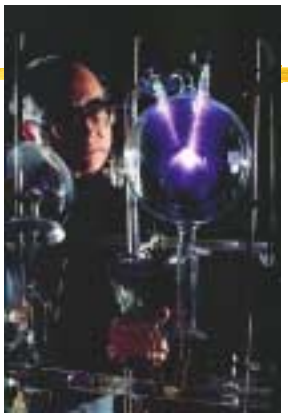
CHAPTER 4
CARBON AND THE DIVERSITY OF LIFE

THE IMPORTANCE OF CARBON

- ORGANIC CHEMISTRY IS THE STUDY OF CARBON COMPOUNDS.
- LIVING AND SYNTHETIC MATERIALS.
- STANLEY MILLERS INVESTIGATIONS.
- PRIMITVE EARTH/ORGANIC COMPOUNDS
- VTALISM VS. MECHANISM THEORIES.

Figure 4.1 Abiotic synthesis of organic compounds under “early Earth” conditions



CARBON ATOMS AS BUILDING BLOCKS

- COVALENT -BONDING CAPACITY OF 4
- LENDS TO ORGANIC DIVERSITY.
- CARBONS CAN BOND TO A VARIETY OF ATOMS; O,H,N.\, ETC.
- C CAN BOND TO OTHER CARBON ATOMS
- FORMS SKELETAL COMPOUNDS

Figure 4.2 The shapes of three simple organic molecules

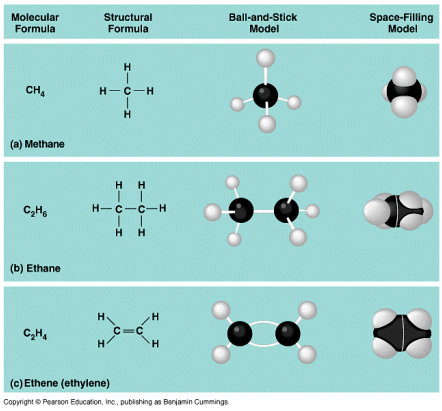
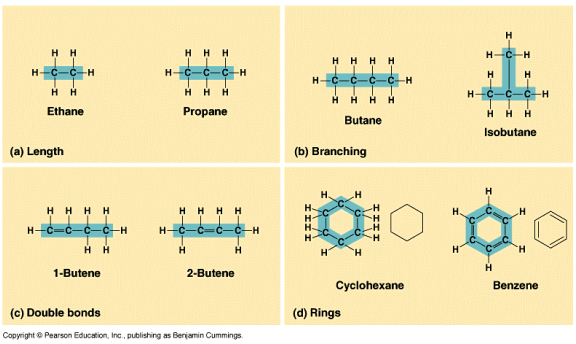


Figure 4.4 Variations in carbon skeletons



CARBON SKLETON VARIATION

- CARBON SKELETONS VARY IN SHAPE AND LENGTH.
- HAVE BONDING SITES FOR OTHER ATOMS.
- HYDROCARBONS CONSIST OF H AND C.
- BASIS FOR ISOMERS: STRUCTURAL, GEOMETRIC AND ENATIOMERS.

Figure 4.6 Three types of isomers

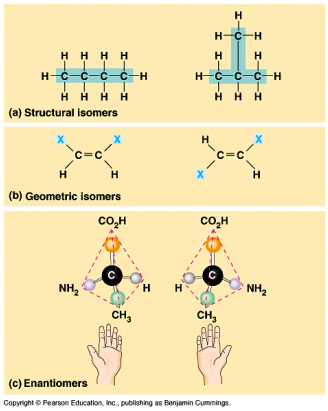
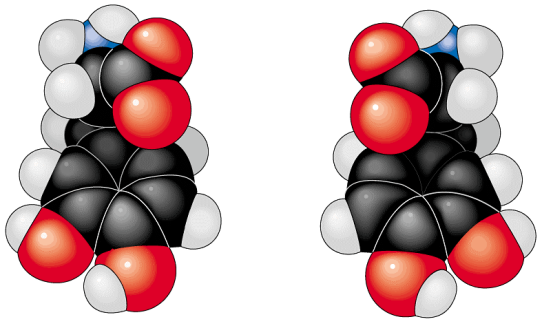


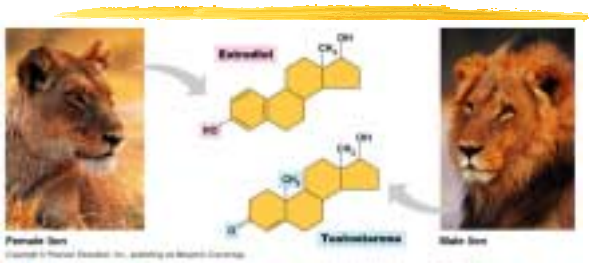
Figure 4.7 The pharmacological importance of enantiomers



L-Dopa
(effective against Parkinson's disease)

D-Dopa
(biologically inactive)

Figure 4.8 A comparison of functional groups of female (estradiol) and male (testosterone) sex hormones



FUNCTIONAL GROUPS

- CONTRIBUTE TO MOLECULAR DIVERSITY
- HYDROXYL GROUP/ALCOHOLS
- CARBONYL GROUP/ALDEHYDE/KETONES
- CARBOXYL GROUP/CARBOXYLIC ACIDS
- AMINO GROUP/AMINES
- SULFHYDRYL GROUP/THIOLS
- PHOSPHATE GROUP/PO4

Table 4.1 Functional Groups of Organic Compounds

Table 4.1 Functional Groups of Organic Compounds

Functional Group	Formula	Name of Compounds	Example
Hydroxyl	—OH	Alcohols	Ethanol (the drug of alcoholic beverages)
Carbonyl		Aldehydes	Propanal
		Ketones	Acetone
Carboxyl	(non ionized) (ionized)	Carboxylic acids	Acetic acid* (the acid of vinegar)
Amino	(non ionized) (ionized)	Amines	Glycine* (an amino acid)
Sulfhydryl	—SH	Thiols	Ethanethiol
Phosphate		Organic phosphates	Glycerol phosphate

*The ionized forms of the carboxyl and amino groups prevail in cells. However, acetic acid and glycine are represented here in their non-ionized forms.