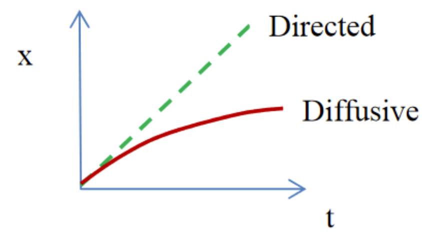
CHAPTER OVERVIEW

15: Passive Transport

Passive transport is often synonymous with diffusion, where thermal energy is the only source of motion.

$$\langle r(t)\rangle = 0 \qquad \langle r^2(t)\rangle^{1/2} = \sqrt{6Dt} \qquad r_{rms} \propto \sqrt{t}$$

In biological systems, diffusive transport may work on a short scale, but it is not effective for long-range transport. Consider:



$\langle r^2\rangle^{1/2}$ for small protein moving in water

~10 nm → 10^{-7} s

~10 μm → 10^{-1} s

Active transport refers to directed motion:

$$\langle r(t)\rangle = \langle v\rangle t \qquad r \propto t$$

This requires an input of energy into the system, however, we must still deal with random thermal fluctuations.

How do you speed up transport?

We will discuss these possibilities:

- Reduce dimensionality: Facilitated diffusion
- Free energy (chemical potential) gradient: Diffusion in a potential
- Directional: Requires input of energy, which drives the switching between two conformational states of the moving particle tied to translation.

15.1: Dimensionality Reduction

15.2: Facilitated Diffusion

15.3: Search Times in Facilitated Diffusion