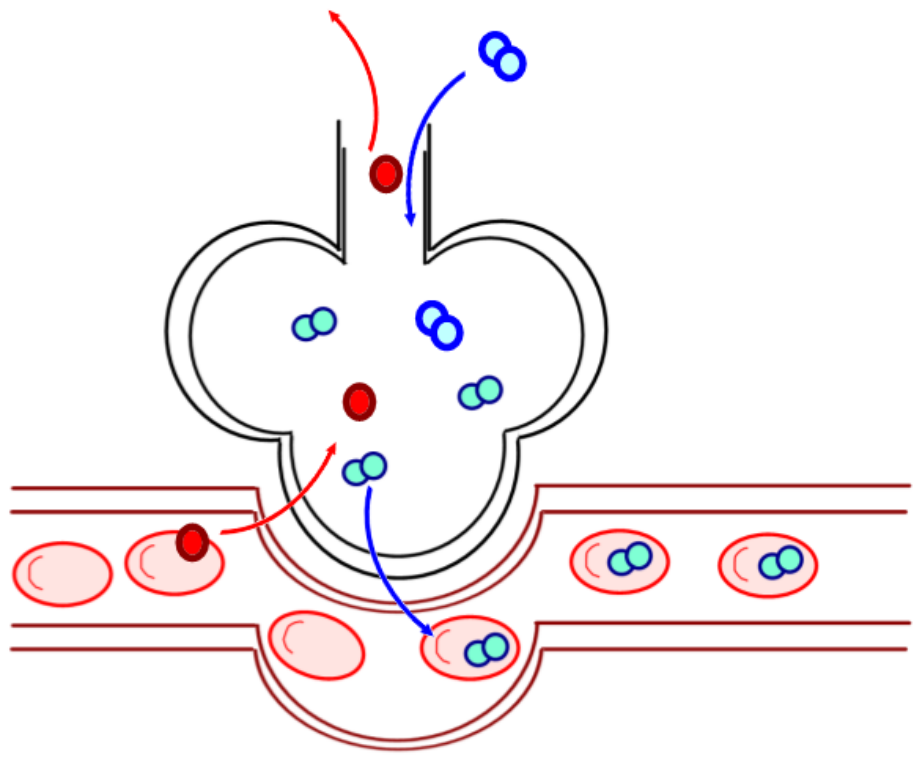
# Alveoli are well adapted to gas exchange



Alveoli increase the surface area for gas exchange. They are millions in number, each with their own network of capillaries - a rich blood supply maintains a high concentration gradient of O<sub>2</sub> and CO<sub>2</sub>.

Membranes are very thin - both of the alveoli and the capillaries - so the diffusion path is short.

Surfaces are wet - so gases are dissolved, making diffusion easier.

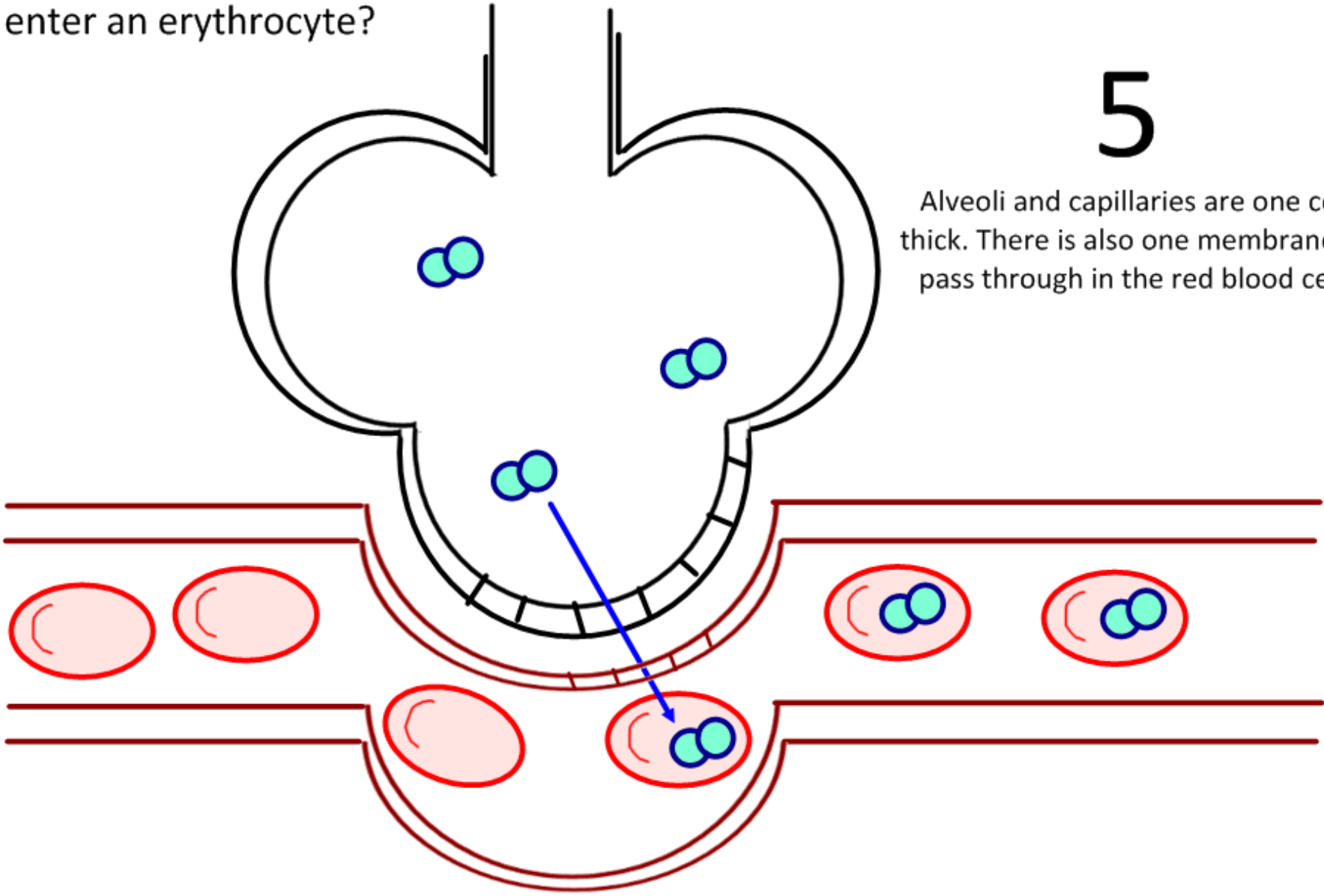


How many membranes must an oxygen molecule pass through in order to enter an erythrocyte?

How many membranes must an oxygen molecule pass through in order to enter an erythrocyte?

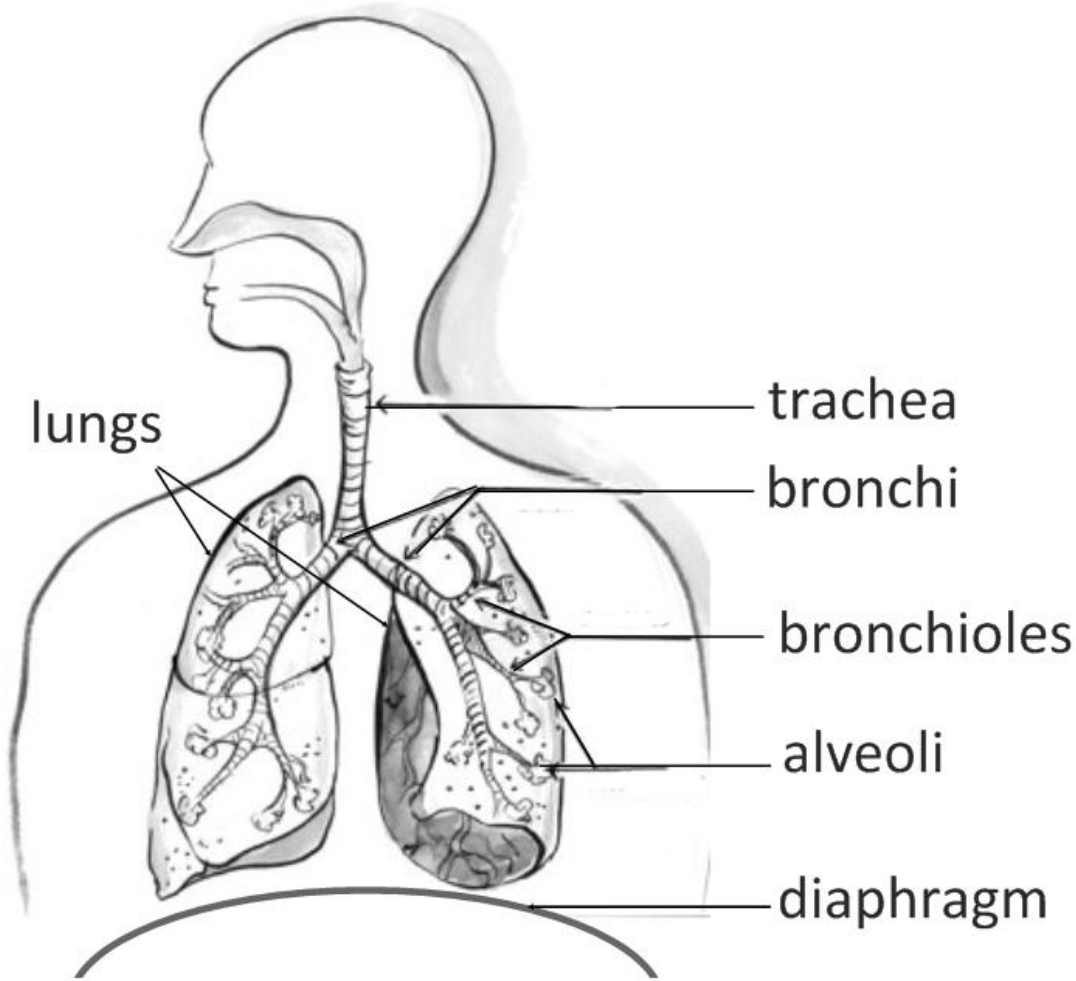
5

Alveoli and capillaries are one cell thick. There is also one membrane to pass through in the red blood cell.



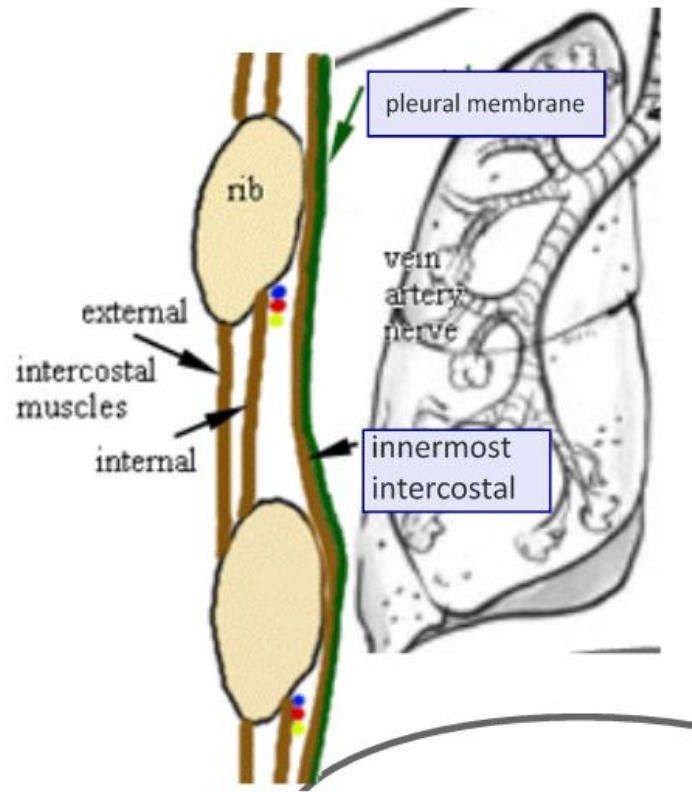


# The Ventilation System



<http://lawrencehallofscience.org/familyhealth/activities/breathing/images/LungDiagram.jpg>

Intercostal muscles control movement of the ribcage:



<http://www.med.mun.ca/anatomy/thorax/van.gif>

# Put the body back together!

skool.com

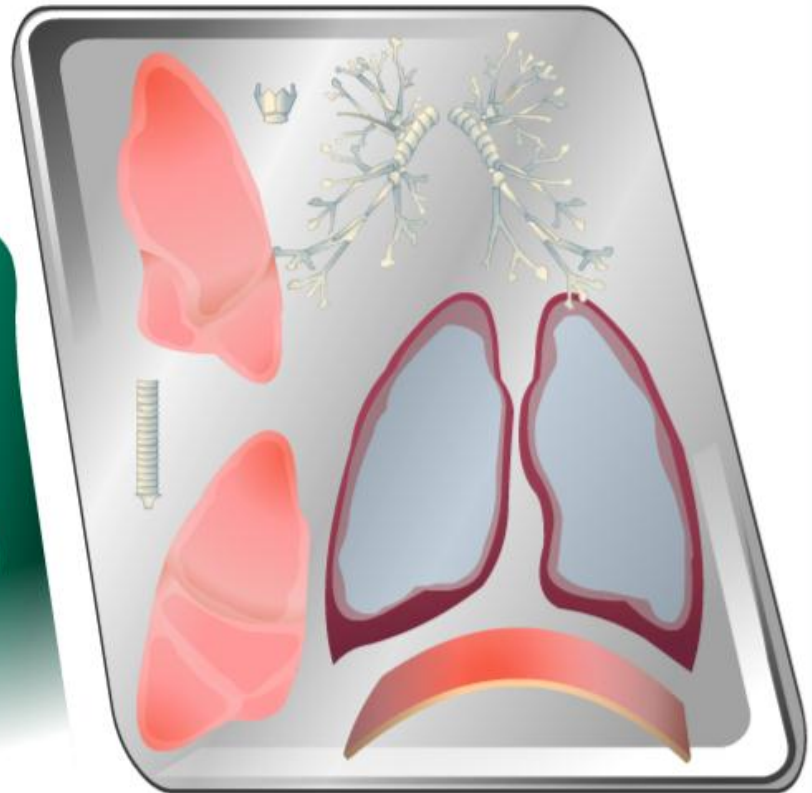
Copyright © 2004 Intel Corporation

## Breathing and Respiration

Reset



Resuscitate



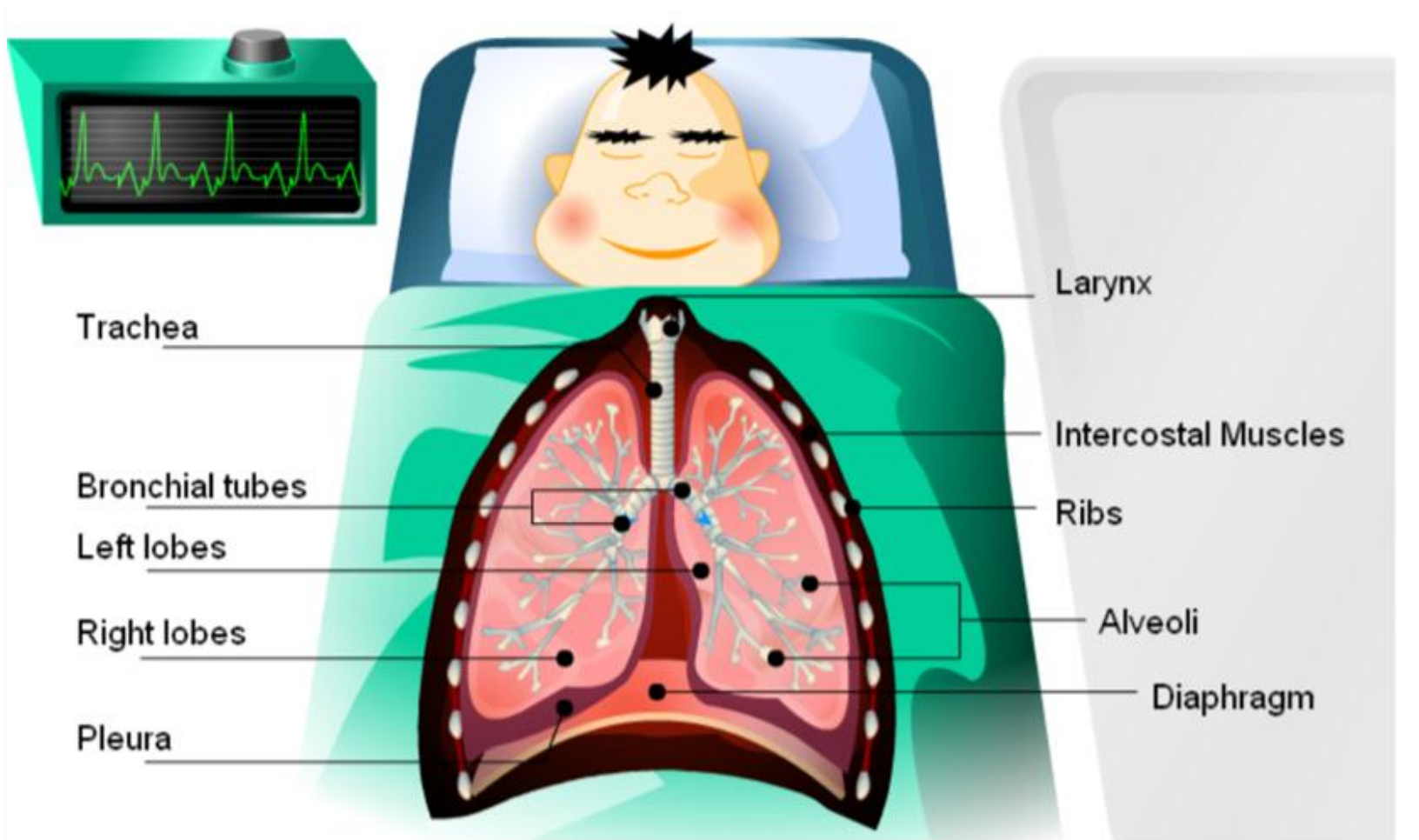
SMART  
Technologies Inc.

Supporting  
Education intel

<http://www.skool.co.uk/>



# The Ventilation System

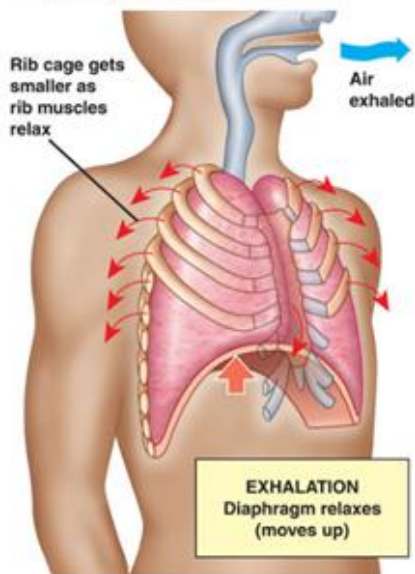
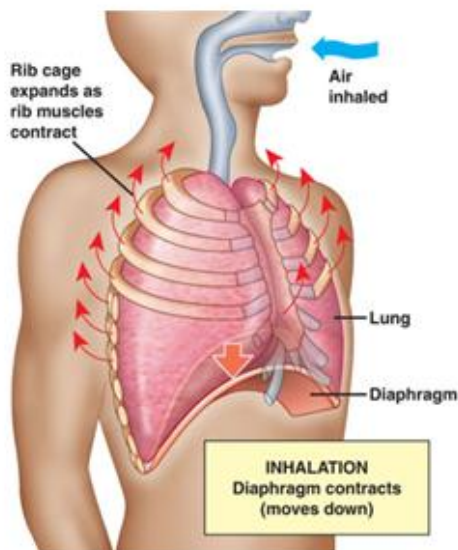


<http://www.skool.co.uk/>



# The mechanics of ventilation

[http://kvhs.nbed.nb.ca/gallant/biology/negative\\_pressure\\_breathing.html](http://kvhs.nbed.nb.ca/gallant/biology/negative_pressure_breathing.html)



## Inspiration:

External intercostal muscles contract.

Diaphragm contracts (drops).

Abdominal muscles relax.

Chest volume increases,  
pressure in lungs decreases,  
air enters.

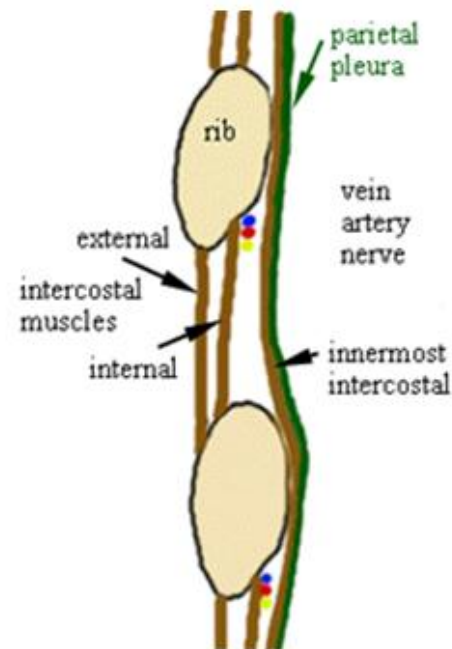
## Expiration:

Internal intercostal muscles contract.

Diaphragm relaxes (rises).

Abdominal muscles contract.

Chest volume decreases,  
Pressure in lungs increases,  
air is pushed out.



<http://www.med.mun.ca/anatomy/thorax/van.gif>



# Asthma (In case you're interested)

Asthma can be caused by environmental and genetic factors. Asthma attacks can be triggered by many factors and must be treated quickly and safely.



## Asthma: an animation



Asthma is a chronic condition that can be managed but not cured. This animation explains asthma in detail.

Visit also the [Health A-Z: asthma](#) section

Credits

show 

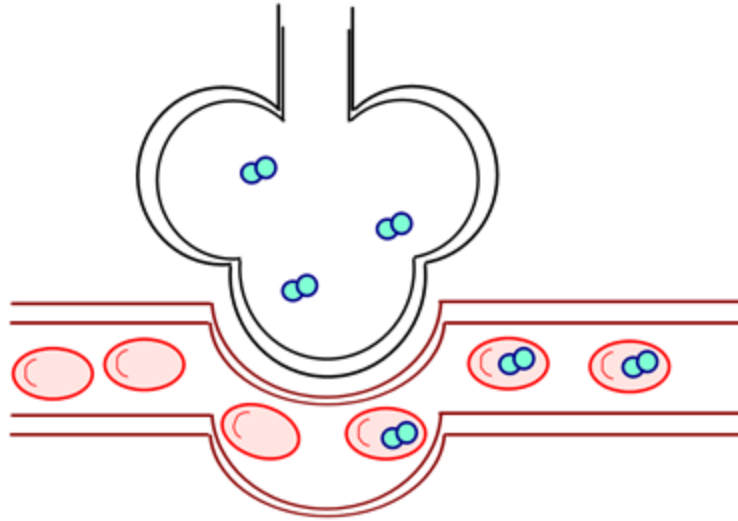
<http://tinyurl.com/37pn5lp>

Inhalers contain hormones which cause the bronchi. When an asthma attack occurs, the hormones relax the muscles of the bronchi to open up and allow air to flow normally.

Asthma sufferers must be aware of asthmatic triggers and take steps to avoid them (prevention).

Video and image source: UK NHS  
<http://tinyurl.com/37pn5lp>





For more IB Biology resources:

<http://sciencevideos.wordpress.com>