Biochemistry I

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Progress is the most important!

Biochemistry

Biochemistry

- Chemistry of living matter (stardust)

- What is the living matter?

1. Metabolism & Energy: Must intake and transform nutrients into energy
2. Sensation & Response: Must sense and respond to changes in surroundings
3. Reproduction: Must accurately reproduce

Three Domains of Life

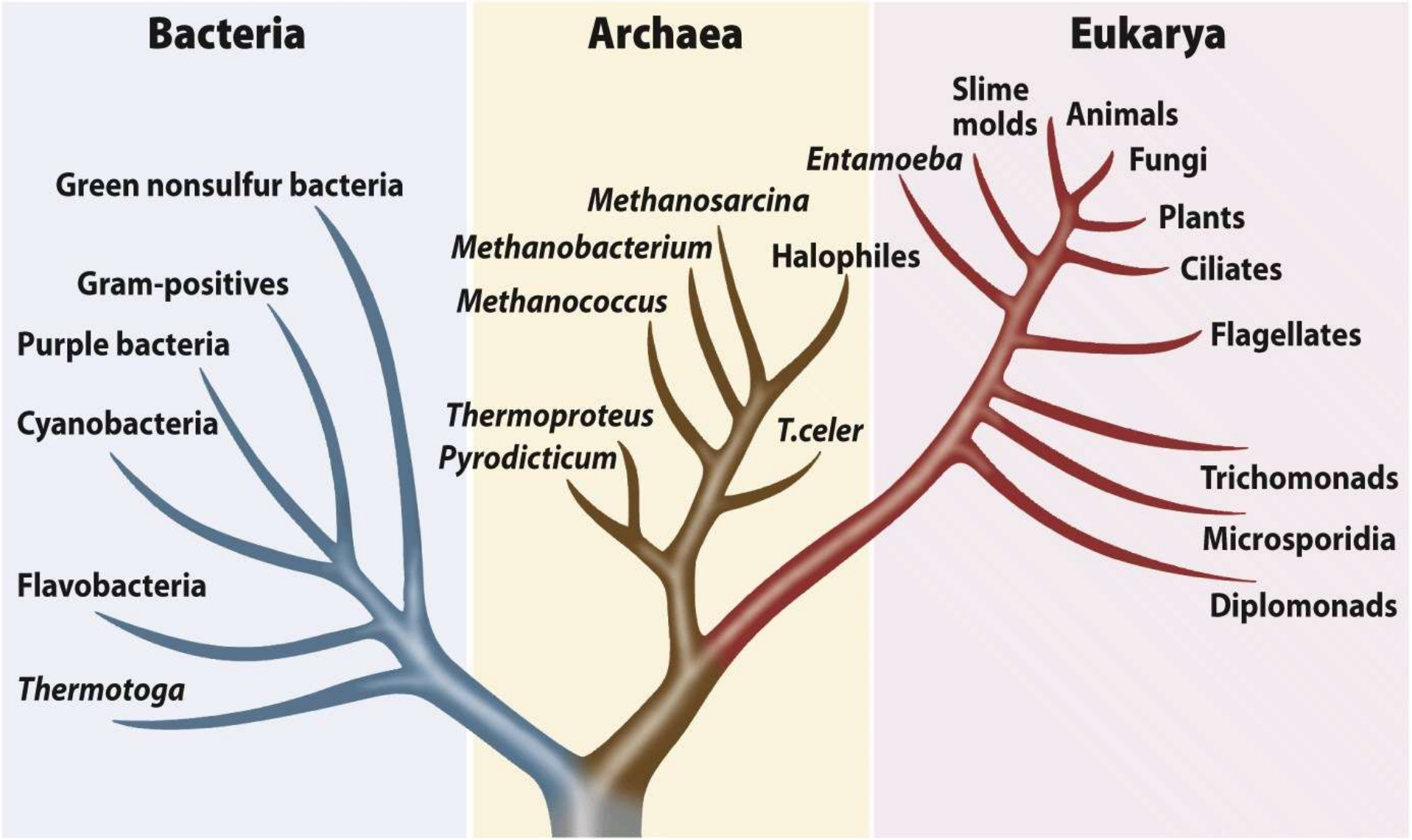


Figure 1-9

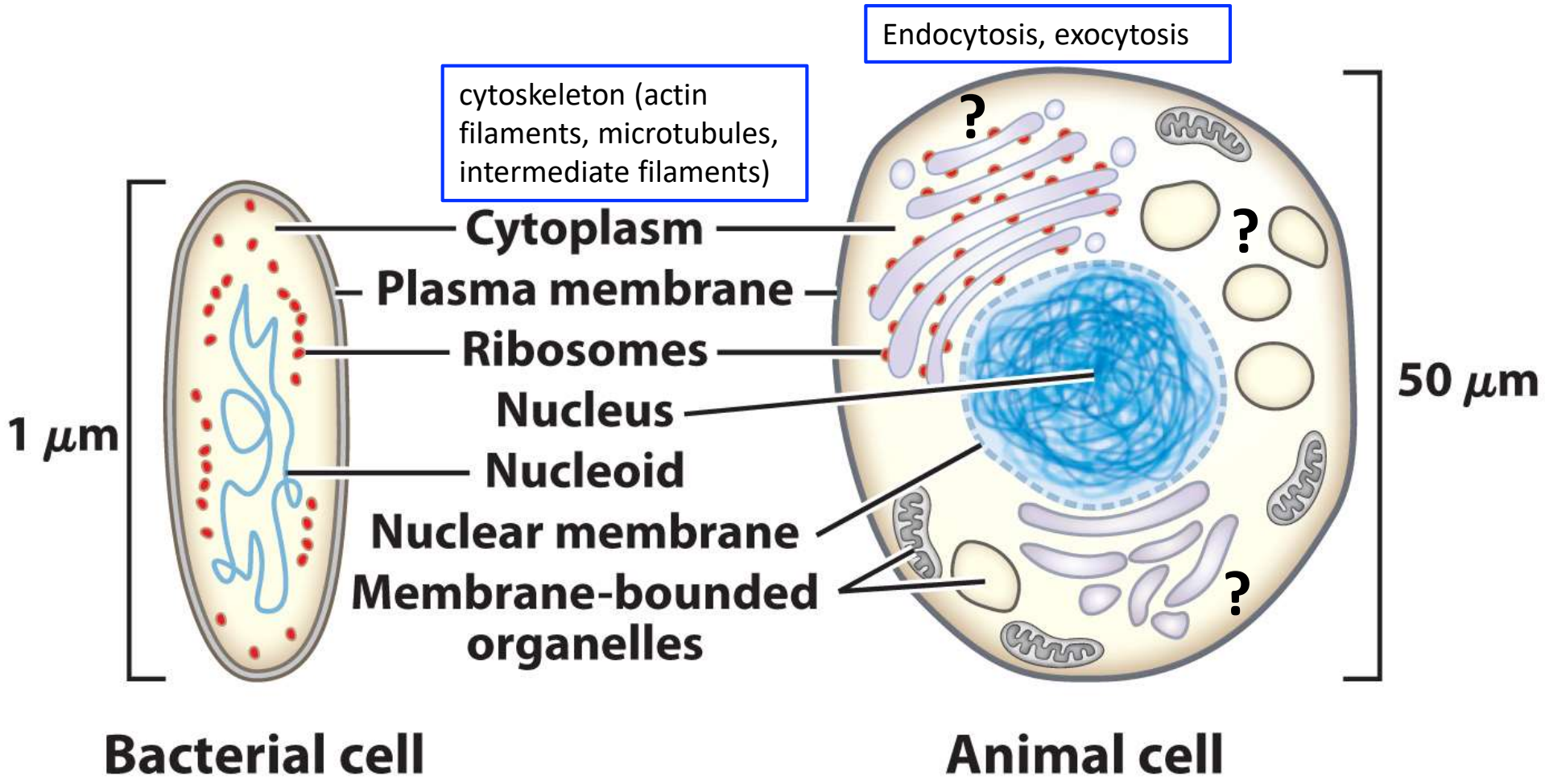
Six Kingdoms of Life

Six kingdoms		Cellular organization
1. Archaea	→	Unicellular prokaryote
2. Bacteria	→	Unicellular prokaryote
3. Protista	→	Unicellular eukaryote
4. Fungi	→	Uni- or Multicellular eukaryote
5. Plantae	→	Multicellular eukaryote
6. Animalia	→	Multicellular eukaryote

Cell: The Universal Building Block

- Living organisms are made of cells.
- The simplest living organisms are unicellular (single-celled).
- Larger organisms are multicellular (many-celled), with different functions for different cells.
- Different cells have common and unique features.

Prokaryotes vs Eukaryotes



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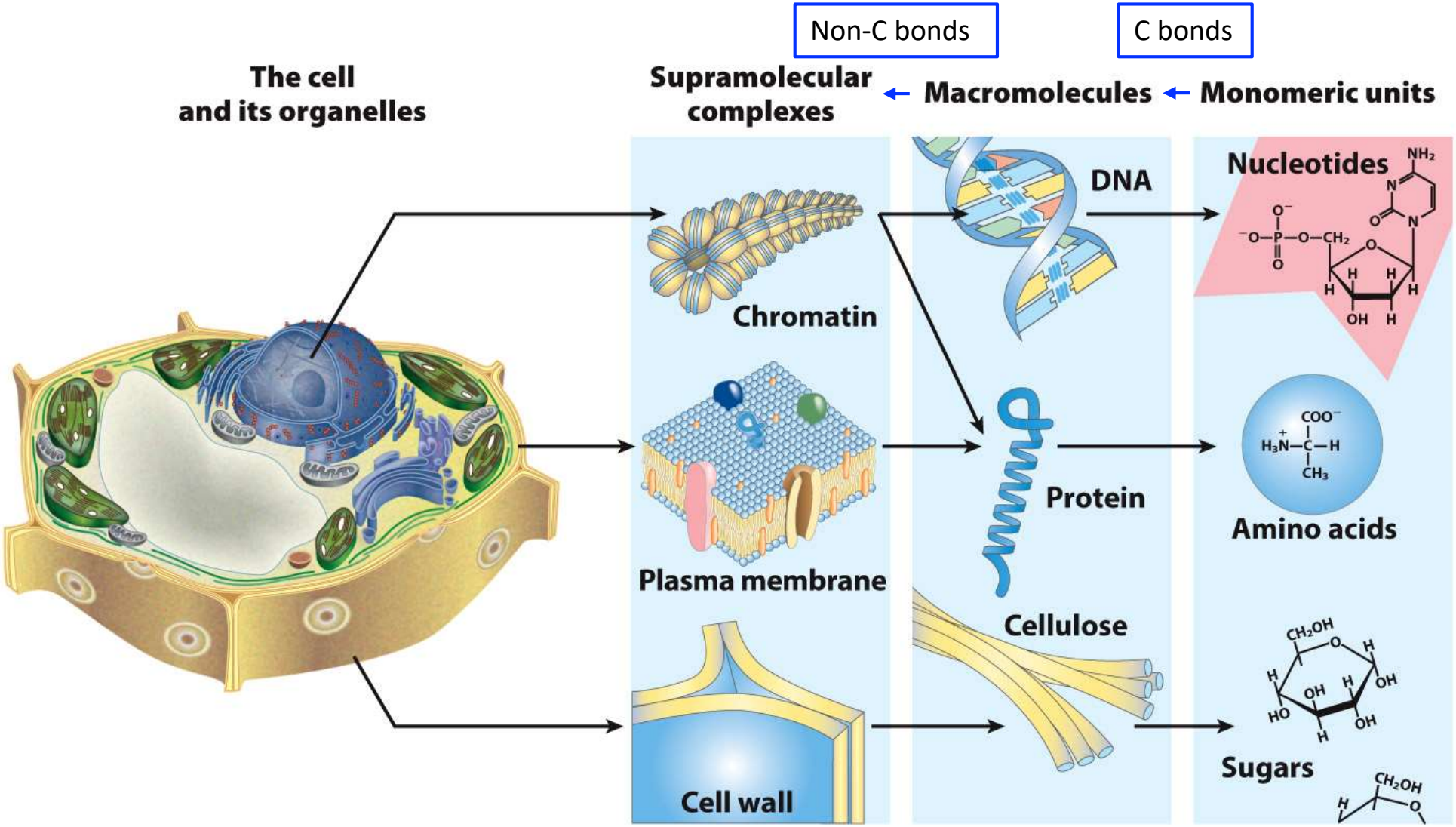
What limits cell size?

The Molecular Hierarchy of Structure



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30 Elements Essential for Life

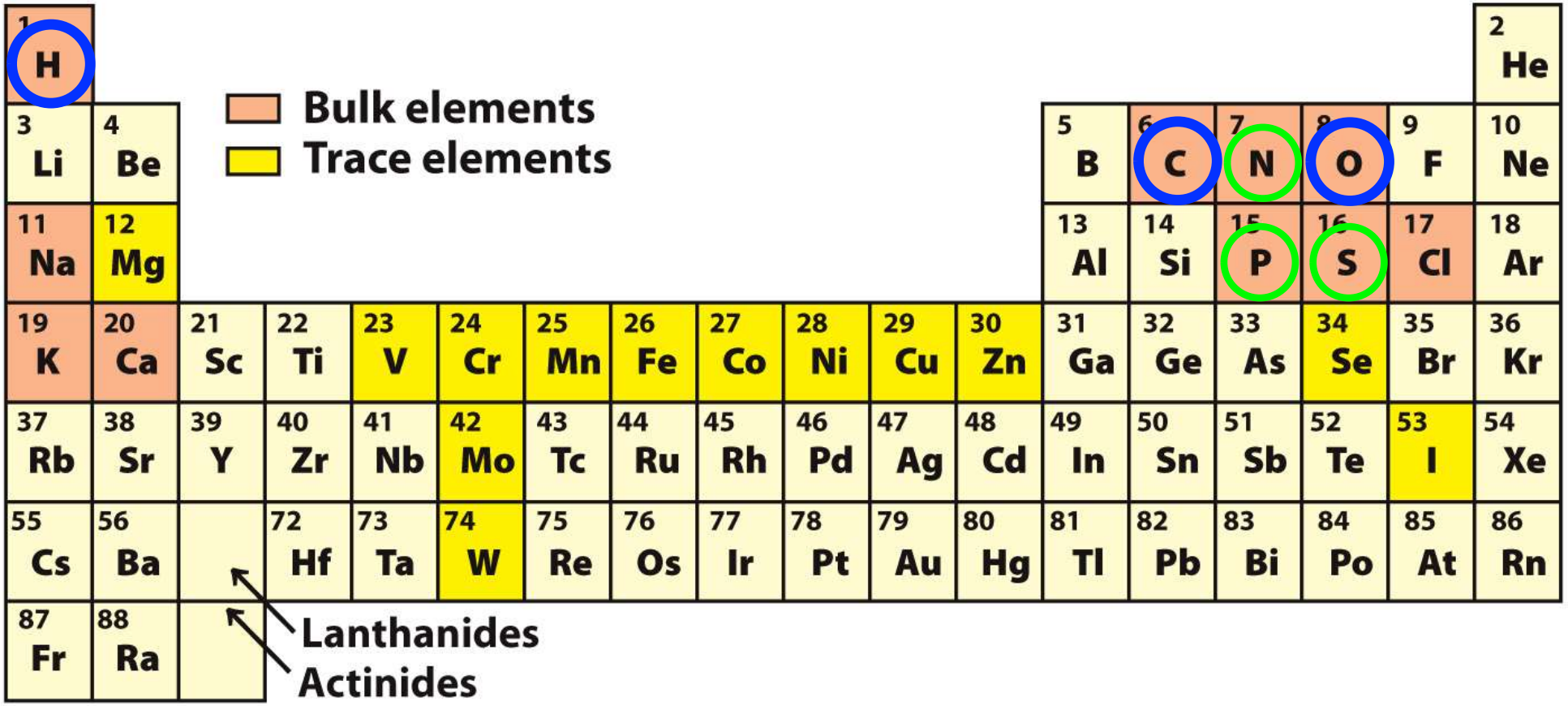

Figure 1-14

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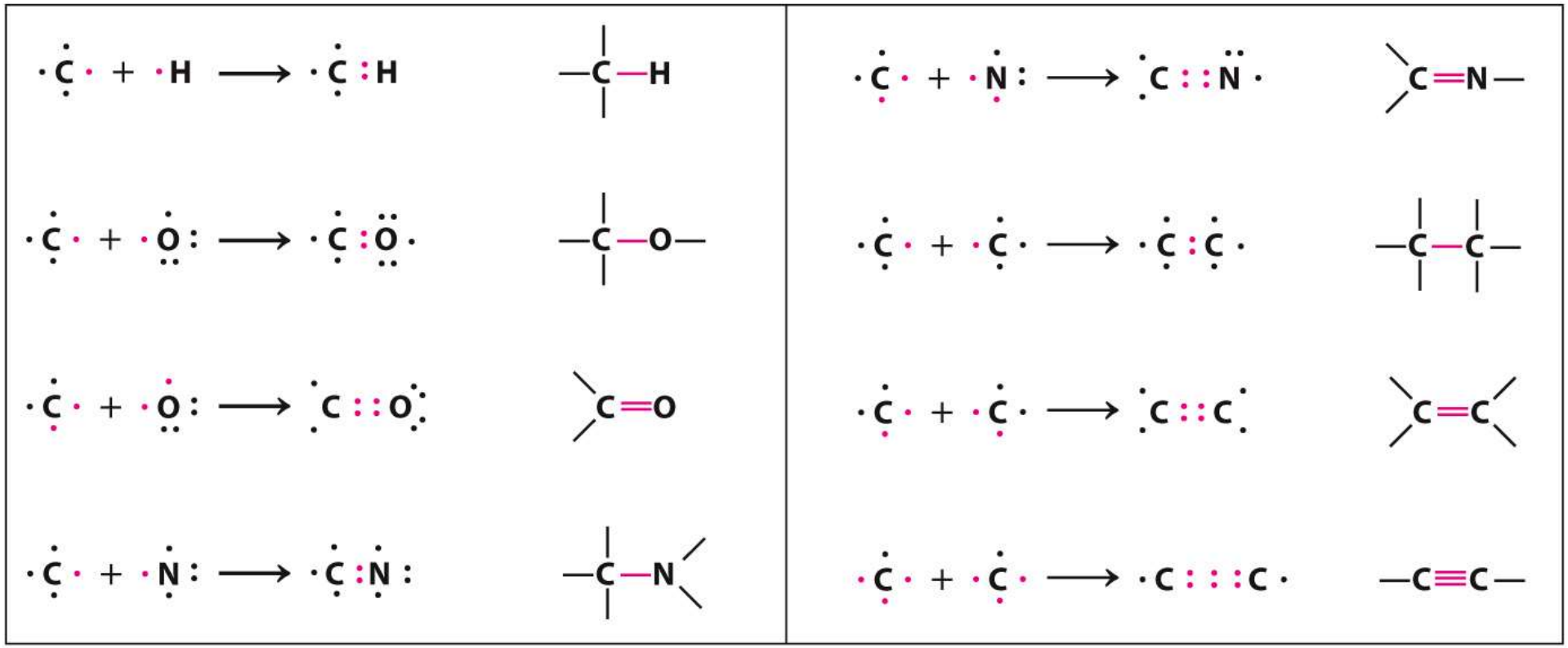
Carbon!



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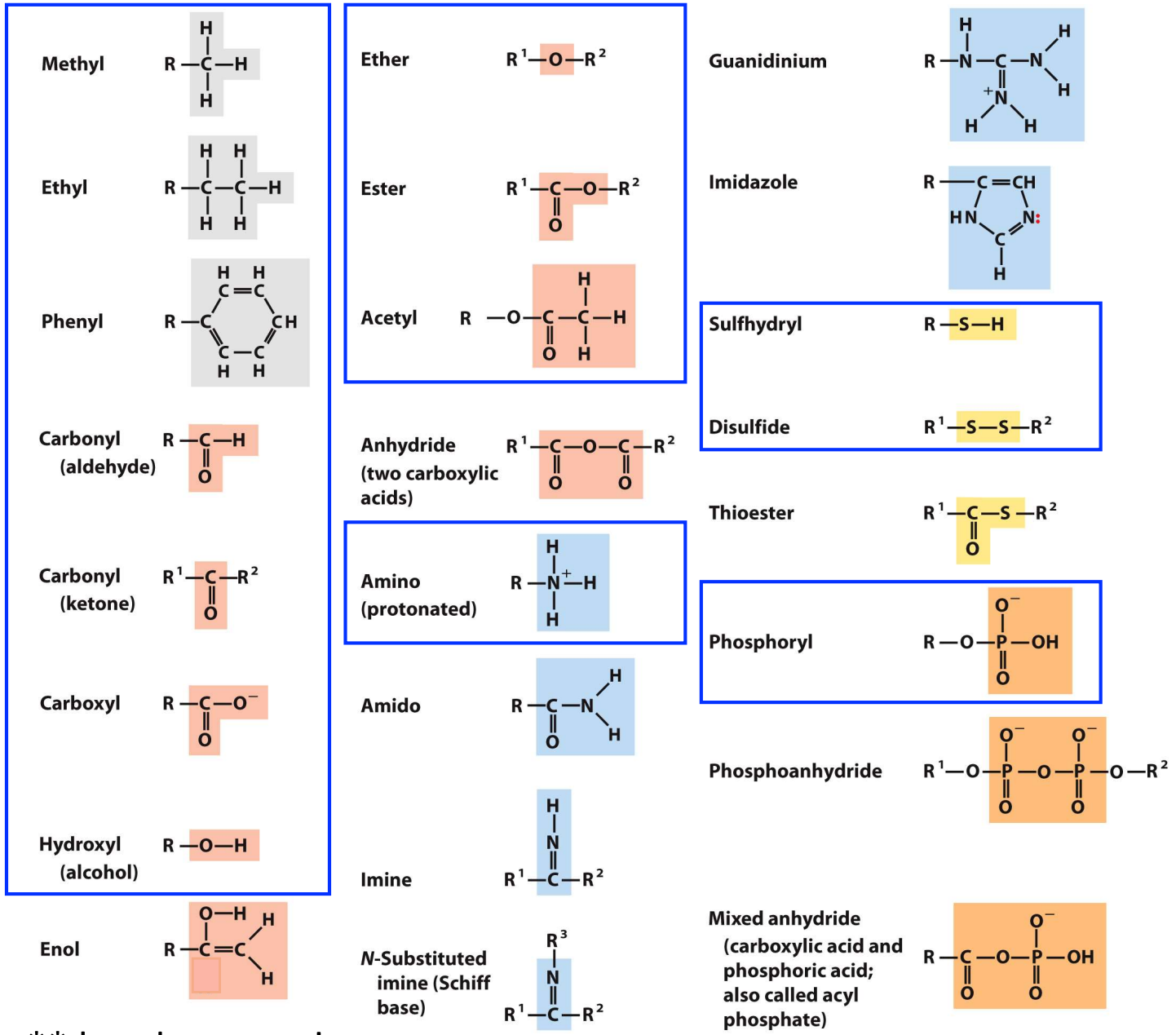
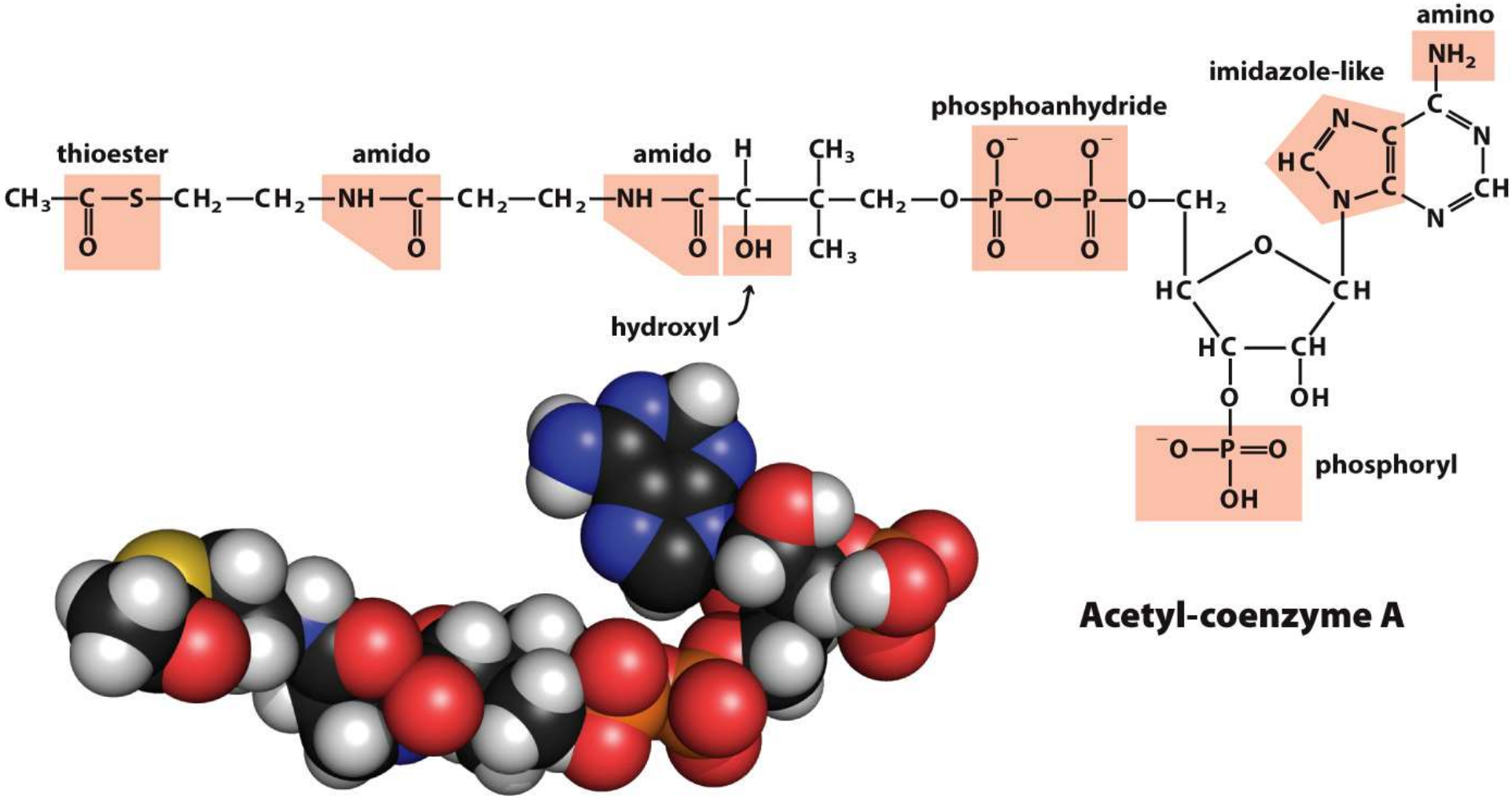
Common Functional Groups of Biological Molecules



** handout typo!

Biological Molecules Typically Have Several Functional Groups



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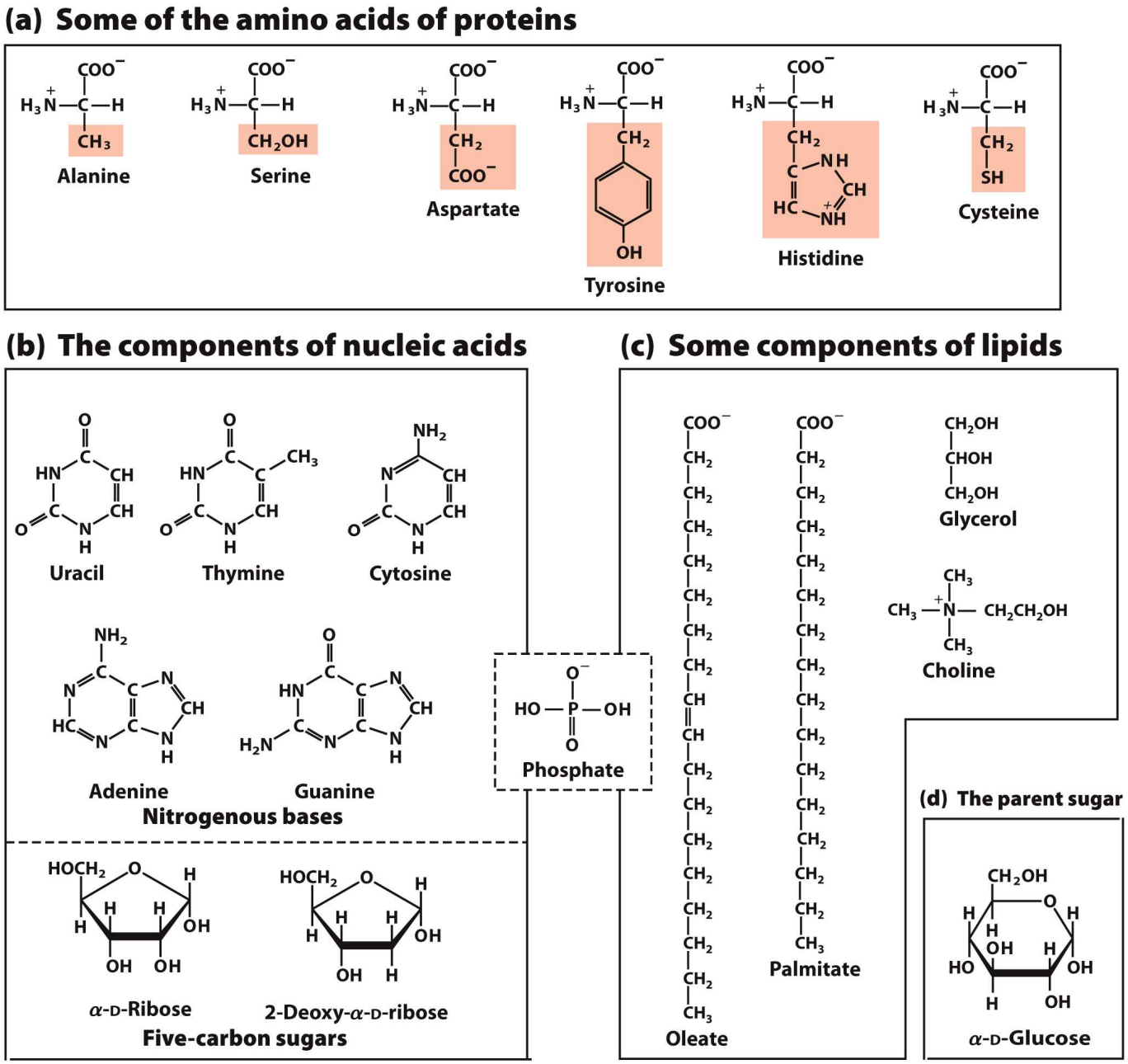
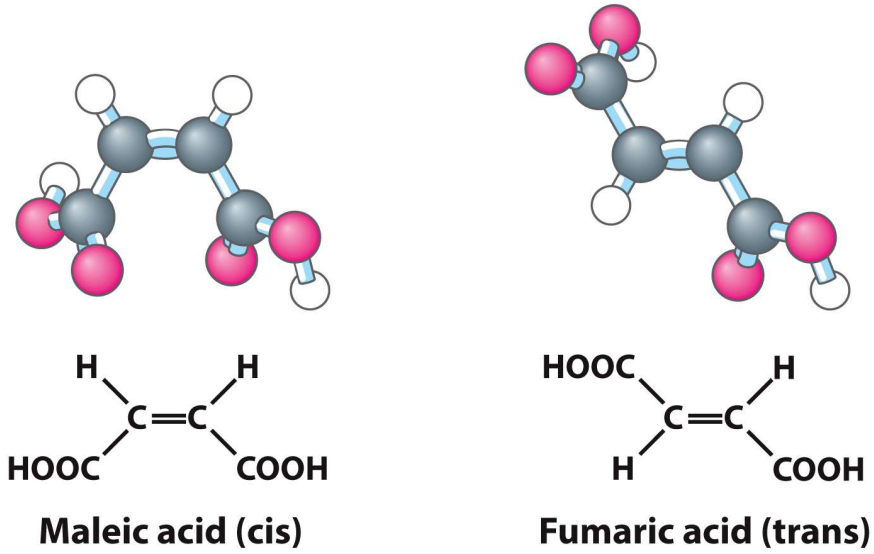
The ABCs of Life



Function of Molecules Depends on 3D Structure

- Stereoisomers
  - have different physical properties
- Geometric isomers (cis vs. trans)
  - have different physical and chemical properties
- Enantiomers (mirror images)
  - have identical physical properties (except with regard to polarized light) and react identically with achiral reagents
- Diastereomers
  - have different physical and chemical properties

Cis vs. Trans



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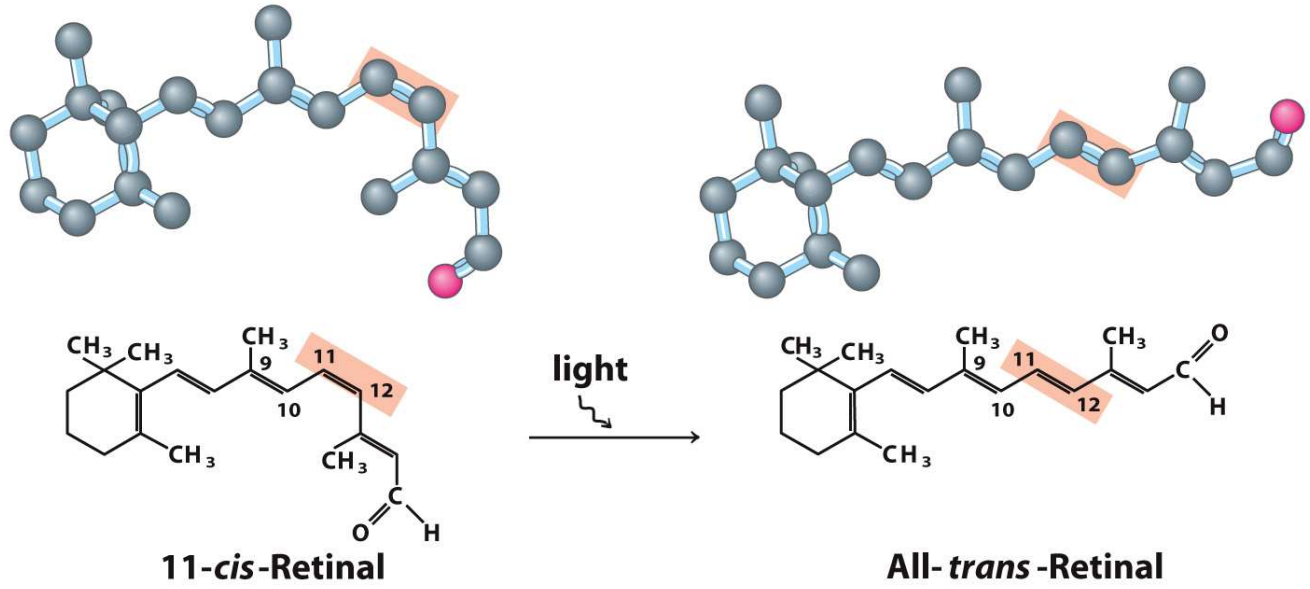

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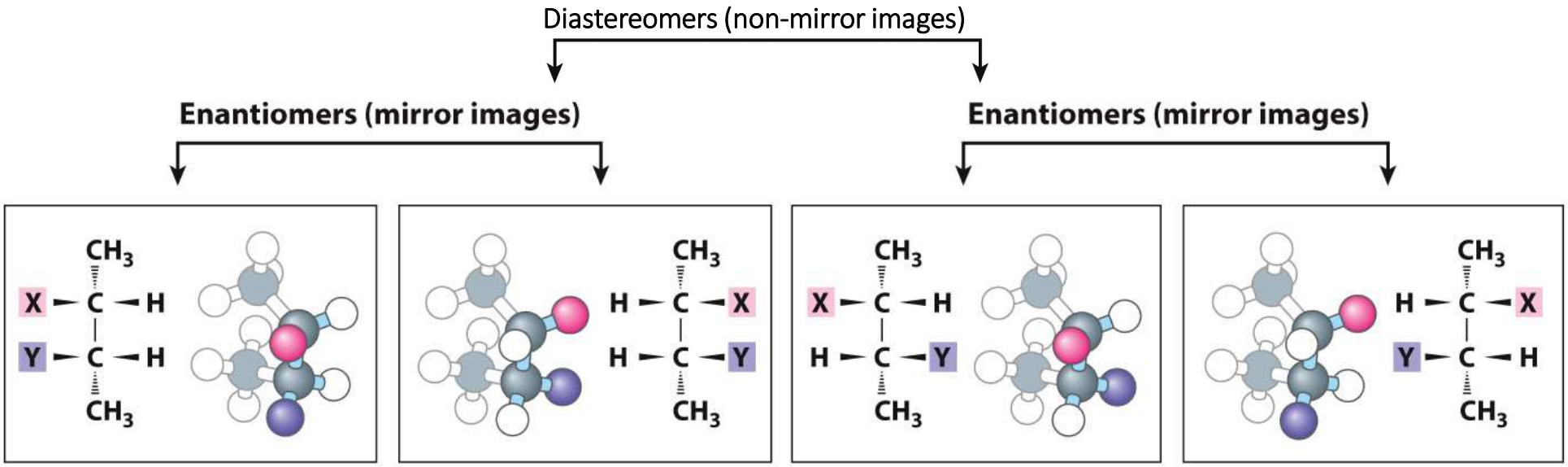
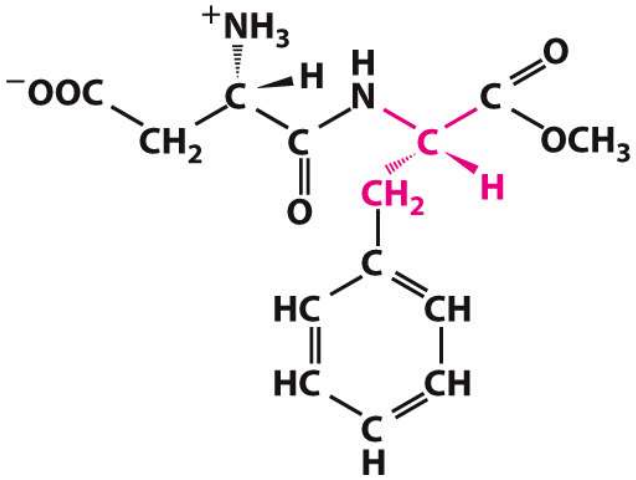
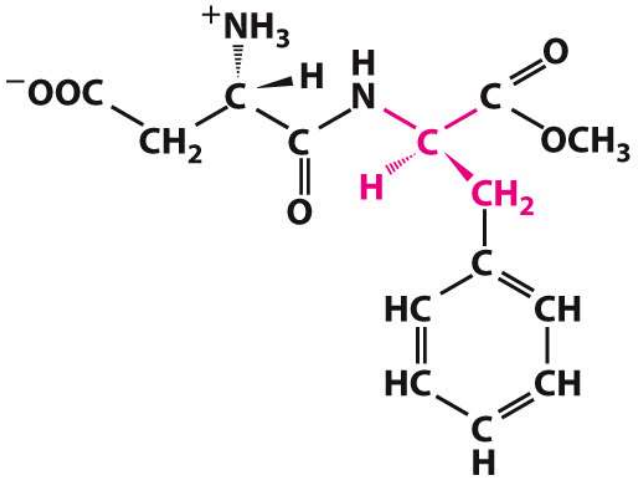
Enantiomers and Diastereomers





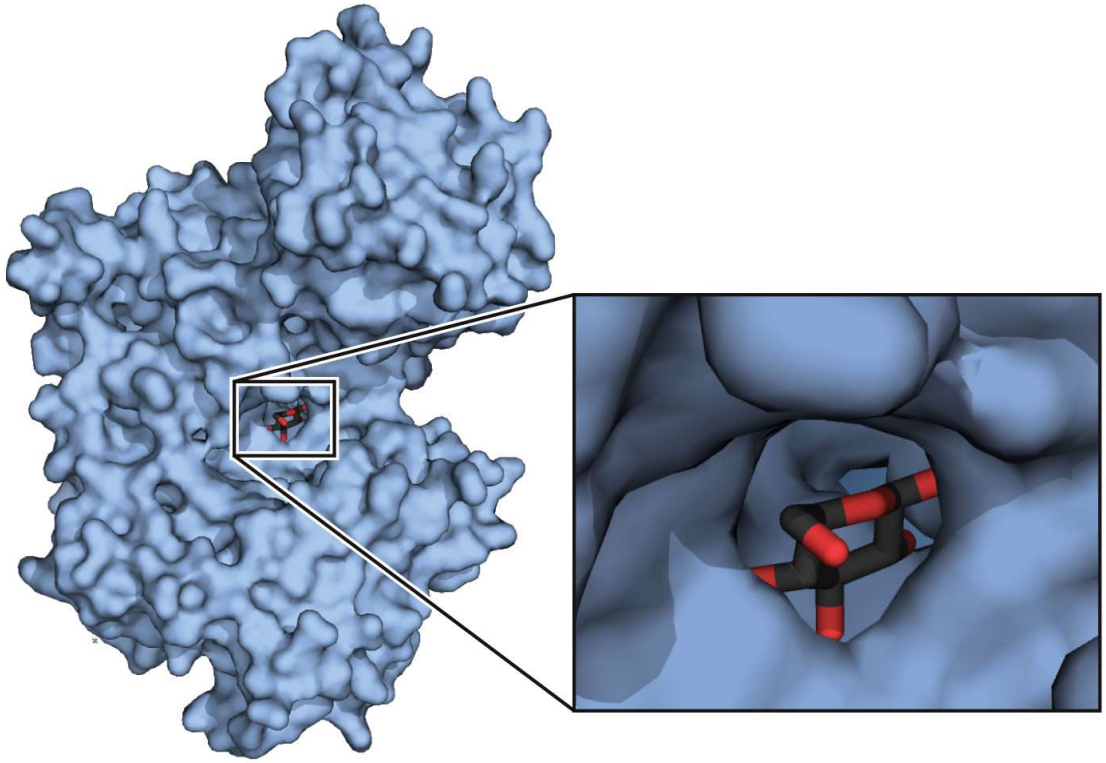
L-Aspartyl-L-phenylalanine methyl ester (aspartame) (sweet)



L-Aspartyl-D-phenylalanine methyl ester (bitter)

Specific Interactions between Biomolecules

- Macromolecules fold into 3D structures with unique binding pockets.
- Only certain molecules fit in well and can bind.
- Binding of chiral biomolecules is stereospecific.



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Chapter 1: Summary

- Living organisms (domains, kingdoms, definition?)
- Structure and function of the cell (2 types)
- Biomolecules and building blocks

Next week: Energy and metabolism, thermodynamics