Chapter 4

Carbon and the Molecular Diversity of Life

PowerPoint® Lecture Presentations for

Biology

Eighth Edition

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Lectures by Chris Romero, updated by Erin Barley with contributions from Joan Sharp

Overview: Carbon: The Backbone of Life

- Why dedicate a whole chapter to Carbon?
- Importance of Carbon:

Periodic Table

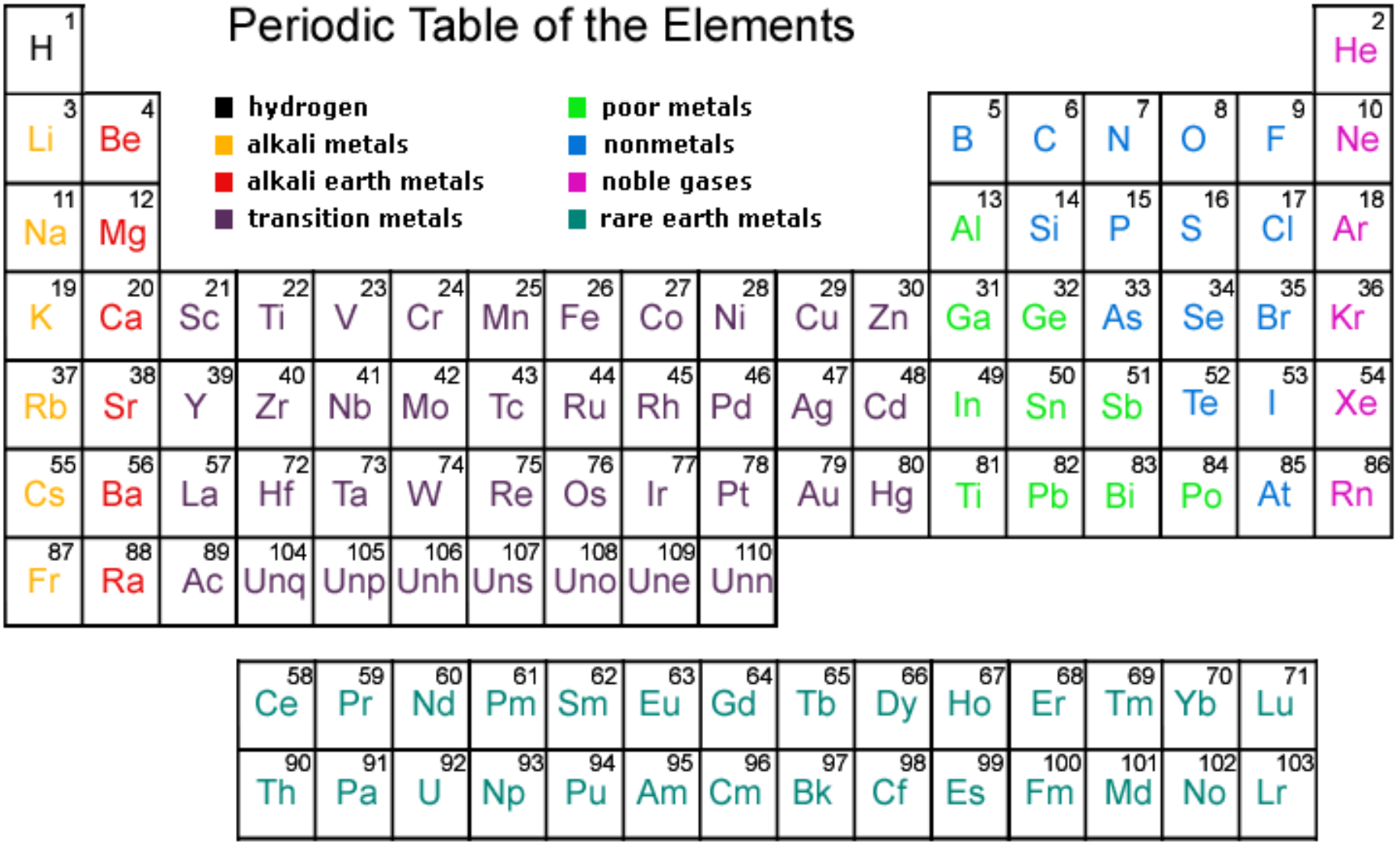
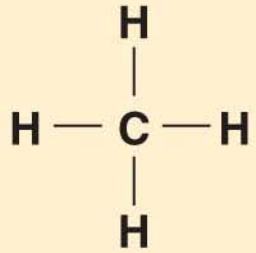
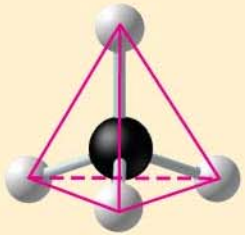
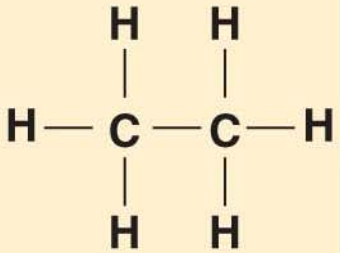
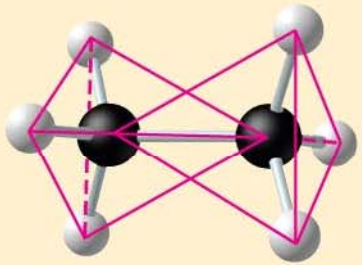
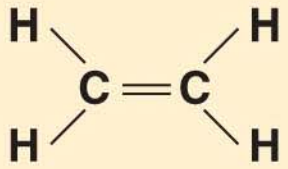
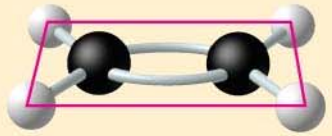


Fig. 4-3

Name	Molecular Formula	Structural Formula	Ball-and-Stick Model	Space-Filling Model
(a) Methane	CH_4			
(b) Ethane	C_2H_6			
(c) Ethene (ethylene)	C_2H_4			

- How many valence electrons does C have?
- How many covalent bonds can C form with other atoms?
- What atoms most frequently bond with C?

- Carbon chains form the skeletons of most organic molecules
- Carbon chains vary in length and shape

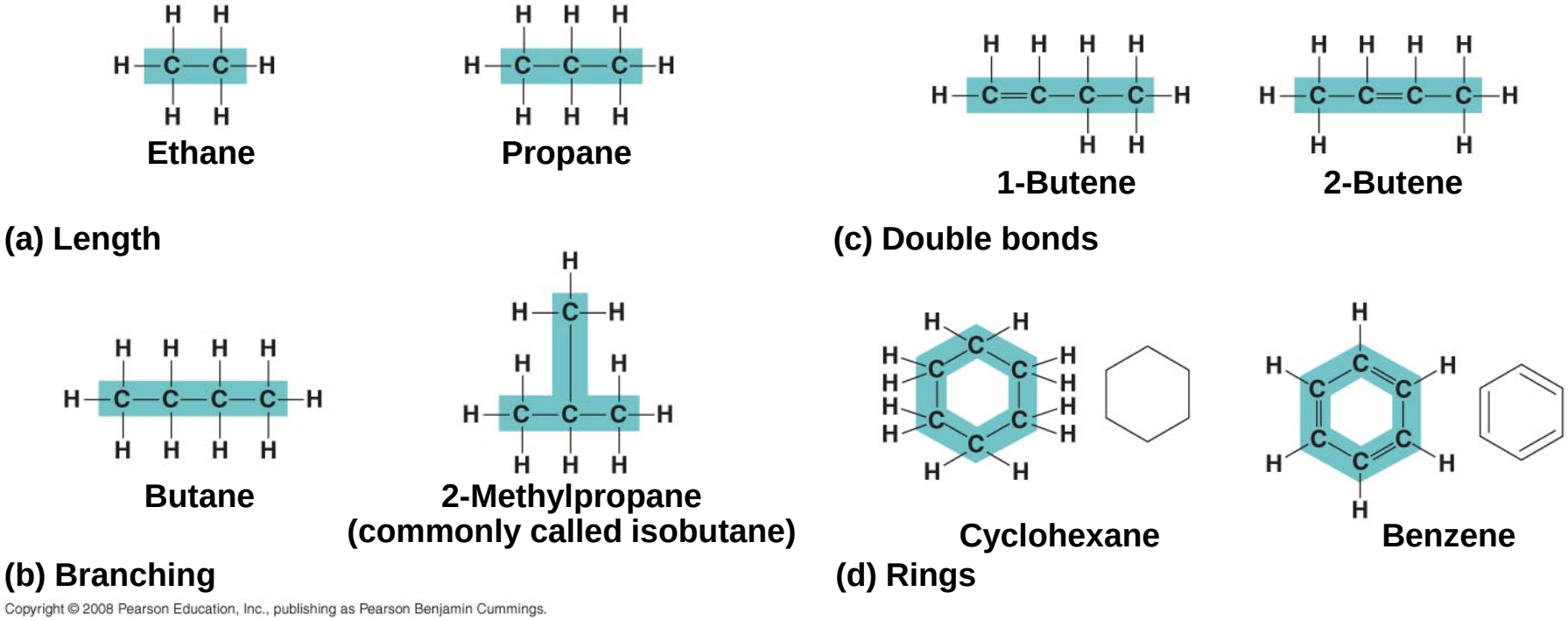
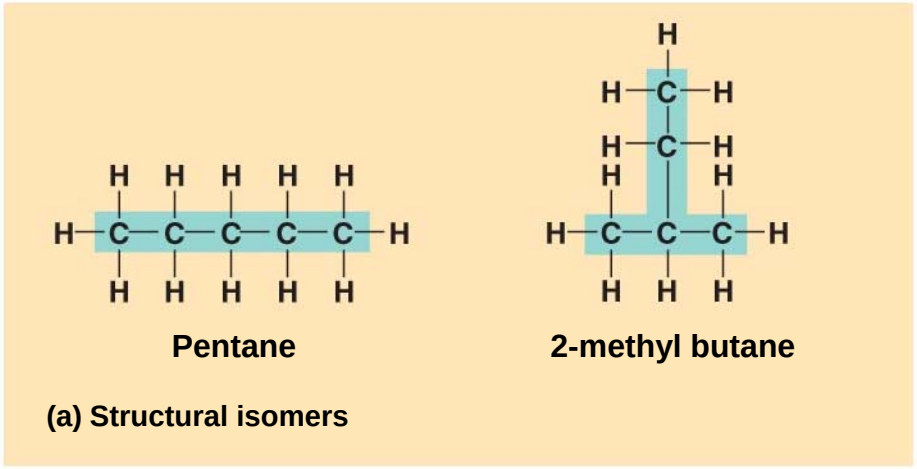


Fig. 4-5

Fig. 4-7



What is an isomer?

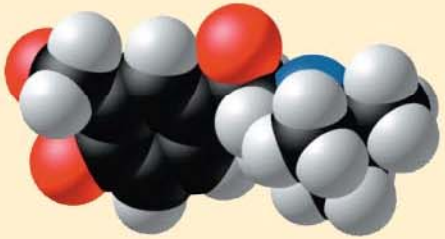
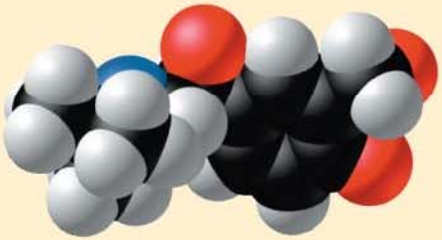
Do you have to have a double bond?

What is an asymmetric carbon?

Does it really matter?

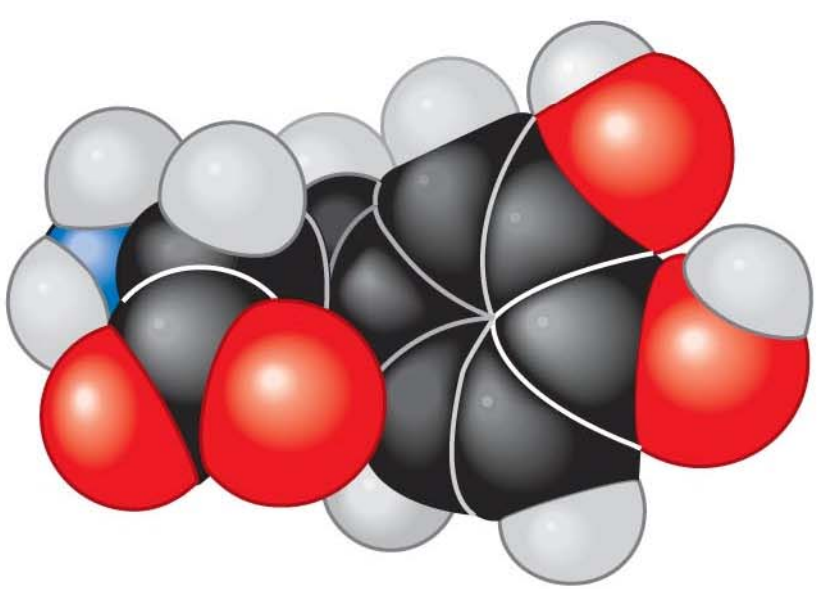
Fig. 4-8

Two enantiomers of a drug may have different effects

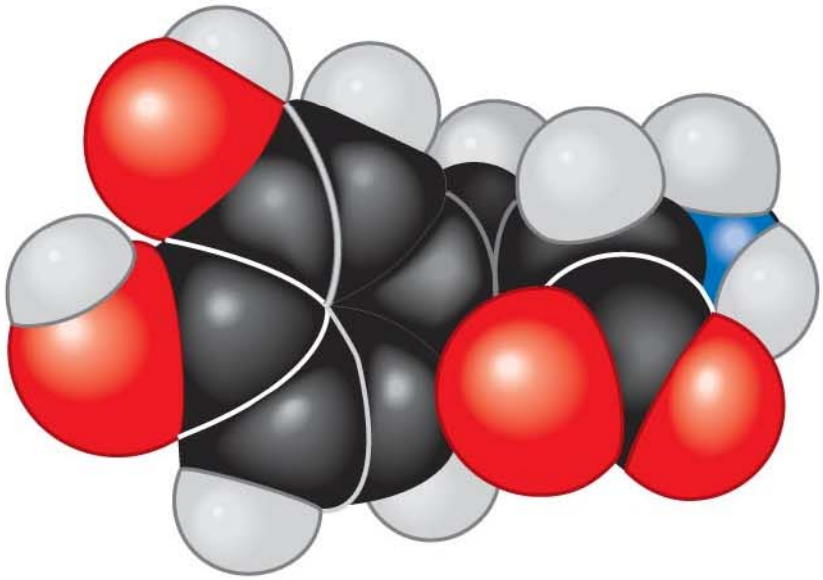
Drug	Condition	Effective Enantiomer	Ineffective Enantiomer
Ibuprofen	Pain; inflammation	 *S*-Ibuprofen	 *R*-Ibuprofen
Albuterol	Asthma	 *R*-Albuterol	 *S*-Albuterol

PLAY Animation: L-Dopa

Fig. 4-UN9



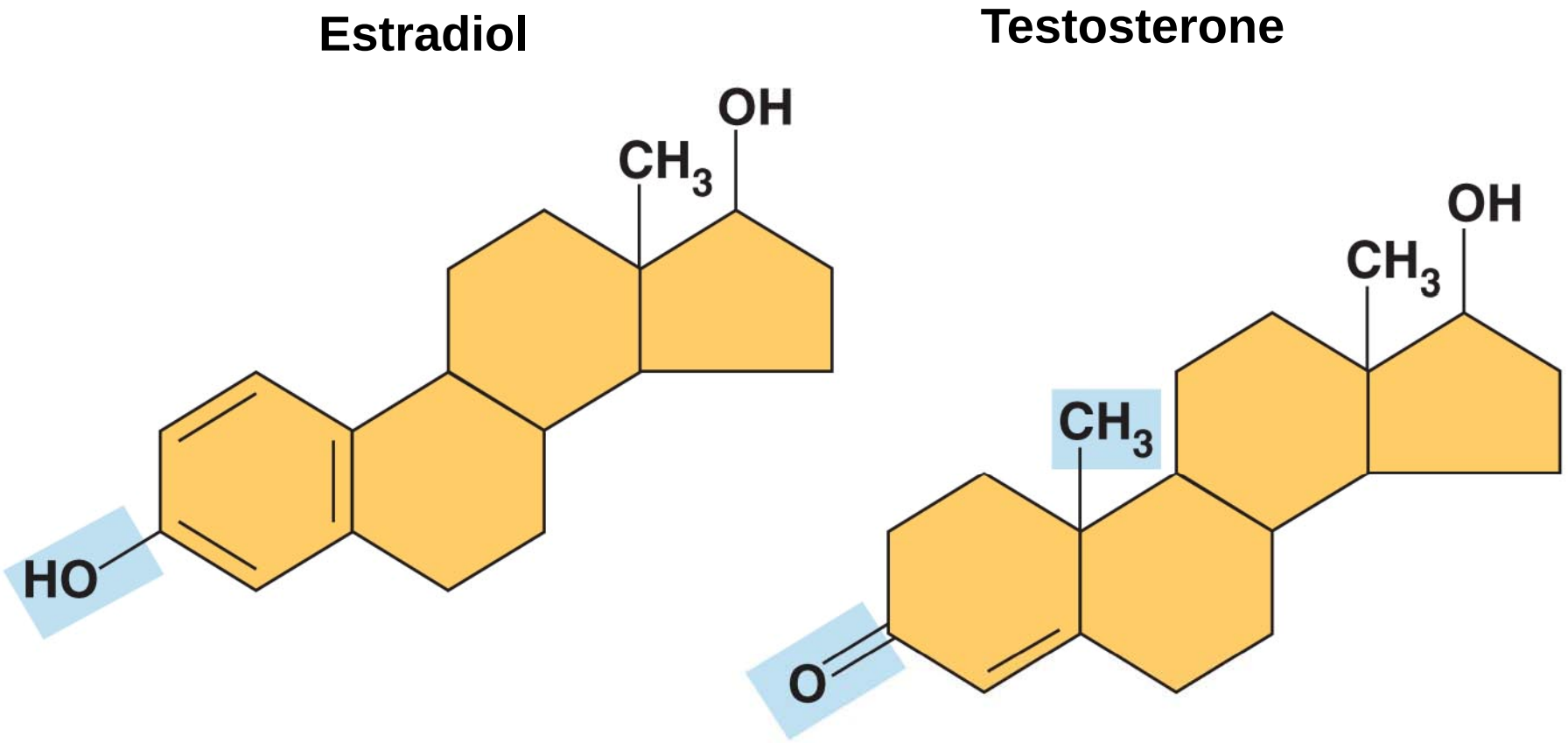
L-dopa



D-dopa

Fig. 4-9

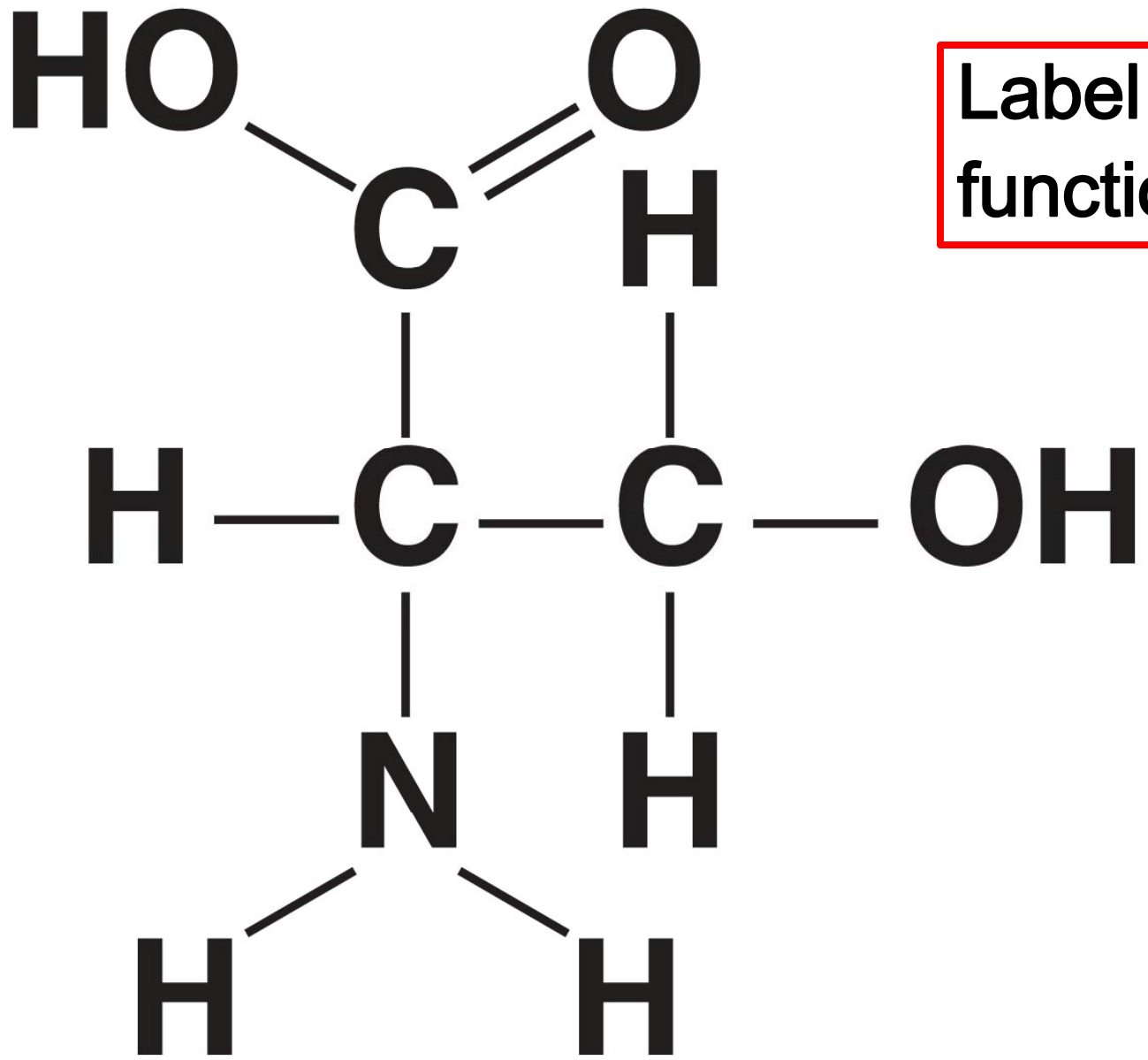
Distinctive properties of organic molecules depend not only on the carbon skeleton but also on molecular components attached to it



Functional groups are the components of organic molecules that are most commonly involved in chemical reactions

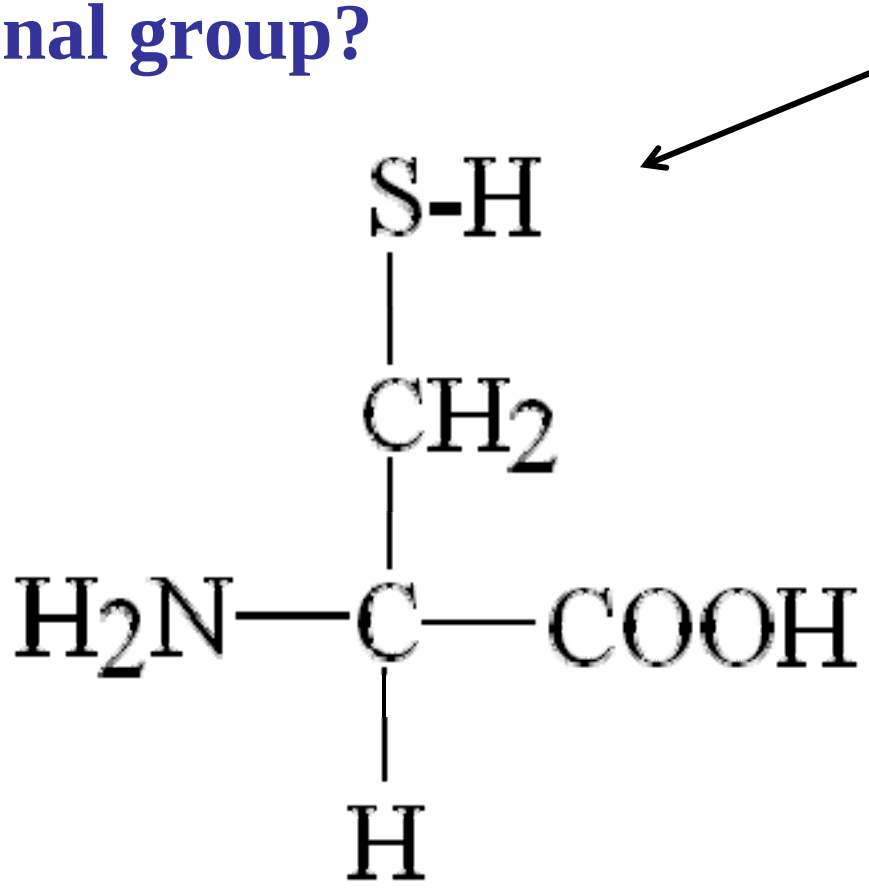
- Seven important functional groups – Draw them:
  - Hydroxyl group
  - Carbonyl group
  - Carboxyl group
  - Amino group
  - Sulfhydryl group
  - Phosphate group
  - Methyl group

Fig. 4-UN8



Label all of the functional groups

Name and describe the importance of this functional group?

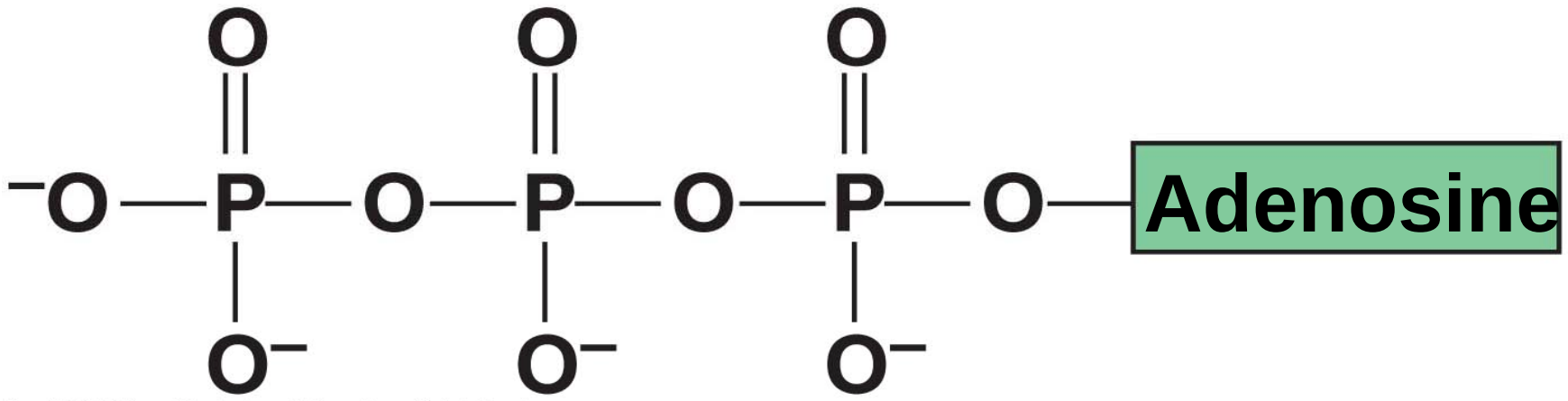


cysteine

Fig. 4-UN3

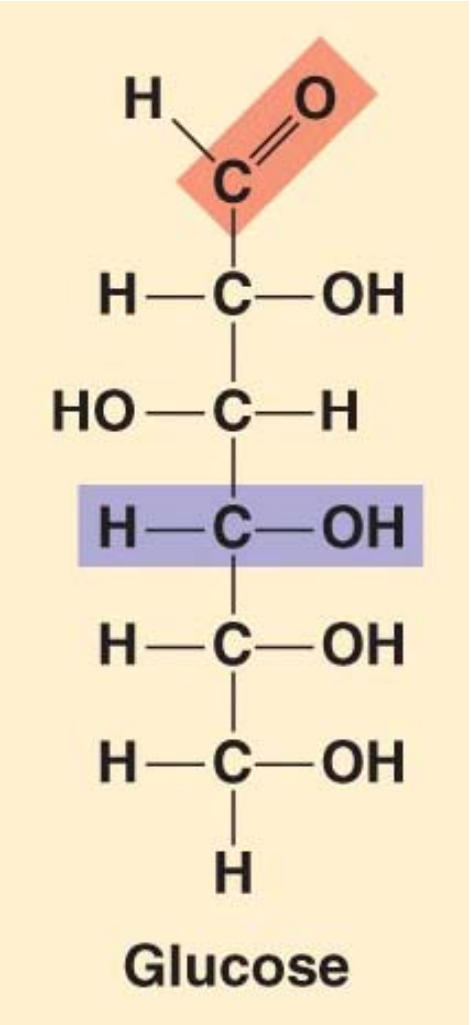
Name this molecule?

What is the importance of its functional groups?



Is this molecule soluble in water?

- yes
- no



The Chemical Elements of Life: *A Review*

BIG take-home messages are: