

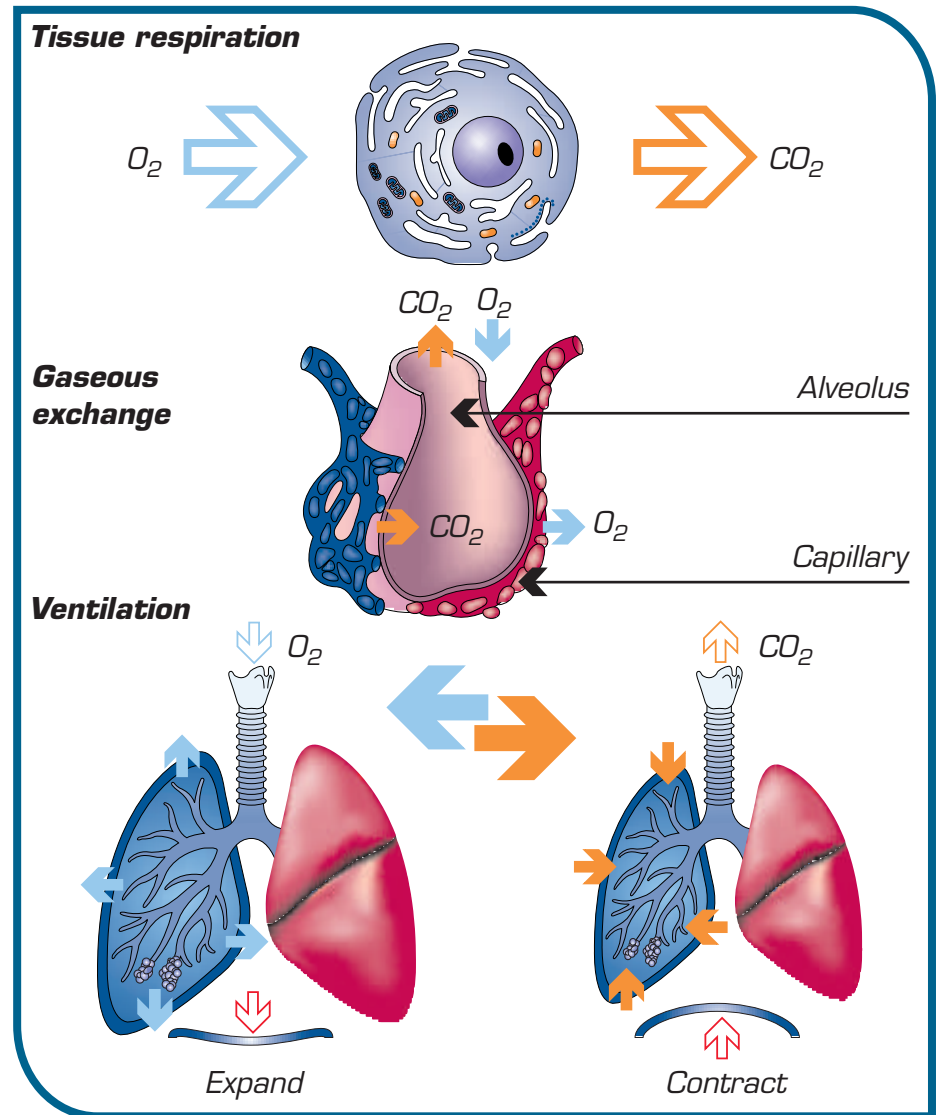


introduction

The term 'respiration' actually refers to three different processes:

- **tissue respiration:** movement of oxygen into cells to produce energy and removal of carbon dioxide – a waste product – from the cells
- **gaseous exchange:** movement of oxygen from alveoli into the bloodstream and of carbon dioxide from the bloodstream into the alveoli
- **ventilation:** the mechanics of inspiration (breathing in) and expiration (breathing out).

These are unconscious processes that we all do without a second thought, but the mechanisms behind them are complex.





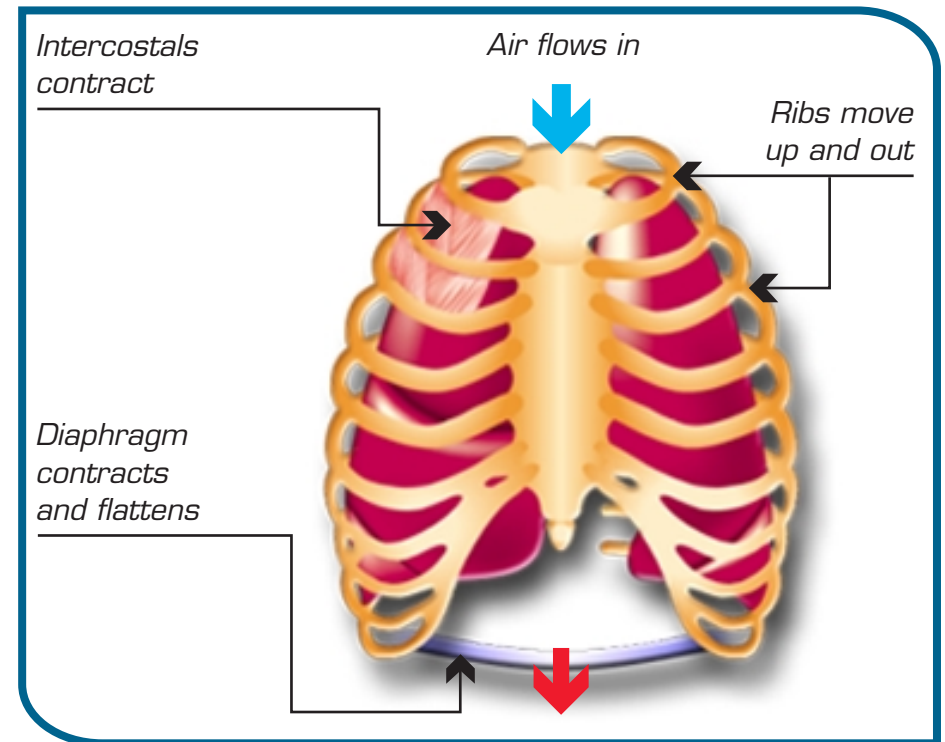
the mechanics of breathing

Breathing is the flow of air into and out of the lungs, which is dependent on pressure gradients – differences in gas pressure from one area to another. A gas will flow from the area of higher pressure to the area of lower pressure.

Inspiration

For air to flow into the lungs on inspiration, the pressure in the lungs must be lower than atmospheric pressure. This is achieved by increasing the volume of the lungs. The diaphragm contracts and flattens and the intercostal muscles contract to expand the ribcage. The resulting increase in lung volume causes the pressure in the lungs to fall slightly below atmospheric pressure.¹ Even though the pressure gradient is small, it is sufficient to draw around 500–700ml of air into the lungs because there is little resistance to the flow of air.

If the body needs more oxygen, the volume of each breath must be increased. This is partly achieved by the relaxation of the smooth muscle of the bronchiolar walls, which enlarges the bronchioles and reduces airflow resistance. Using the accessory muscles of inspiration (e.g. shoulder and neck muscles) can also improve the delivery of air to the lungs.





transport of gases in blood

Oxygen is carried in the bloodstream by a molecule called haemoglobin, found in red blood cells. Haemoglobin takes up oxygen from tissues with a high oxygen concentration (e.g. the lungs) to form oxyhaemoglobin,¹ the main form in which oxygen is transported in the bloodstream.

Oxyhaemoglobin gives blood its characteristic red colour.

When the oxygen concentration is low (e.g. in tissues that are using oxygen), oxyhaemoglobin releases its oxygen.¹ The darker-coloured haemoglobin can then return to the lungs to collect more oxygen.

In people with respiratory disease, low oxygen levels can cause a reduction in oxyhaemoglobin levels and an increase in haemoglobin levels. This may cause the patient to look slightly blue (cyanosed), particularly around the lips.

