Chem 431A-Lecture 2 9/24/07
admin:
(1) sign attendance sheet.
lecture:
The role of water is very important in living environment.
water is special in that it has
-hi specific heat
-very polar (solubility of ions)
-surface tension high - allows capillary action
- lower density in solid form vs liquid form.

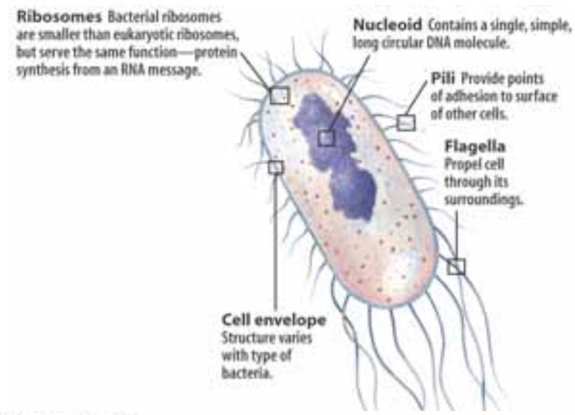
But water is also important as a medium for the interaction and even chemical reactions which take place within a cell.

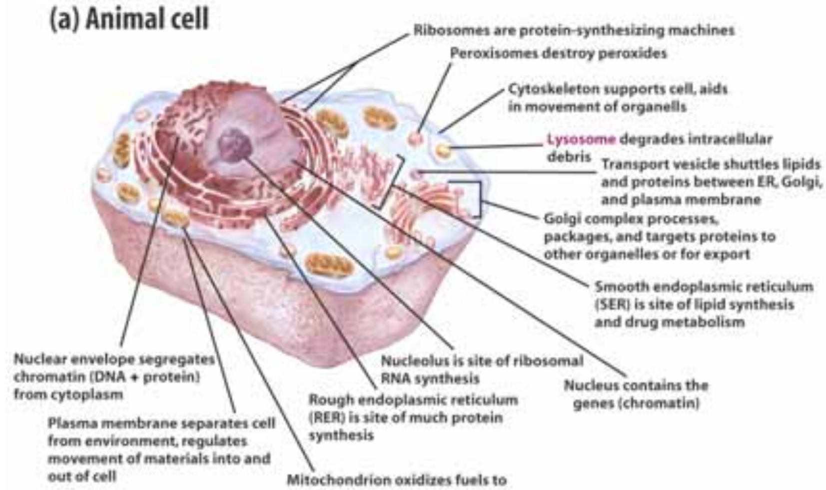
Here we need to review the various types of interactions that can take place between and among molecules.

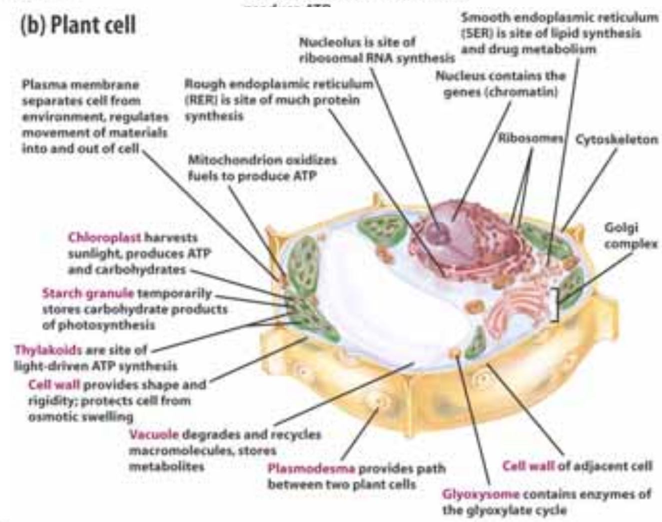
5) weak interactions in the cell: aqueous solution-like environment. Covalent bonding alone is not sufficient to determine the actual shapes of molecules. complexity of these molecules very much depends on noncovalent interactions.

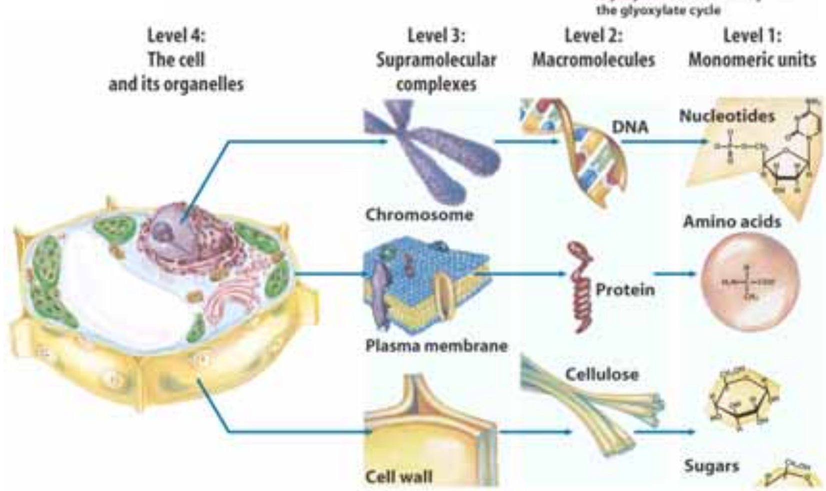
examples:
nucleic acids like DNA or RNA are really polymers of smaller units (monomers) called nucleotides, these are held together by covalent bonds involving phosphate groups - phosphoesters and phosphoanhydride bonds. these molecules has a specific 3d structure (double helix)

proteins are even more complex and the
**structure of the cells: hierarchy:

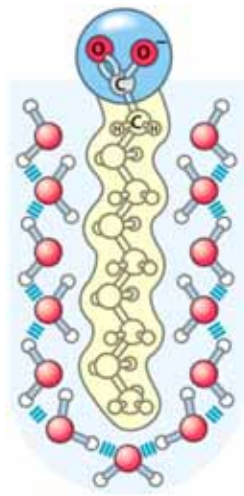








amino acids forming these polymers (polypeptide) are precisely positioned to result in unique or nearly unique 3 d shapes and structures.



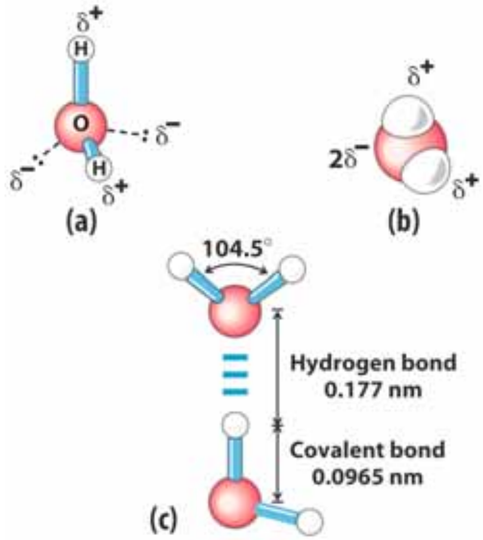
what are these non covalent interactions? same as those learned in general chemistry:

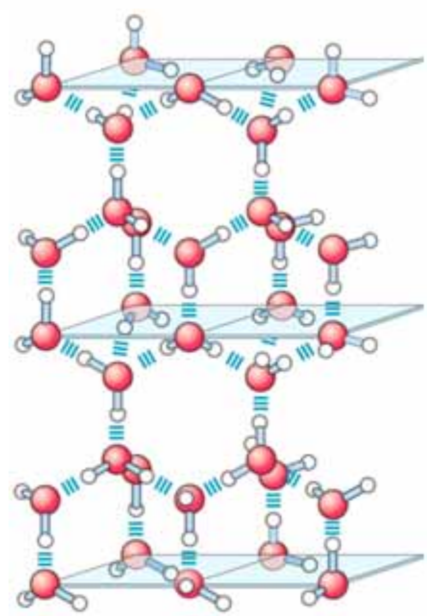
ion-ion, dipole-ion, dipole-dipole, dispersion, H-bond....etc.
importance of water can not be overemphasized.
Solubility- "like dissolves like",etc eg.- O_2 can dissolve in water. so aquatic animals can live. similarly for CO_2,
- allows cell membranes to stay undissolved and keeps integrity of living cells.

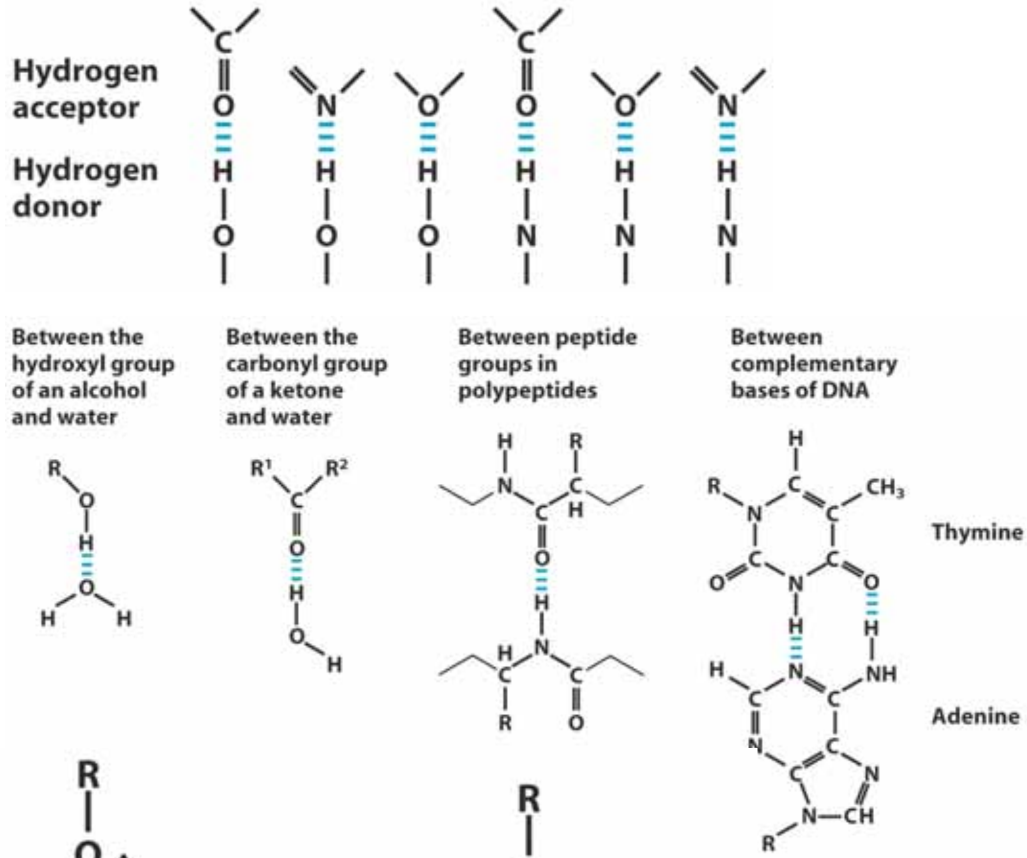
TABLE 2-1 Melting Point, Boiling Point, and Heat of Vaporization of Some Common Solvents

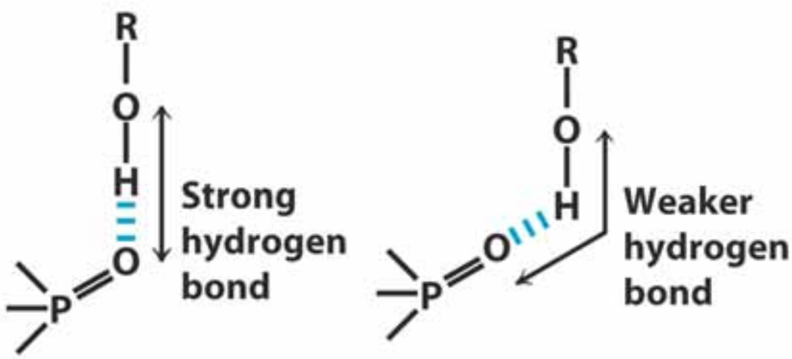
	Melting point (°C)	*Boiling point (°C)*	*Heat of vaporization (J/g)**
Water	0	100	2,260
Methanol (CH_3OH)	−98	65	1,100
Ethanol (CH_3CH_2OH)	−117	78	854
Propanol ($CH_3CH_2CH_2OH$)	−127	97	687
Butanol ($CH_3(CH_2)_2CH_2OH$)	−90	117	590
Acetone (CH_3COCH_3)	−95	56	523
Hexane ($CH_3(CH_2)_4CH_3$)	−98	69	423
Benzene (C_6H_6)	6	80	394
Butane ($CH_3(CH_2)_2CH_3$)	−135	−0.5	381
Chloroform ($CHCl_3$)	−63	61	247

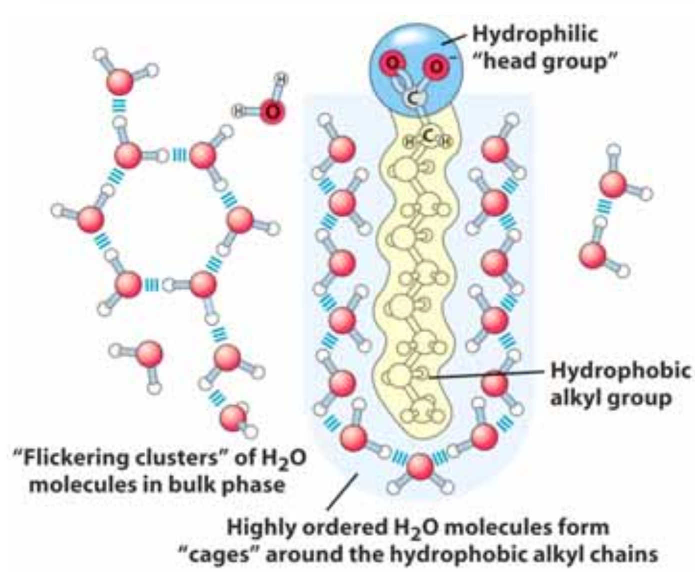
*The heat energy required to convert 1.0 g of a liquid at its boiling point, at atmospheric pressure, into its gaseous state at the same temperature. It is a direct measure of the energy required to overcome attractive forces between molecules in the liquid phase.

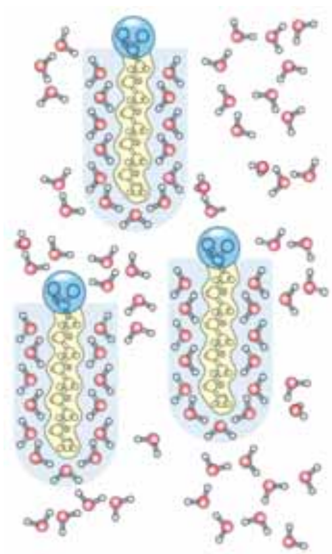





Hydrogen acceptor
Hydrogen donor
Between the hydroxyl group of an alcohol and water
Between the carbonyl group of a ketone and water
Between peptide groups in polypeptides
Between complementary bases of DNA
Thymine
Adenine

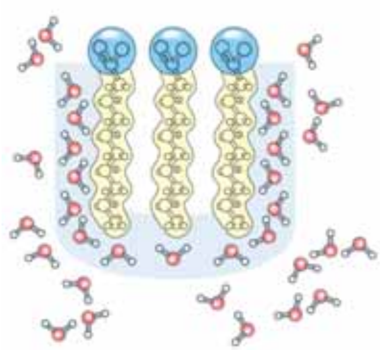

Strong hydrogen bond
Weaker hydrogen bond


Hydrophilic "head group"
Hydrophobic alkyl group
"Flickering clusters" of H2O molecules in bulk phase
Highly ordered H2O molecules form "cages" around the hydrophobic alkyl chains



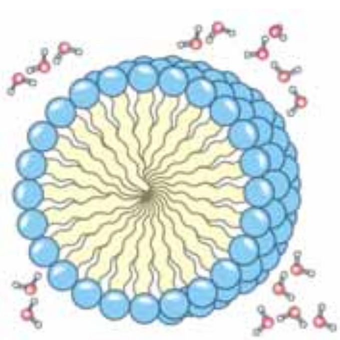
Dispersion of lipids in H_2O

Each lipid molecule forces surrounding H_2O molecules to become highly ordered.



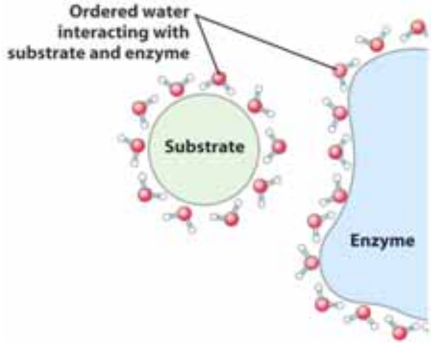
Clusters of lipid molecules

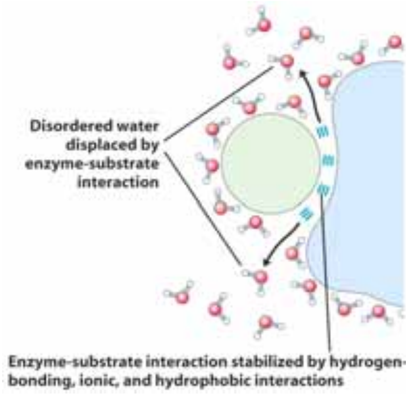
Only lipid portions at the edge of the cluster force the ordering of water. Fewer H_2O molecules are ordered, and entropy is increased.



Micelles

All hydrophobic groups are sequestered from water; ordered shell of H_2O molecules is minimized, and entropy is further increased.





Acids and bases: concept of acids and bases are important because they often determine the interactions/mechanism of reactions of biochemicals...