

Gas exchange

Why does gas exchange become harder as organisms increase in size?

Gas exchange

Four properties of a gas-exchange surface

Gas exchange

Three ways animals maintain concentration gradients at exchange surfaces

Gas exchange

Surfactant

Gas exchange

How does the branched network of bronchioles help gas exchange?

Gas exchange

Why are the alveoli covered in extensive capillary beds?

Gas exchange

Muscle actions during inspiration

Gas exchange

Muscle actions during forced expiration

Permeable, thin tissue layer, moist and large surface area.

Surface area-to-volume ratio decreases and the distance from the centre to the exterior increases.

Fluid lining the alveoli that reduces surface tension, so alveoli do not stick together and collapse when air is breathed out.

Dense networks of blood vessels, continuous blood flow, and ventilation with air (lungs) or water (gills).

Blood flows close to all of the surface, removing O_2 and bringing CO_2 to keep gradients steep.

It carries air to and from hundreds of millions of alveoli, giving a very large surface area.

Internal intercostals contract, ribs move down and in; abdominal muscles contract, pushing the diaphragm up. Thorax volume falls, pressure rises.

Diaphragm contracts and flattens; external intercostals contract, ribs move up and out; abdominal muscles relax. Thorax volume rises, pressure falls.

Gas exchange

Vital capacity

Gas exchange

Tidal volume

Gas exchange

**Role of the waxy cuticle and epidermis
in gas exchange**

Gas exchange

**Role of spongy mesophyll and air
spaces**

Gas exchange

Plan diagram

Gas exchange

Transpiration

Gas exchange

**Four factors that increase the rate of
transpiration**

Gas exchange

How is stomatal density calculated?

The volume of air breathed in or out in one normal breath.

Tidal volume + inspiratory reserve volume + expiratory reserve volume: the most air that can be breathed out after the deepest breath in.

Air spaces let gases diffuse through the leaf; moist spongy mesophyll walls give a large surface for gas exchange.

Reduce water loss by evaporation; the transparent epidermis protects the leaf and lets light through.

Loss of water vapour from the leaves and stems of plants, a consequence of opening stomata for gas exchange.

A diagram showing the distribution of tissues as outlined areas, with no individual cells drawn.

Number of stomata in the field of view $\div$ area of the field of view (πr^2), usually in stomata per mm^2 .

Higher light intensity, higher temperature, lower humidity and higher wind speed.

Transport

Three adaptations of capillaries for exchange

Transport

Fenestrations

Transport

How to tell an artery from a vein in a micrograph

Transport

Role of elastic fibres in arteries

Transport

Role of smooth muscle in arteries

Transport

Two adaptations of veins for returning blood

Transport

Where can the pulse be felt?

Transport

Occlusion of a coronary artery

Pores in the walls of some capillaries, for example in the kidney glomerulus, that allow particularly rapid exchange.

Branching and narrow diameters (large surface area), thin walls one cell thick, and fenestrations where exchange must be rapid.

Stretch when blood is pumped in and recoil between beats, maintaining high pressure and pushing blood on.

Artery: thick wall compared with a narrow, round lumen. Vein: thin wall compared with a wide, often flattened lumen.

Valves prevent backflow; thin, flexible walls are compressed by contracting skeletal muscles, pushing blood towards the heart.

Contracts to narrow the lumen, helping to maintain blood pressure; the thick wall withstands high pressure.

Blockage by fatty plaque (atherosclerosis) or a blood clot, cutting O₂ supply to cardiac muscle and causing a heart attack.

At the radial artery (inside of the wrist) or carotid artery (neck), using fingertips, not the thumb.

Transport

What does a correlation coefficient show?

Transport

Cohesion-tension mechanism

Transport

Four adaptations of xylem vessels

Transport

Arrangement of tissues in a dicotyledonous stem

Transport

Arrangement of tissues in a dicotyledonous root

Transpiration draws water out of xylem by capillary action, creating tension that pulls water up; cohesion keeps the column continuous.

The strength of the correlation between two variables, from -1 to $+1$. A strong correlation does not prove causation.

Epidermis, cortex, ring of vascular bundles (phloem outside, xylem inside) and central pith.

No cell contents, incomplete or absent end walls, lignified walls to withstand tension, and pits for water entry and exit.

Epidermis with root hairs, wide cortex, central vascular region with star-shaped xylem and phloem between its arms.