Science 10

Unit C: Cycling of matter in living systems

Surface area to volume and cell size

Exchange limits in two cubes

- A 1 cm cube has a surface-area-to-volume ratio of 6:1.
- A 3 cm cube has a ratio of 2:1, so each cubic centimetre has less surface available for exchange.

Area and volume growth

- Larger cells have more total area but less area relative to each unit of volume.
- Volume grows with length cubed while surface area grows with length squared.
- Quantify how cell size changes surface-area-to-volume ratio and limits exchange.

Key terms

surface area

The total area of an object's outer boundary.

volume

The three-dimensional space occupied by an object.

surface-area-to-volume ratio

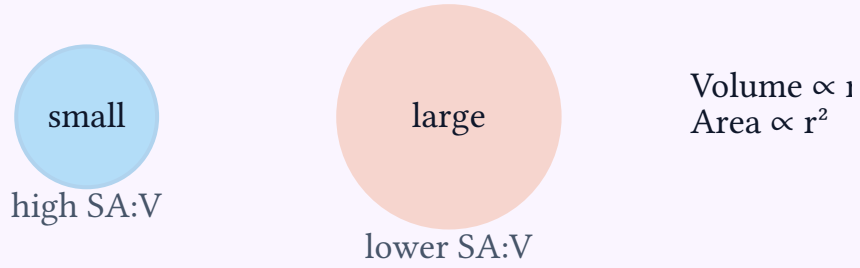
Surface area divided by volume; a measure of exchange area relative to internal demand.

exchange rate

Amount of matter or energy crossing a boundary per unit time.

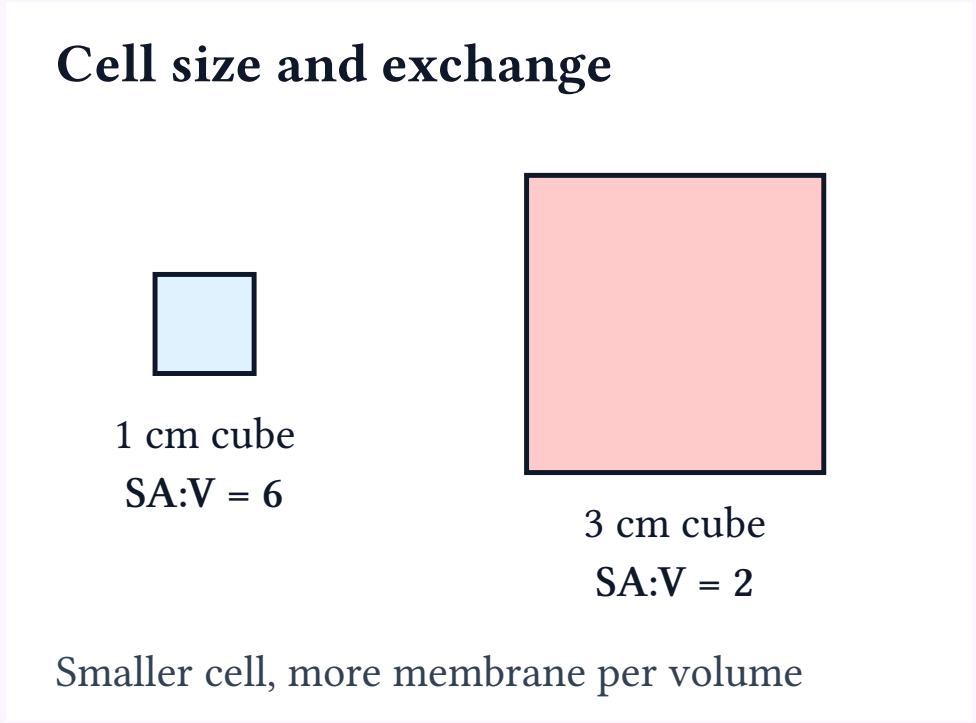
Surface area to volume ratio

- Compare a tiny cell with a larger one of the same shape.
- Volume increases faster than surface area as the side length grows.
- The bigger cell has more membrane in total and less membrane for each unit inside.
- Nerve cells, blood cells, root hairs, and leaf cells stay small or folded for that reason.



Cell size and exchange

- The inside of a cell has to be supplied through its surface.
- If volume outgrows the membrane, exchange falls behind.
- Organisms answer that limit with many small cells, folds, and transport tissues.
- Plants and animals solve the problem with many small cells.



Calculation and explanation

- Calculate ratios for two cubes and connect the result to membrane exchange.
- A complete answer uses the right formulas and units, reports the ratios, and explains relative surface area, the surface for each unit of volume.