CONCEPT: HYDROPHOBIC EFFECT

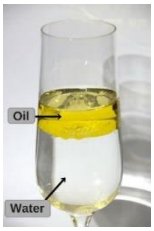
●The *hydrophobic effect*: phenomenon of the exclusion of _____ substances by water.

□ Hydrophobic (water "fearing") molecules are insoluble & form a separate phase in water.

□ Critical for _____ folding & the formation of membranes.

● In water, hydrophobic/nonpolar substances _____ to have a strong net affinity for each other, but that is *not* the case.

EXAMPLE:



Hydrophobic Effect Explained

●*Hydrated* nonpolar substances: *cage-like shell/layer* of water molecules around them (*hydration shell*).

□ Hydration shell H_2O cannot participate in *normal* _____ bonding.

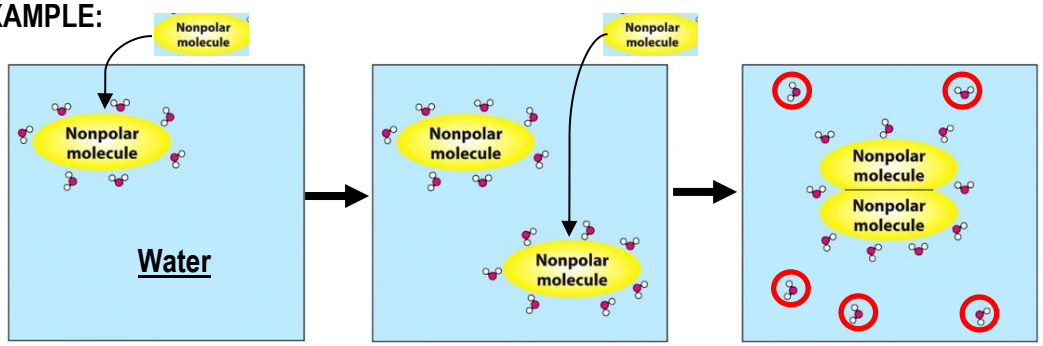
□ H_2O in the hydration shell move _____ & form fewer but stronger hydrogen bonds (less stable).

□ Hydration shell H_2O have _____ options for orientations in 3D space (more order & less entropy).

●It is thermodynamically _____ for hydration shells to *merge* when nonpolar molecules clump & reduce surface area.

●Entropy is decreased with clumping, but its largely offset by _____ entropy of the H_2O molecules that break free.

EXAMPLE:



1) **Hydrated** nonpolar substance with more-ordered H_2O molecules in the _____ **shell** (lowered entropy of system).

2) 2nd nonpolar substance further _____ **the entropy** of system.

3) Clumping of nonpolar molecules _____**:**

□ surface area

□ # of molecules in the hydration shell

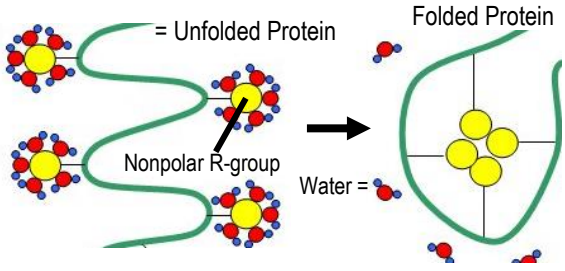
□ local entropy

4) H_2O molecules that break free from the shell **offset** local entropy decrease with overall **increased entropy** of the surroundings.

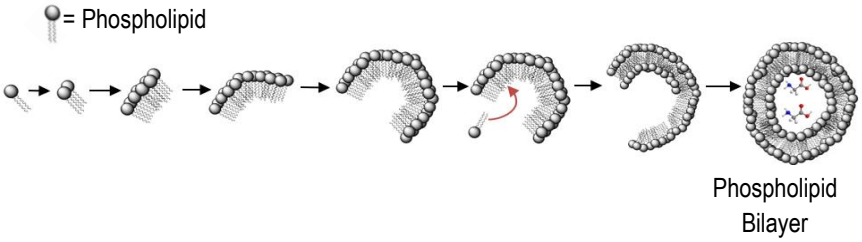
Protein Folding & Membrane Formation

●Hydrophobic effect: important for *protein folding* & the *formation of membranes*.

EXAMPLE: Protein folding.



Membrane formation.



CONCEPT: HYDROPHOBIC EFFECT

PRACTICE: Which of the following best explains the hydrophobic effect?

a) Hydrophobic substances have a strong net affinity for each other.
b) Hydrophilic substances increase local entropy upon clumping.
c) Hydrophobic substances clump due to their strong intermolecular forces.
d) Hydrophobic substances increase universal entropy when they clump.

PRACTICE: Which of the following is false concerning H_2O molecules in the hydration shell around nonpolar substances?

a) Cannot participate in normal hydrogen bonding.
b) Form stronger hydrogen bonds than free H_2O
c) Less ordered & higher entropy than free H_2O
d) Less options for orientations in 3D space than free H_2O