

The site of gas exchange in mammals is the epithelium of the alveoli.

To ensure a constant supply of oxygen to the body, a diffusion gradient must be maintained at the alveolar surface.

To enable efficient transfer of materials across them, exchange surfaces are thin, partially permeable and have a large surface area. To maintain a diffusion gradient, there also has to be movement of both the environmental medium (air) and the internal medium (blood).

Being thin, these specialised exchange surfaces are easily damaged and so are often located inside an organism for protection.

Where an exchange surface (like the lungs) is located in the body, the organism has some means of moving the external medium over the surface, like a means of ventilating the lungs in a mammal.

This is because diffusion alone isn't fast enough to maintain adequate transfer of oxygen and carbon dioxide along the trachea, bronchi and bronchioles.

Exchange of gases in the lungs

Role of the alveoli in gas exchange:

There are about 300 million alveoli in each human lung. Each alveolus is lined with epithelial cells. Around each alveolus is a network of pulmonary capillaries, so narrow that red blood cells are flattened against the thin capillary walls in order to squeeze through. These capillaries have walls that are only a single layer of cells thick.

Diffusion of gases between the alveoli and the blood will be very rapid because:

- Red blood cells are slowed as they pass through the pulmonary capillaries, allowing more time for diffusion.
- The distance between the alveolar air and red blood cells is reduced as the red blood cells are flattened against the capillary walls.
- The walls of both alveoli and capillaries are very thin = the distance over which diffusion takes place is very short.
- Alveoli and pulmonary capillaries have a very large total surface area.
- Breathing movements constantly ventilate the lungs, and the action of the heart constantly circulates blood around the alveoli. Together, these ensure that a steep concentration gradient of the gases to be exchanged is maintained.
- Blood flow through the pulmonary capillaries maintains a concentration gradient.

