Gaseous Exchange

This is the exchange of respiratory gases between cells and the environment.

Aerobic organisms require O_2 to produce ATP during respiration and they must get rid of CO_2. The area where gaseous exchange takes place is called respiratory surface. It takes place by diffusion. Organisms which have a large SA:V gaseous exchange occurs by simple diffusion. Larger organisms have developed into specialised respiratory surfaces.

Fick's Law:

Rate of diffusion α SA x difference of concentration on either side

Thickness of respiratory surface

Respiratory surface:

- Permeable and thin
- Large SA
- Good blood supply (steep diffusion gradient)

Respiratory pigments: increase the efficiency of the blood's oxygen carrying capacity since it permits for greater amount of O2 to be taken up and transported. They contain a coloured non-protein portion (e.g. haem in haemoglobin)

Oxygen availability in aquatic environments

Air contains more oxygen, water is denser and more viscous than air, oxygen diffuses much slower through water. Every cell is surrounded by an extracellular fluid, therefore the slow diffusion of oxygen in water affects air-breathing organisms, and therefore every cell in the body is close to a blood vessel.

Temperature and gas content of water

Warm water hold less dissolved gas but with increasing temperature the organism needs more oxygen.

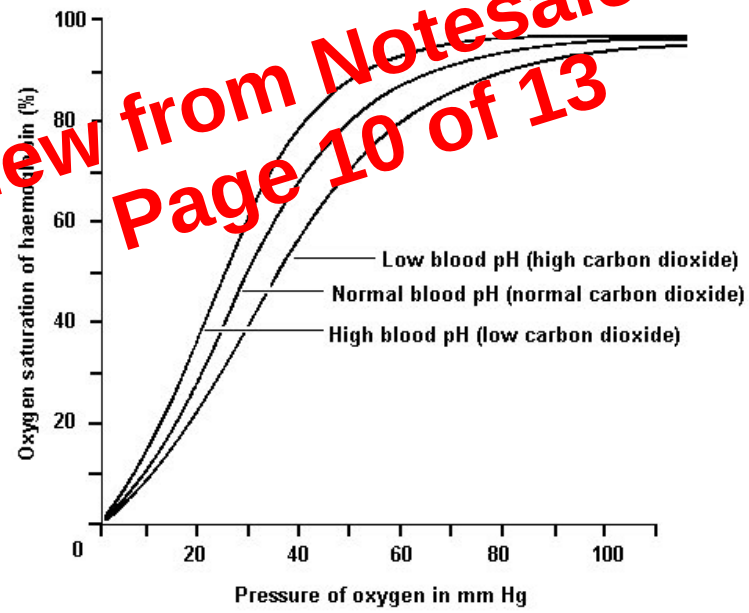
Myoglobin shows a great affinity for oxygen. It provides a reserve of oxygen for muscles for times when metabolic demands are high and blood flow is interrupted. Diving muscles have high concentrations of myoglobin therefore they can stay under water for so long.

Foetal haemoglobin has a higher affinity for oxygen than normal haemoglobin.

Over the steep part of the curve, a small decrease in the oxygen partial pressure of the environment will bring about a large fall in the percentage saturation of haemoglobin.

The Bohr Effect

In regions with an increased partial pressure of CO_2, the curve shifts to the right. This is the Bohr Effect. The increase in CO_2, causes the haemoglobin to release its O_2.



Transport of carbon dioxide

It is carried by the blood in three different ways:

1. In solution: transported in physical solution