كلية المستقبل الجامعة
الفيزياء الحياتية
المرحلة الثانية

Biophysics

second lecture

Diffusion and directed transport

Second stage

Department of medical physics

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1- Diffusion and directed transport

1-1 Fick's laws of diffusion

The diffusion of molecules is dependent on the gradient of those molecules over a distance. The measurement of flux is the amount of material moved through a cross sectional area in a given time. These conditions, such as the viscosity of the medium or the temperature, will affect how fast the material will diffuse. The unit of flux is mol/cm2·s. This is intuitively satisfying, for it tells you the number of molecules (mol) moving through a given area (cm2) over a given time (seconds). The flux Jx through area A in the x-direction for a given concentration gradient dC/dx is:

$$Jx=-DA\frac{dc}{dx} \quad ... (3\text{-}1)$$

where D is the diffusion coefficient, the proportionality constant determined by the conditions of the medium and the physical properties of the molecule, such as the molecular weight. The concentration gradient, always measured from high to low concentration, goes from left to right in the figure; that is, it has a negative slope. Material will diffuse down the concentration gradient, so that the flux will also go from left to right. Since the flux will have a positive value, and the direction of the flux will be in the same direction as the negative slope, the negative sign is needed to reconcile these factors. This is Fick's first law of diffusion