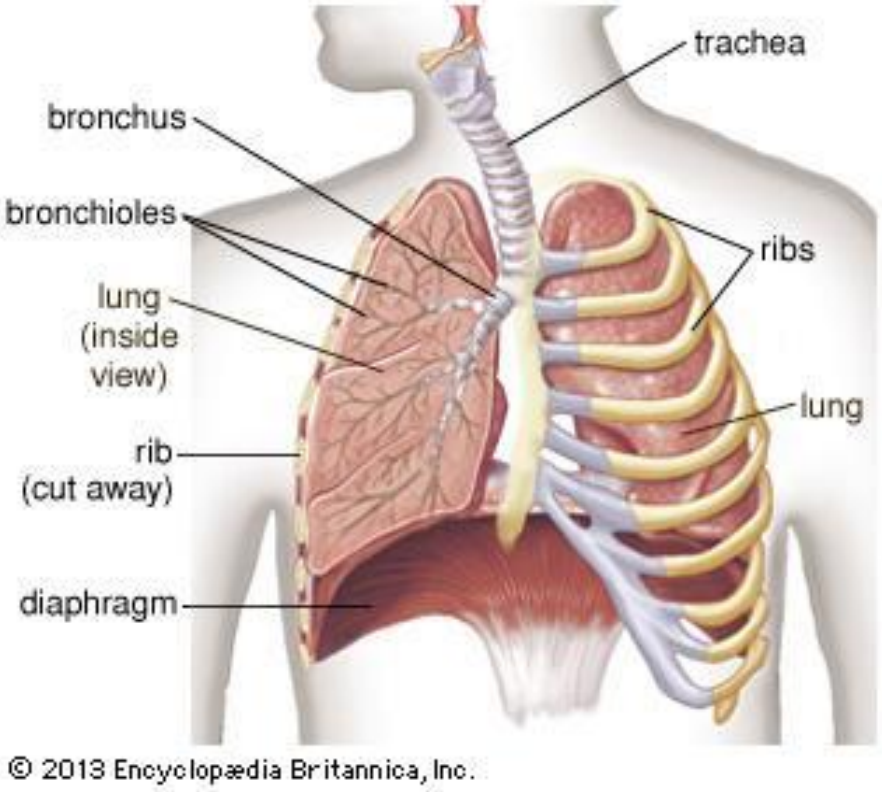
Human Respiration – V3



Respiration is all the processes that supply oxygen, O_2, to the cells of the body and the process by which carbon dioxide, CO_2, waste is removed from the lungs by

exhalation. There are four main steps to respiration:

1. Breathing or ventilation – the physical movements of air to and from the lungs.

A. **At rest**

B. **Inspiration or inhalation**

a. signal from medulla oblongata

b. nerve signal causes rib muscles and diaphragm to contract

c. thoracic cavity size increases and lung air pressure decreases

d. air enters the lungs

C. **expiration or exhalation**

a. muscles relax

b. pressure on lungs increases

c. air pushed out of the trachea

2. External Respiration – diffusion of O_2 from the air in the alveoli to the blood in the capillaries and removing CO_2 from the blood.

3. Internal Respiration – diffusion of O_2 from the blood into the cells and removal of CO_2.

4. Cellular Respiration – involves the production of ATP energy molecules in the body's cells by aerobic breakdown of glucose **(in the mitochondria)**

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + 36\ ATP$$

Molecules naturally **diffuse** from areas of high concentration to areas of low concentration through cell membranes. For bacteria and other single celled organisms this is the only way gases can enter or leave the organism. Diffusion only works well when there is a large surface area to cell volume. This is why cells are all small and

organisms often use **folds** in membranes to increase surface area.

The chart below shows that when the radius increases the ratio of surface to volume in a cell decreases making diffusion very difficult. This is why cells are small.

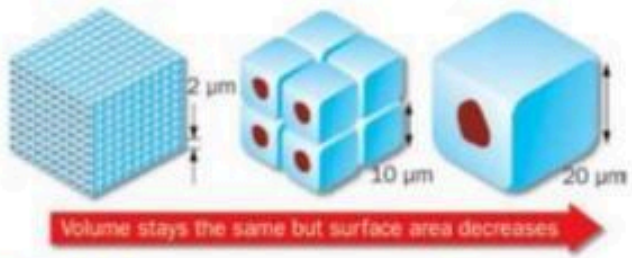


Figure 2.2.9 The size of cells and their surface area and volume

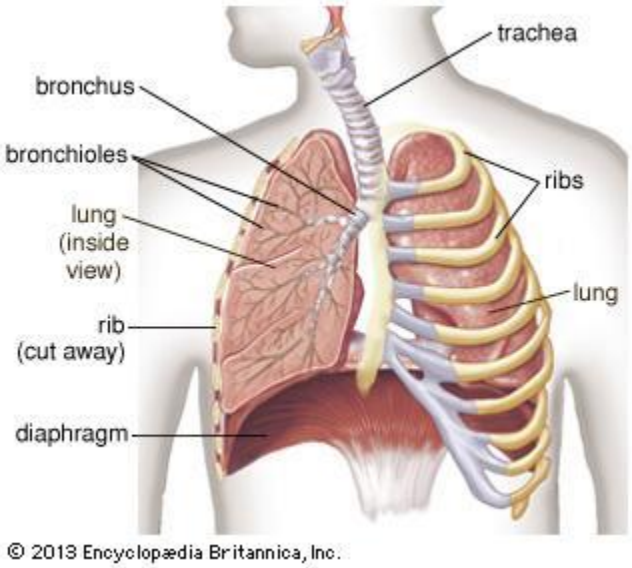
Table 2.2.4 Surface area to volume ratio of spherical cells

Radius	2 µm	10 µm	20 µm
Total surface area $4\pi r^2$	50 μm^2	1256 μm^2	5024 μm^2
Total volume $^4/_3\pi r^3$	33 μm^3	4187 μm^3	33 493 μm^3
Surface area/volume ratio	1.5	0.3	0.15

Table 1.2 Surface area to volume ratios

Factor	Measurement		
Cell radius (r)	0.25	0.50	1.25
Surface area	0.79	3.14	19.63
Volume	0.07	0.52	8.18
Surface area : volume ratio	11.29:1	6.04:1	2.40:1

Human Respiration v3



Respiration is

_____

___, O_2, to the cells of the body and the process by which _____ is removed from the lungs by exhalation. There are four main steps to respiration:

1. Breathing or _____ – the physical movements of air to and from the lungs.

A. _____

B. Inspiration or _____

a. signal from _____

b. nerve signal causes

_____

c. thoracic

_____

d. _____

C. expiration or _____

a. muscles _____

b. pressure on lungs _____

c. _____ of the trachea

2. _____ Respiration – _____ of O_2 from the air in the alveoli to the blood in the capillaries and removing CO_2 from the blood.

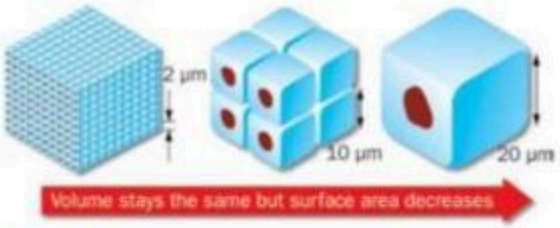
3. _____ Respiration – diffusion of _____ and removal of CO_2.

4. _____ Respiration – involves the _____ molecules in the body's cells by aerobic breakdown of glucose

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + 36\ ATP$$

Molecules naturally **diffuse** from areas of _____ concentration _____ concentration _____. For bacteria and other single celled organisms this is the only way gases can enter or leave the organism. Diffusion only works well when there is a _____. This is why cells are all small and organisms often use folds in membranes to increase surface area.

The chart below shows that when the _____ the ratio of surface to volume in a cell decreases making diffusion very difficult. This is why _____ _____.



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Human Respiratory System: