What’s Organic About Organic Chemistry?

Mid 18th Century - Compounds produced by living things were recognized as more difficult to isolate, purify and handle than compounds obtained from inanimate minerals.

1770 - Torbern Berman (Swedish chemist) noted the difference between chemicals derived from organic (living) and from inorganic (mineral) substances.

Organic chemicals came to mean chemicals derived from living organisms.

The Vital Force Theory of Organic Chemistry

Late 18th and early 19th Centuries - Many chemists believed that a “vital force”, a mysterious, presumed property of living things was needed for the formation of organic compounds.

This theory held that in the absence of this “vital force” of living things, no organic compounds could be formed.

But . . .

Chevreul’s Soap

1816 - Michel Chevreul (French chemist) converted soap (prepared from animal fat and therefore organic) into glycerol and substances he called fatty acids.

Since these were also classified as organic compounds, Chevreul converted one organic compound into other organic compounds without intervention of the vital force.

Wohler’s Synthesis of Urea

In 1828 Friedrich Wohler (German chemist) converted ammonium cyanate, recognized as an inorganic compound, into urea, an organic compound found in human urine.

Wohler’s laboratory synthesis of urea dealt a mortal blow to the vital force theory of organic chemistry.
Organic Chemistry - The Chemistry of Carbon Compounds
Because almost all chemical compounds found in living systems contain carbon, today we recognize organic chemistry as the chemistry of carbon compounds. (One vital compound, common to all living things, contains no carbon at all. Which compound is that?)

Carbon's s and p orbitals

Only s and p orbitals are available on a carbon atom.

The Isolated Carbon Atom's Three p Atomic Orbitals

Note that the s orbital is not shown in this illustration.

Carbon - sp³ Hybridization

One s and three p orbitals (a total of 4 orbitals containing 4 electrons) hybridize to . . . . . four energetically equivalent sp³ orbitals (again, a total of 4 orbitals containing 4 electrons).

The Lewis Structure of Methane, CH₄

Lewis structures show all valence electrons

The Molecular Structure of Methane, CH₄

Overlap of each of the sp³ orbitals of the carbon with an s orbital of a hydrogen produces methane, CH₄, a tetrahedral hydrocarbon containing four sp³-s covalent bonds.
Methane, A Tetrahedral Hydrocarbon

The orbital and molecular structure of ethane, C$_2$H$_6$

The ethane molecule contains six $sp^3$-s C-H bonds and one $sp^3$-$sp^3$ C-C bond.

Ethane, C$_2$H$_6$

Valence bond structure
Condensed structure

The hybridizations of carbon:

- $sp^3$ - The carbons of alkanes
- $sp^2$ - The carbons of the double bond of alkenes, which we will consider later in CHM 201 C
- $sp$ - The carbons of the triple bond of alkynes, which we will consider later in CHM 201 C

End

Structure and Bonding