

## Chem 423: Biochemistry for Chemists

### Course overview

Inanimate molecules → ? → living organisms  
chemistry      biochemistry      biology

### Syllabus/Schedule

I. Molecules of life -- structure & mechanism (protein focus)

How they cooperate in networks & nanomachines for:

II. Harnessing energy

Coupling, catalysis

III. Self-replication (nucleic acid structure)

Central dogma in more detail: DNA → RNA → protein

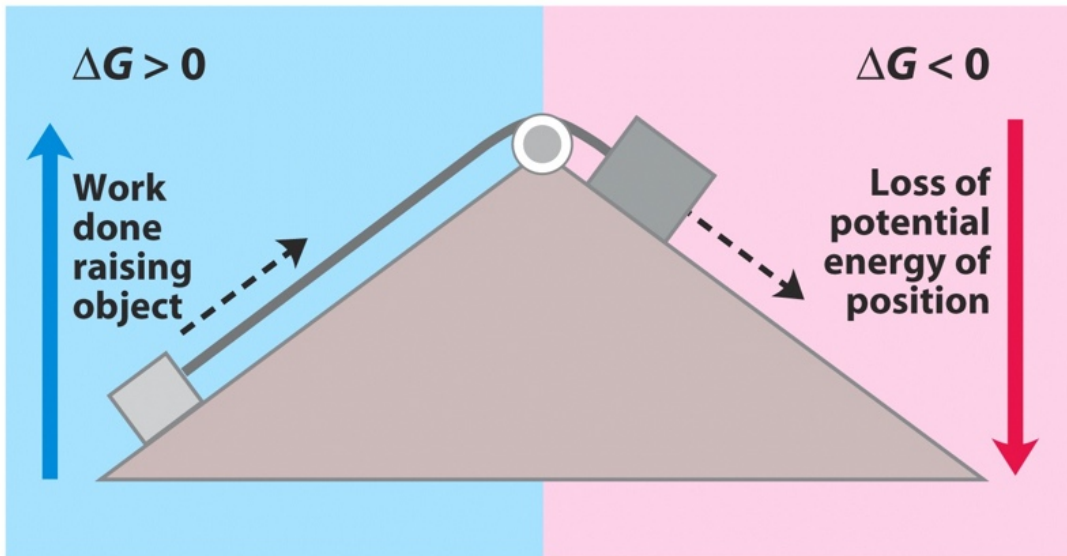
IV. Engineering molecules for medicine and biotechnology

Life is highly diverse but ... closer inspection reveals many common features:

Organisms → Cells → Polymers → Monomers; chemistry underlies function

**Cool examples:** nanomachine in bacteria, engineered proteins

### (a) Mechanical example

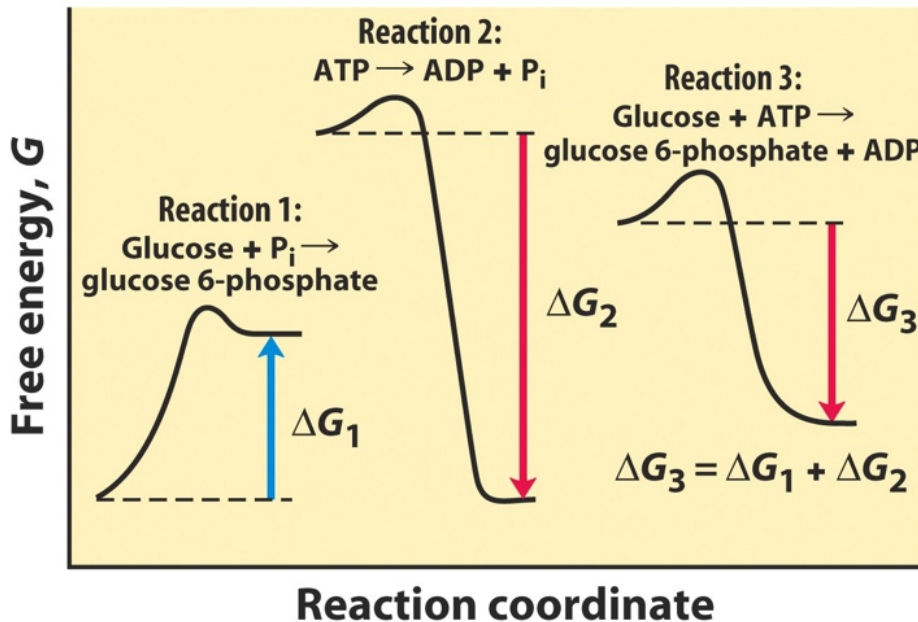


Energy

■ Endergonic

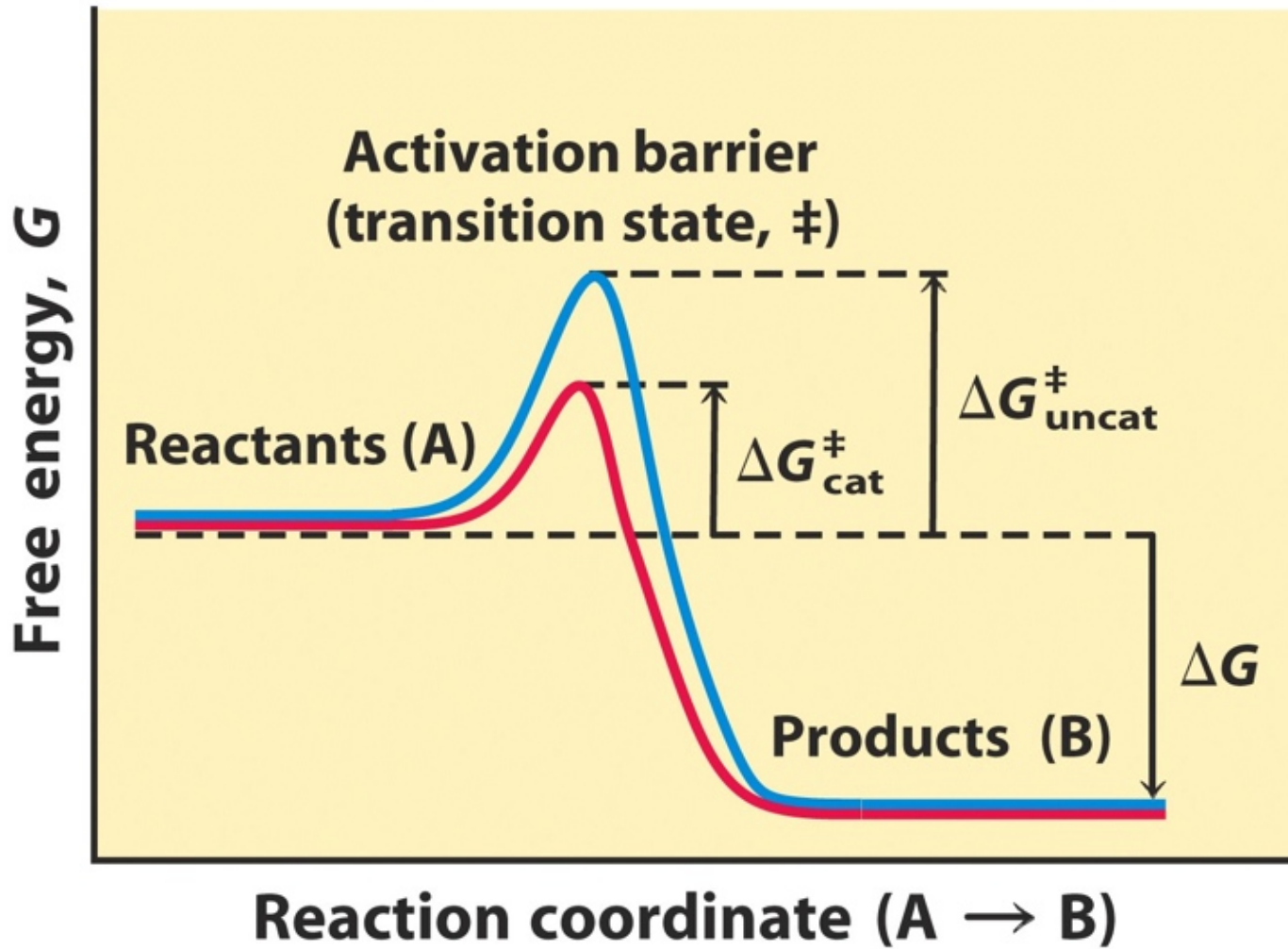
■ Exergonic

### (b) Chemical example



Lehninger, Principles of Biochemistry

## Catalysis

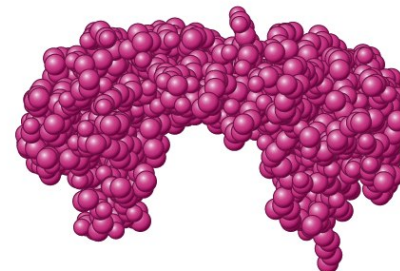
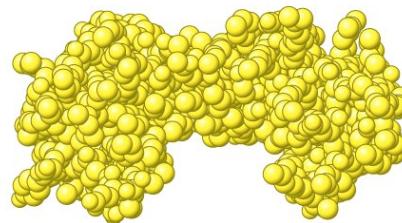
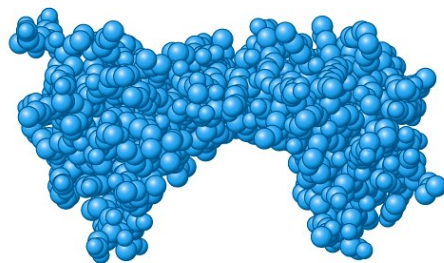


Life is highly diverse but ...

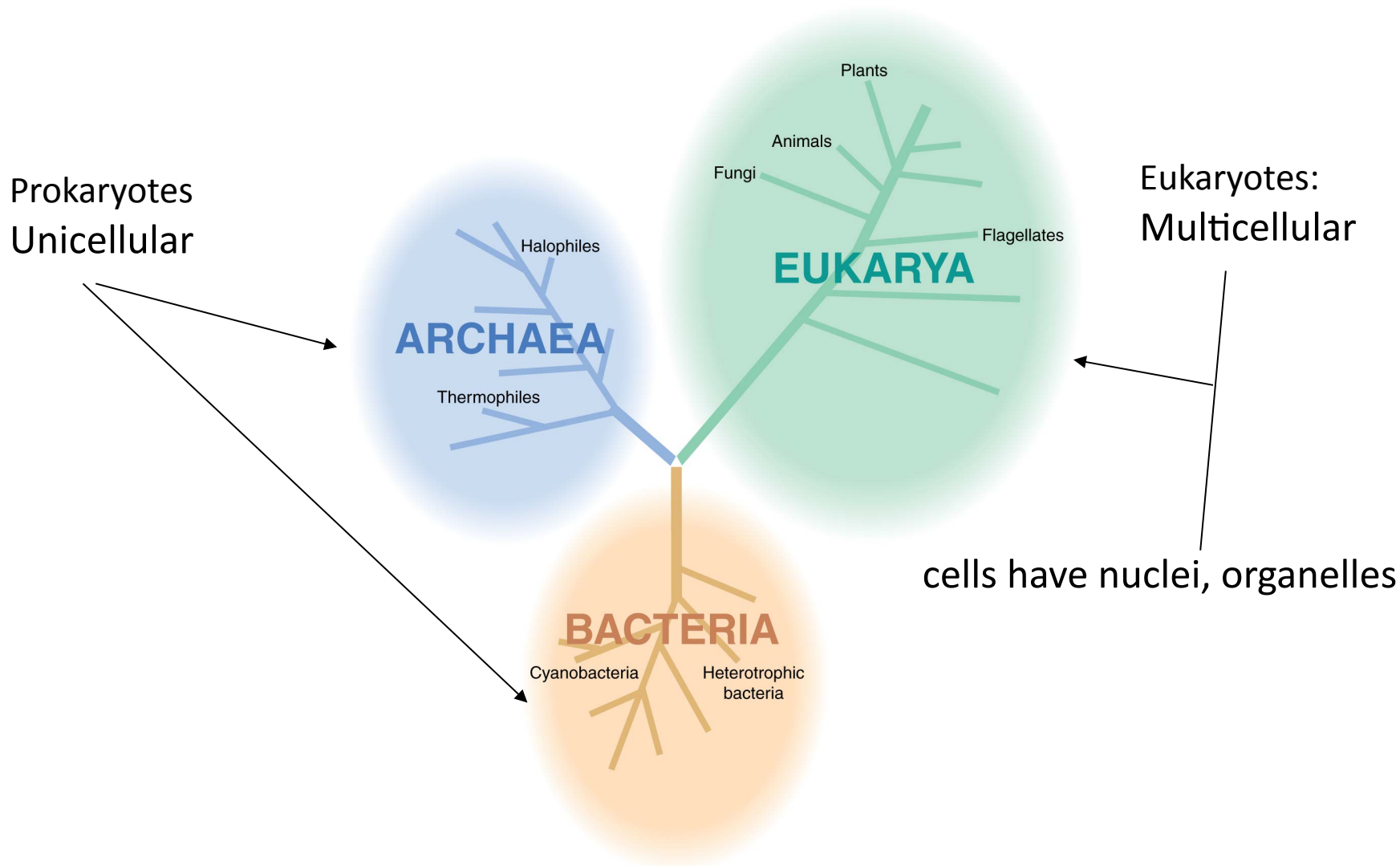
closer inspection reveals many common features:

- Cells
- Molecules
- Reaction networks

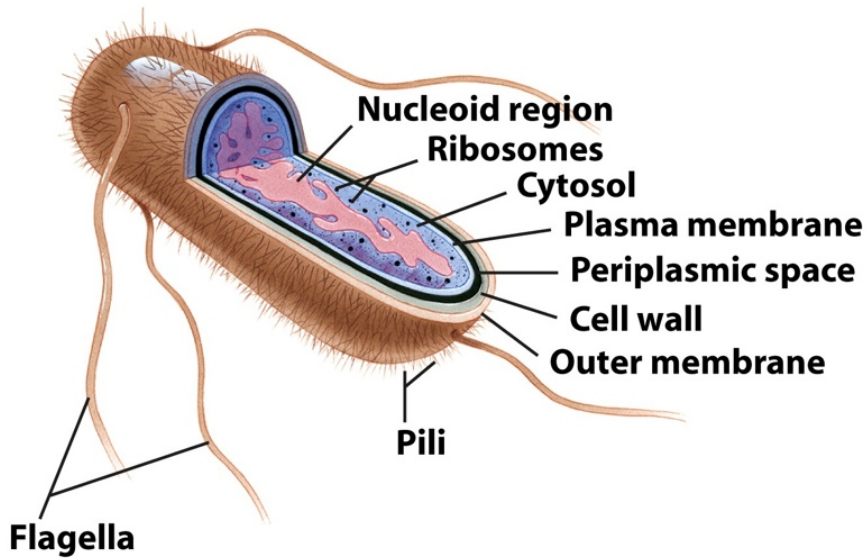
-> Evolution from a common ancestor



Berg, Biochemistry



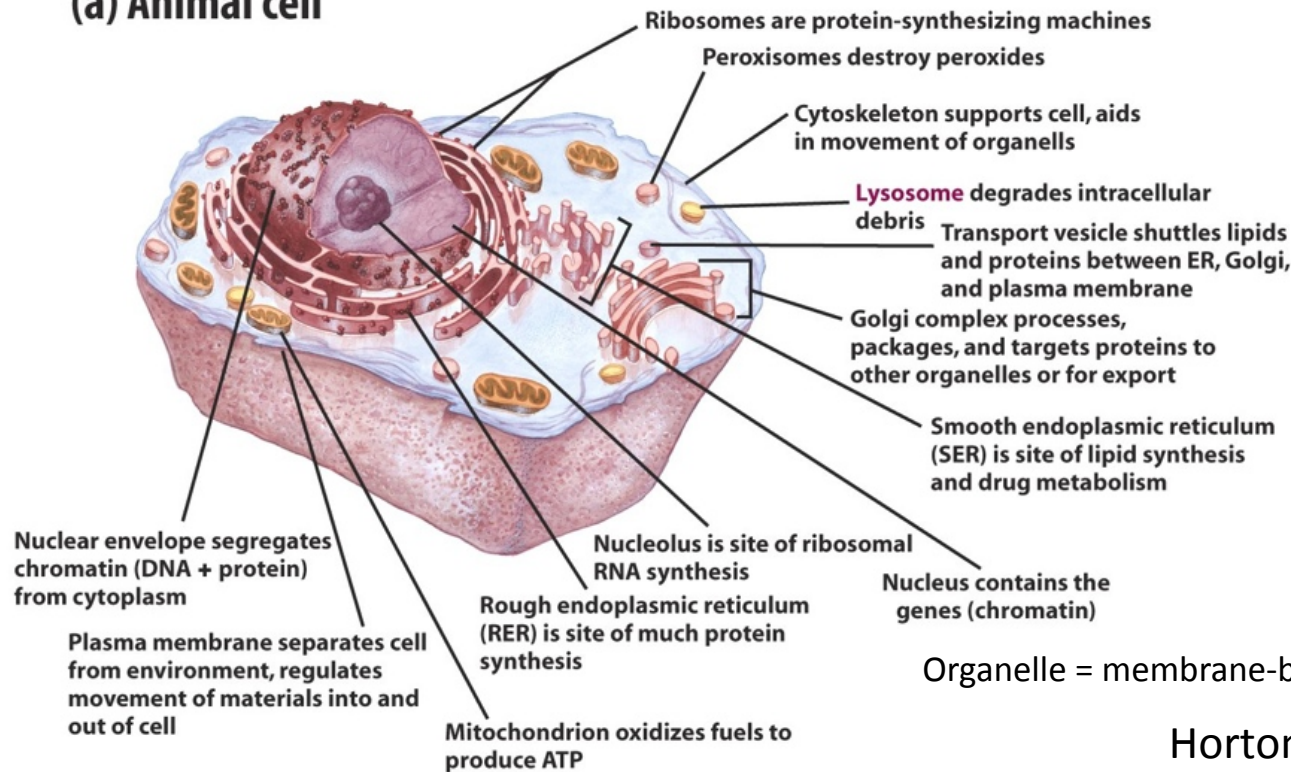
**FIGURE 1.3**  
**The Domains of Life on Earth**



Prokaryotic cell --  
No nucleus or organelles

Figure 1-14 Principles of Biochemistry, 4/e  
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**(a) Animal cell**

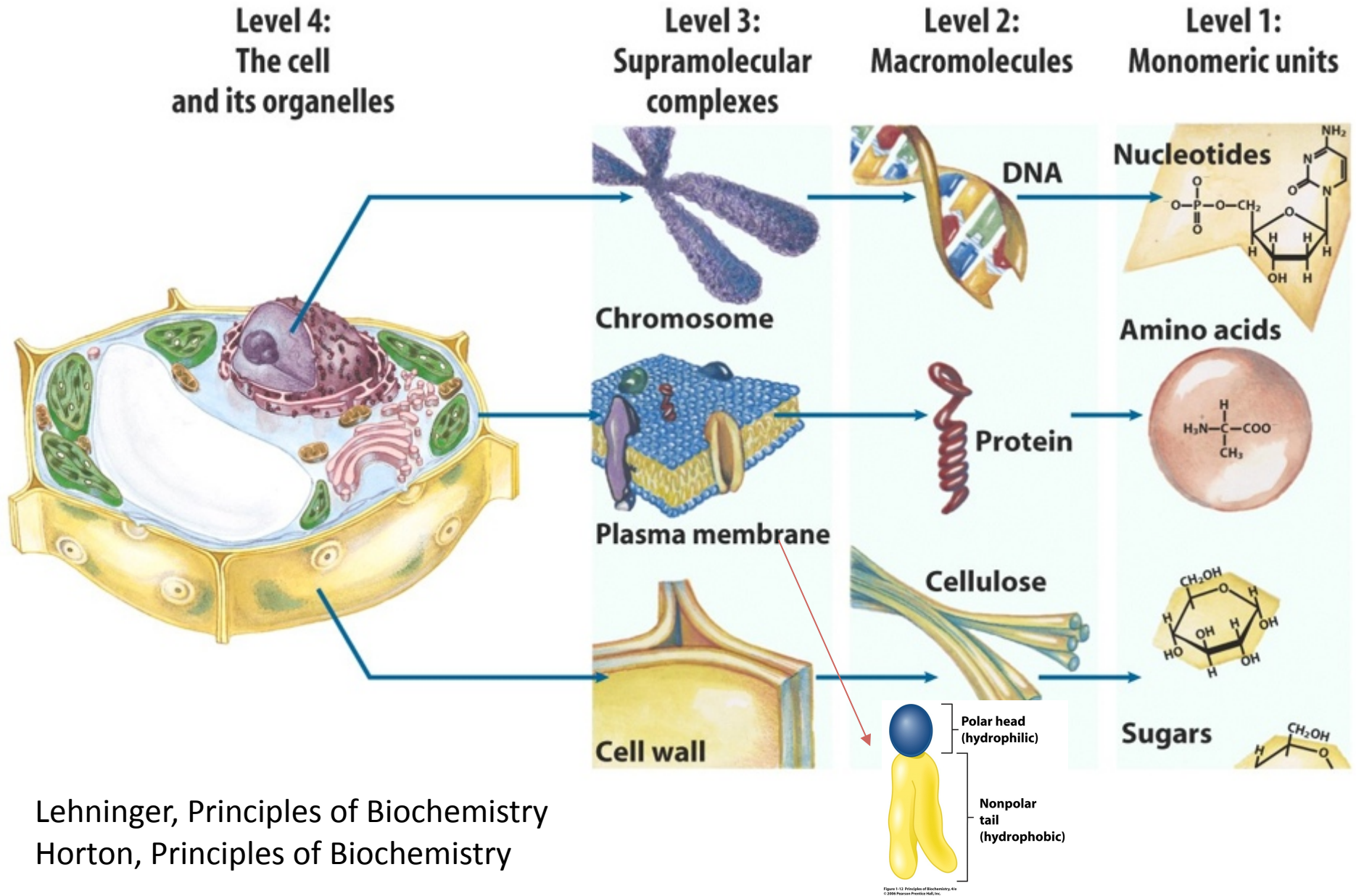


Eukaryotic cell --  
Nucleus,  
Many organelles

Organelle = membrane-bound, subcellular compartment

# The players in biochemistry - in all organisms...

Organisms -> Cells -> Polymers -> Monomers



Lehninger, Principles of Biochemistry  
 Horton, Principles of Biochemistry

# Chemical properties determine function: DNA example

4 bases form 2 base pairs via hydrogen bonds

A-T & G-C

Same size/shape - fit into double helix

Sequence encodes information

Unique base-pairing makes copying possible

Noncovalent interactions (eg hydrogen bonds) -

Weaker than covalent interactions

Makes assembly/disassembly possible in mild conditions

eg for copying DNA

Many together stabilize unique 3D structures

eg DNA double helix

# Next class...

- Non-covalent interactions
- Finish your reading of chapter 1