Why are cells so small?

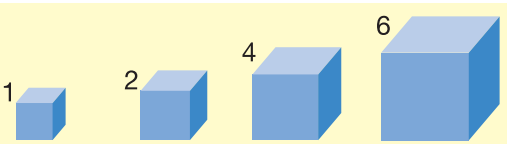
One characteristic of cells is that they are very small. Why are cells so small? The answer has to do with the cell membrane.

Cells need a large surface area

Everything the cell needs to take in or has to get rid of has to go through the cell membrane. Therefore the cell membrane needs to have a large surface area in relation to the volume of the cell. As a cell gets bigger, so does its surface area. However, the volume of a cell increases at a faster rate than the surface area of its cell membrane. If a cell gets too large, its cell membrane will not have enough openings to meet the demands of its volume. This limits the size of cells.

The volume of a cell increases faster than its surface area

To understand why the volume of a cell increases faster than its surface area, let's imagine a perfectly square cell. The *surface-area-to-volume ratio* is the area of the cell's outer surface in relationship to its volume.



Surface area (cm^2)	6	24	96	216
Volume (cm^3)	1	8	64	216
Surface area: Volume	6:1	3:1	1.5:1	1:1

Long and thin cells

One way to increase surface area is to make the cell long and thin or skinny and flat. The nerve cells in your body are very long and thin. A thin, flat cell has a volume of: $16 \times 4 \times 0.125 = 8$. The cell's surface area is: $2(16 \times 0.125) + 2(16 \times 4) + 2(4 \times 0.125) = 133$. The surface-area-to-volume ratio is 133:8 (Figure 6.5).

VOCABULARY

(Discussed on previous page.)

active transport - a process that allows molecules to move across the cell membrane from lower to higher concentrations.

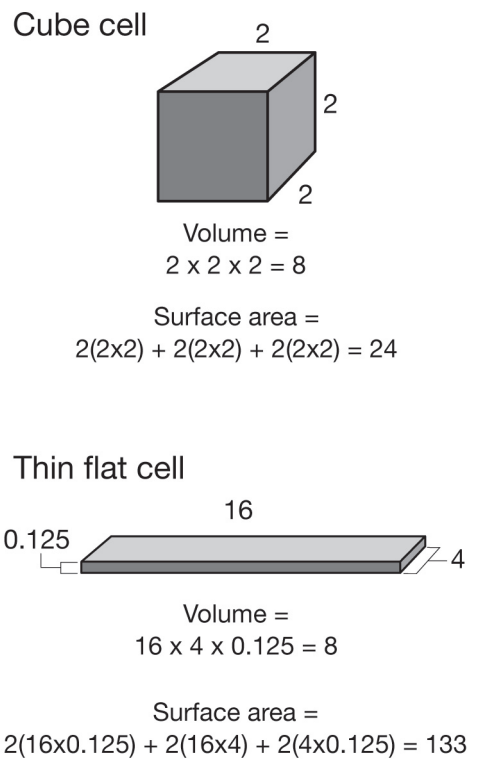


Figure 6.5: *A thin, flat cell has a higher surface-area-to-volume ratio than a square cell of the same volume.*