Assignment for Wednesday

Biographical sketch (paragraphs or just bullet points)

- Name (feel free to include any preferred names and pronouns)
- Where are you from? (Geographically, academically, etc.)
- What is/are your major(s) and minor(s)?
- How does biochemistry fit into your broader interests?
- What are your goals for this course? What are you most excited to learn about? What are you most worried about?
- Any other relevant information?

What is biochemistry? (What isn't biochemistry?)

Evolution and classification of life

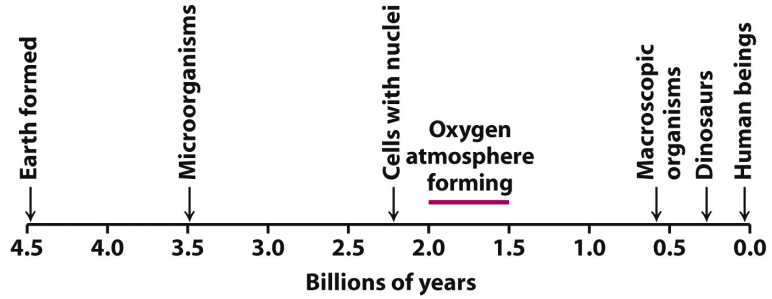

Figure 1.2
Biochemistry, Seventh Edition

Evolution and classification of life

The three domains of life

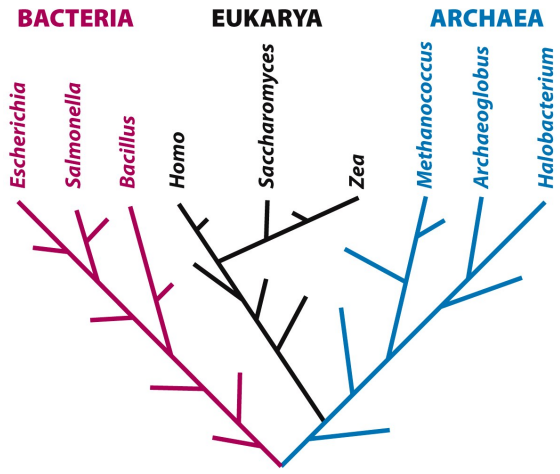

Figure 1.3
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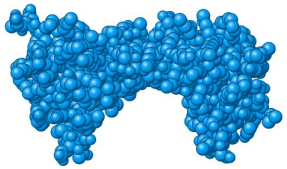
Evolution and classification of life

The three domains of life

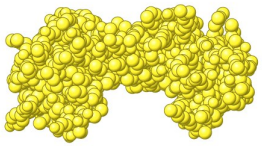
The cell

Biochemical unity amidst biological diversity

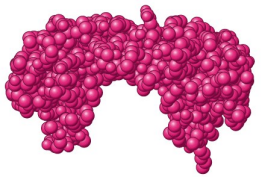
TATA-box binding protein in archaea, plants, and humans



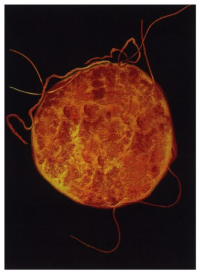
Sulfolobus acidicaldarius



Arabidopsis thaliana



Homo sapiens



Bonding

Water and the hydrophobic effect

- Water is polar
- Water can form hydrogen bonds with itself
- Water can dissolve many species, especially polar and charged compounds

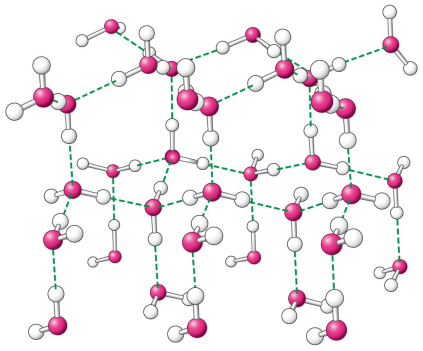


Figure 1.11
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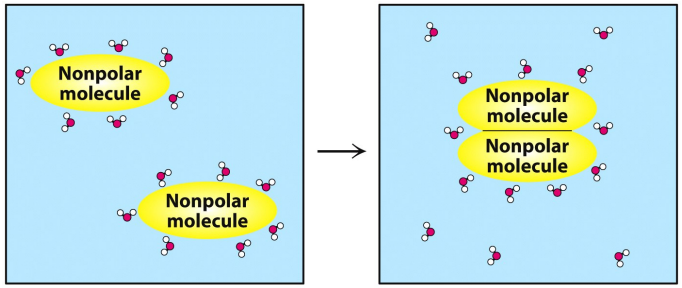
Water and the hydrophobic effect



The hydrophobic effect

- Non-polar molecules *cannot* dissolve in water
- They are sequestered in "cages" of water molecules
- They can associate with each other
  - Water cage is released and forms a new cage around the larger non-polar structure

Thermodynamics

First law of thermodynamics

Second law of thermodynamics

Thermodynamics

For any process:

$$\Delta S_{\text{universe}} > 0$$

- For the system, there is $\boldsymbol{\Delta S_{\text{system}}}$
- If the system releases heat, the heat released is $\boldsymbol{\Delta H_{\text{system}}}$, and the disorder of the surroundings is increased.
- By how much? $\boldsymbol{\Delta S_{\text{surroundings}}}$

$$\Delta S_{\text{surroundings}} = -\frac{\Delta H_{\text{system}}}{T}$$

- $\Delta S_{\text{surroundings}}$ is directly proportional to $-\Delta H_{\text{system}}$
- $\Delta S_{\text{surroundings}}$ is inversely proportional to the temperature of the surroundings (higher temperature, less increase in entropy)

Thermodynamics

For any process:

$$\Delta S_{surroundings} = -\Delta H_{system} / T$$

and: $\Delta S_{universe} = \Delta S_{system} + \Delta S_{surroundings}$

$$\Delta S_{universe} = \Delta S_{system} - \Delta H_{system} / T$$

To satisfy the Second Law of Thermodynamics ($\Delta S_{universe} > 0$):

Therefore, a reaction will only take place spontaneously if:

Acid-base chemistry

$HA \rightleftharpoons A^- + H^+$ Equilibrium constant, K_a

Buffers: