

1. What structures might form if PHOSPHOLIPIDS and SURFACTANTS are placed in chloroform?
2. If lipid has a diffusion coefficient D of $10^{-8} \text{ cm}^2/\text{s}$, what is the average distance travelled by membrane lipid in $1 \mu\text{s}$; 1 ms ; 1 s ; Assume 2D lateral diffusion in a membrane.
3. Diffusion coefficient D of a rigid spherical molecule is given by

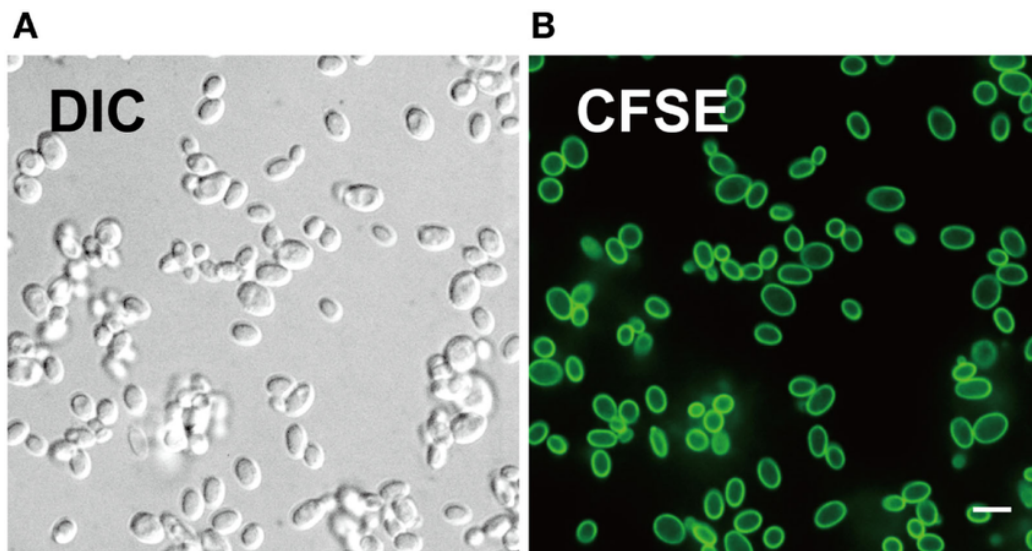
$$D = \frac{kT}{6\pi\eta r}$$

If $\eta = 1 \text{ poise}$; $T = 310 \text{ K}$; mass of protein =

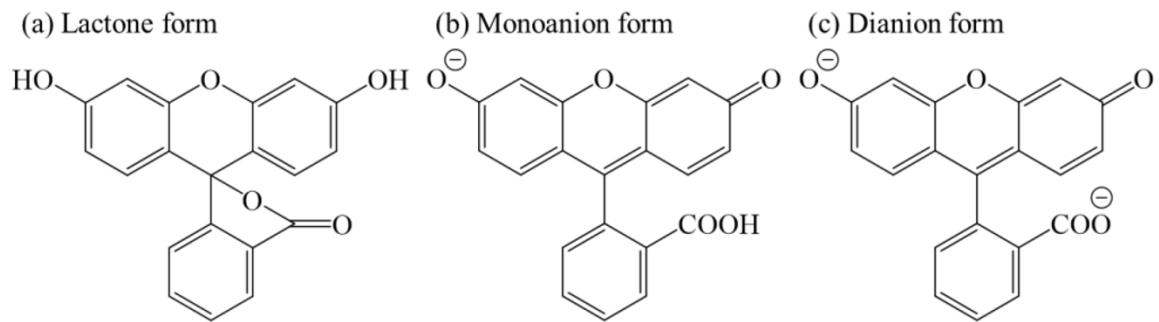
100 kDa ; Density of protein as an unhydrated rigid sphere = 1.35 g/cm^3 .

Calculate D . Calculate the average distance travelled by membrane lipid in $1 \mu\text{s}$; 1 ms ; 1 s ;

4. Why is melting point of Palmitic acid (C_{16}) 6.5°C lower than Stearic acid (C_{18})
5. What is critical micellar concentration (cmc)? What is the cmc of SDS? How can cmc of SDS be reduced?
6. In cell biology research, cell cytoplasm is NOT VISIBLE under fluorescence microscopy because it does not contain any endogenous fluorophores. Often cell interior is labelled with bright fluorescent dyes in the visible wavelengths.



Consider the fluorescent dye FLUORESCEIN



As fluorescein is charged, it cannot easily cross the cell plasma membrane to enter the cytoplasm and emit fluorescence. How can you enable fluorescein to cross the cell membrane and reach the cytoplasm.

7. Write expression for free energy change for a simple transport of a solute across the membrane from a region of concentration c_1 to a region c_2 .
8. Calculate the energy cost of pumping an UNCHARGED solute across the membrane against a concentration gradient of 10,000: 1. Assume $T = 298\text{K}$
9. Calculate the energy cost of pumping an CALCIUM ions to the extracellular side across the membrane. Calcium concentration inside cell is 10^{-7} M , while on the extracellular side it is 10^{-3} M . Transmembrane potential across the cell membrane is 50 mV (inside negative). Assume physiological temperature $T = 310\text{ K}$