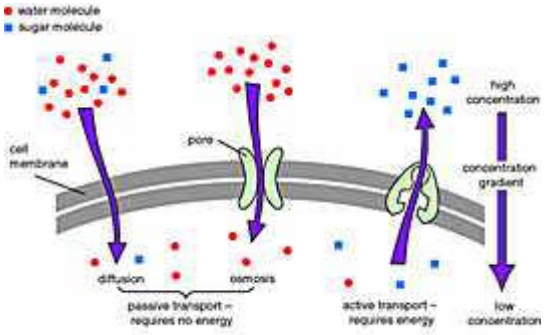
Crossing the Membrane

Generally obey **Fick's Law**: $\frac{\text{Surface Area} \times \text{Concentration Difference}}{\text{Distance}}$

Any tissue designed for absorption has: **maximised SA** (villi/microvilli/alveoli); and will use **active transport out** (to ↑ conc. Diff.); be **thin**, (thus close to blood supply/food/air)

Passive: Molecules move **down the concentration gradient** (high → low)
Simple Diffusion: gases (O_2, CO_2) pass **between molecules** in membrane
Facilitated Diffusion: uses carrier (channel) proteins to cross membrane (glucose, amino-acids etc.)
Osmosis: water **only.** Goes **down the water potential gradient** (less –ve towards more –ve)



Active: **Against the concentration gradient**; needs ↑ energy (**ATP**); ↑ **respiration**; ↑ **mitos**.
Ions/small molecules: **sodium pump** (**Na^+ out, K^+ in**). Found in **all cells**
Large molecules: enter through **pinocytosis**; leave through **secretion** (vesicles, Golgi body)
Particles: Enter through **phagocytosis** (WBC's, *Amoeba*)

Tools & Techniques

Cell fractionation: Break open cells with ultrasound/homogeniser;
use ice-cold osmotic buffer (to keep organelles intact); then use
Centrifuging: organelles settle in size order:
nucleus; chloroplasts; mitochondria; lysosomes; e.r./ribosomes; remaining cytoplasm = **supernatant**
Chromatography: chemicals identified by **R_f values**, which remain constant (table of data)
Calculation: distance to **front** of spot ÷ distance moved by **solvent** (= solvent front). **Use mm's!**
Staining: **Gram's** with bacteria (+ve = black, -ve = pink); **Heavy metals** for e-m's
all stains show up (particular) parts of cells – so **name the part**
(nucleus / DNA /chromosomes / starch grains /cell wall)
Squashing: makes cells spread out (and flat), so easier to see
Sectioning: Allows light through, one cell thick; easier to see cells
Food Tests: Sugars - Benedicts; Starch - iodine **solution;** protein – biuret; lipids - ethanol/emulsion
Light microscope: + points: easy to use, portable, colour, movement, (< x 1,000)
Transmission e.m. + points: **high resolution** (due to short wavelength) x 50,000+
Scanning e.m. + points – 3-D images of **surface** of object (with high resolution) x 200-10,000
Magnification calculations: Distance across object (mm) ÷ magnification (1000's) = real size (µm)