

INTRODUCTION TO BIOCHEMISTRY





OBJECTIVES

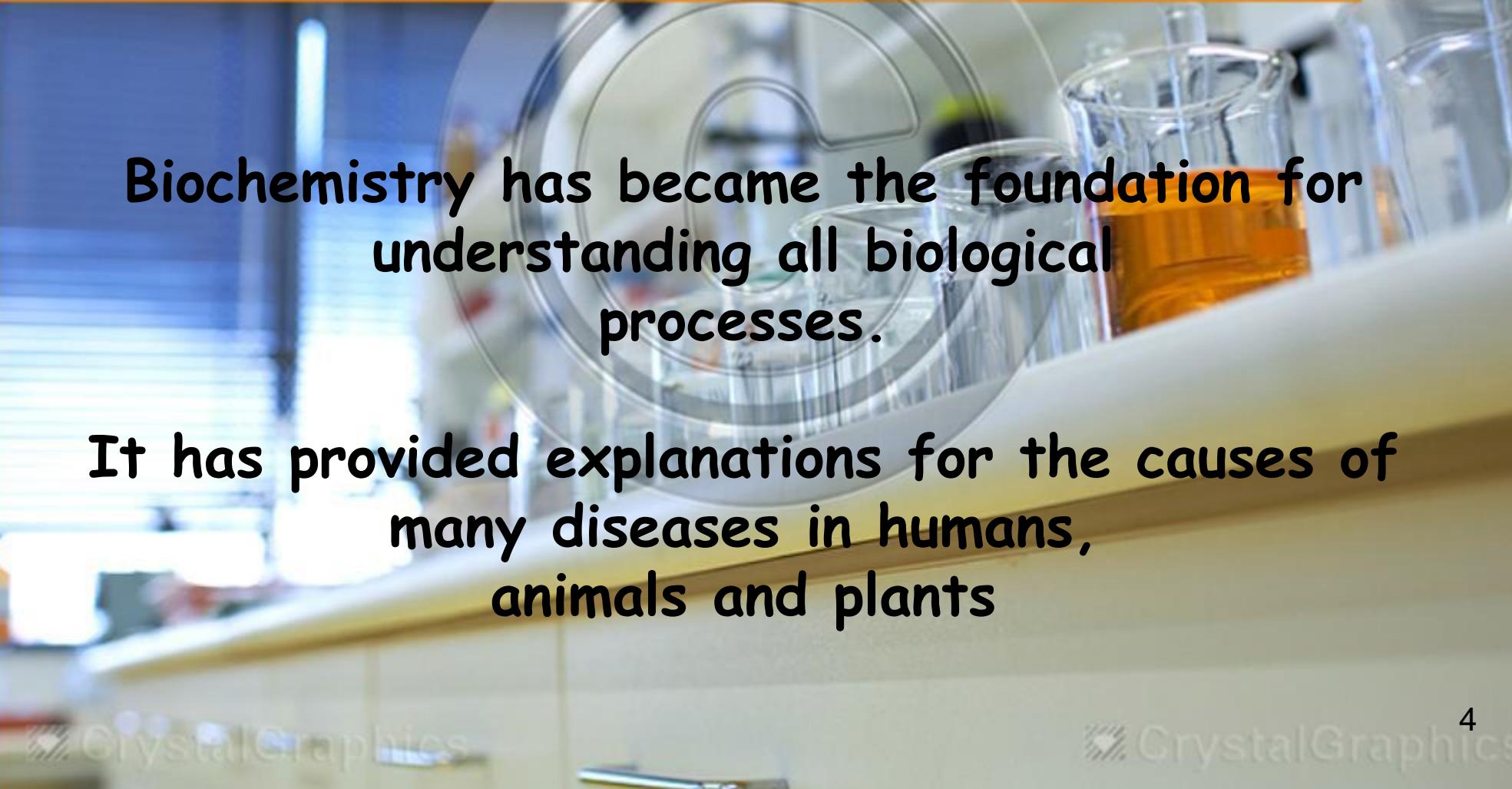
- ***At the end of lecture, student would be able to:***
 - Define biochemistry of human body.
 - Understand the biochemical structure and of the human body.
 - Describe the three classes of polymeric biomolecules and their monomeric building blocks.

CHEMISTRY

The study of:

- the composition (make-up) of matter
- the changes that matter undergoes

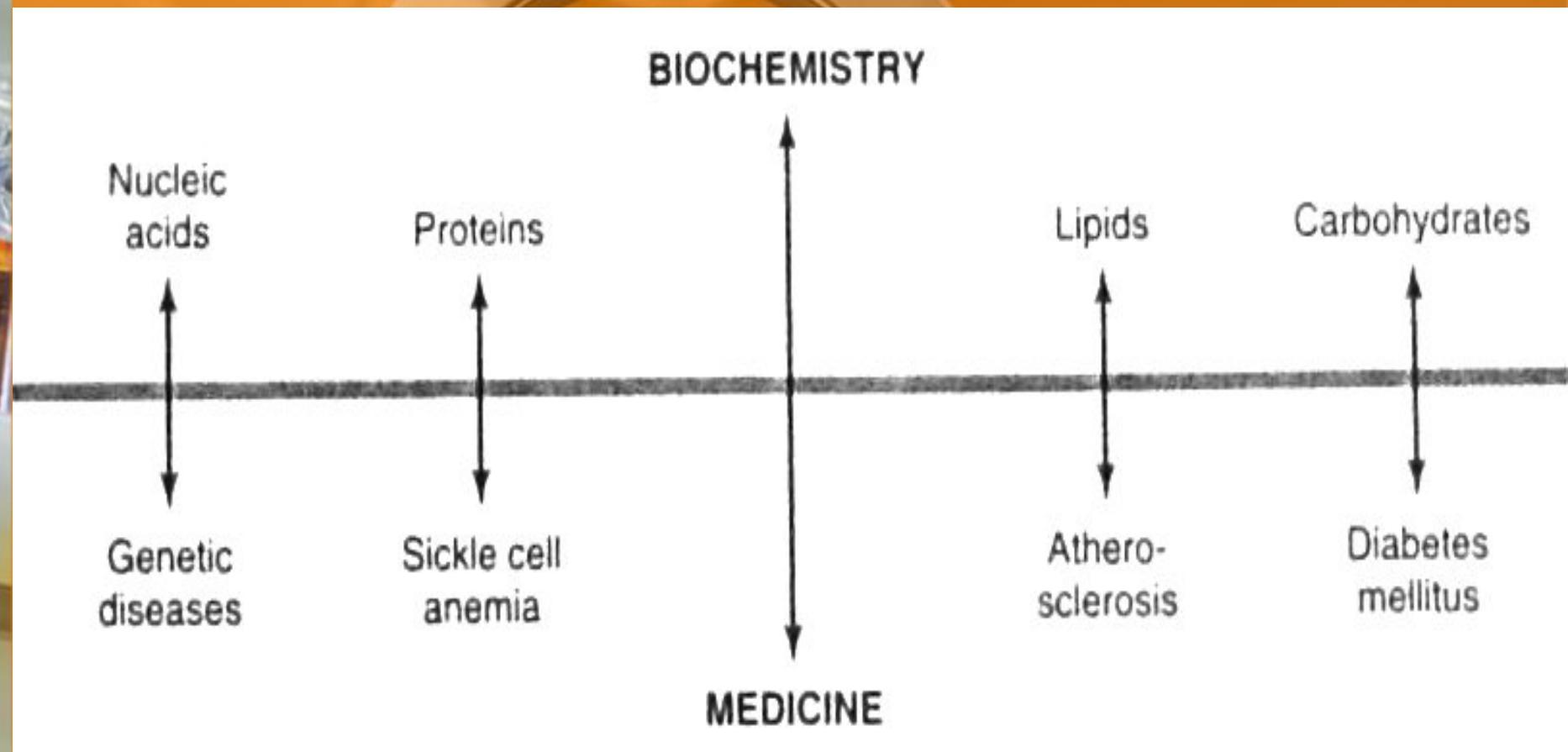
Biochemistry = chemistry of life



Biochemistry has became the foundation for understanding all biological processes.

It has provided explanations for the causes of many diseases in humans, animals and plants

Two-Way Street: Medicine and Biochemistry

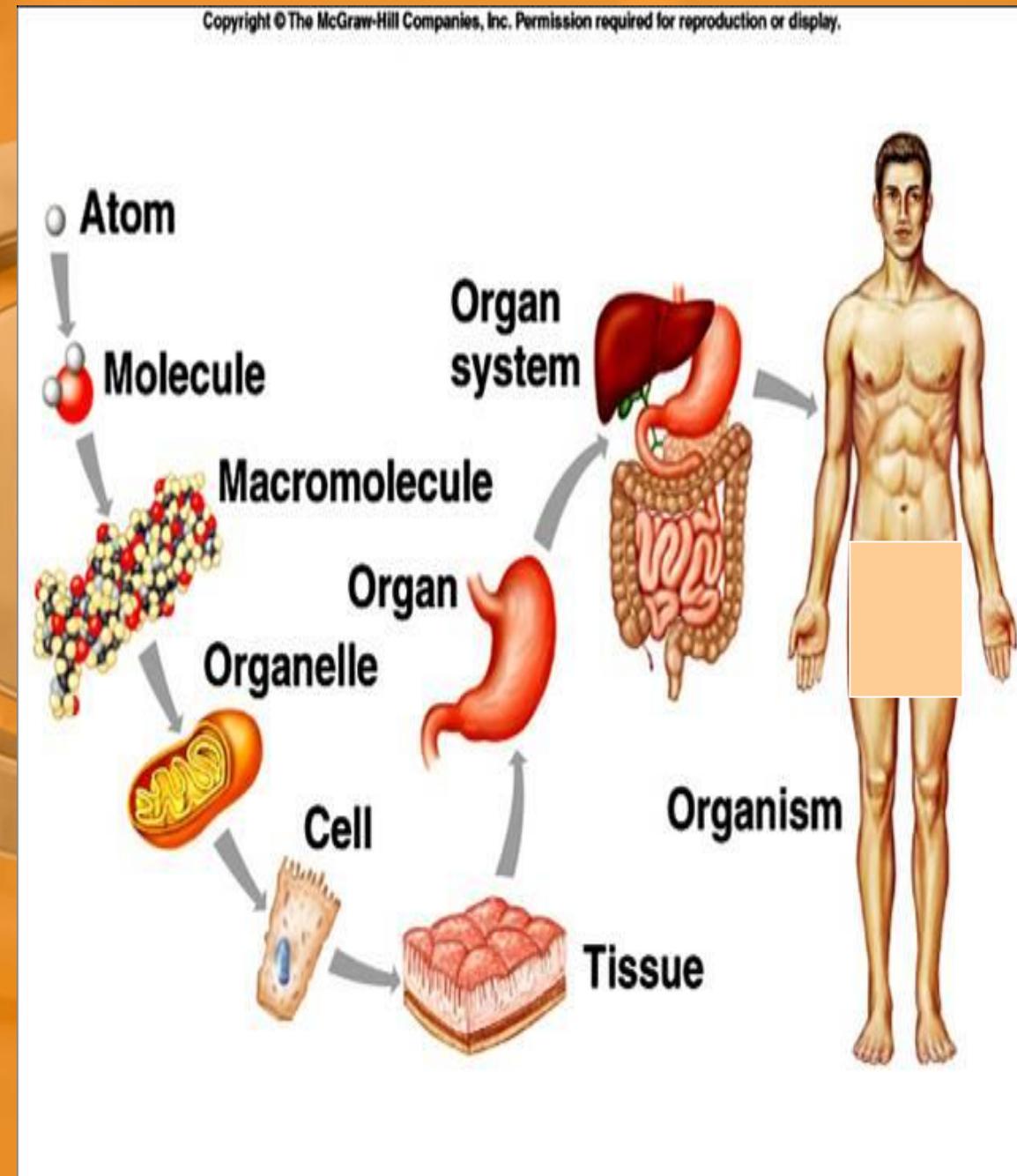


What is Biochemistry ?

- Biochemistry is the application of chemistry to the study of biological processes at the cellular and molecular level.
- It emerged as a distinct discipline around the beginning of the 20th century when scientists combined chemistry, physiology and biology to investigate the chemistry of living systems by:
 - A. Studying the structure and behavior of the complex molecules found in biological material and
 - A. the ways these molecules interact to form cells, tissues and whole organism

Organization of Life

- Elements
- Simple organic compounds (monomers)
- Macromolecules (polymers)
- Organelles
- Cells
- Tissues
- Organs
- Organ System
- Organisms

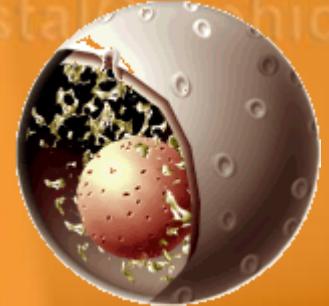


BIOCHEMISTRY



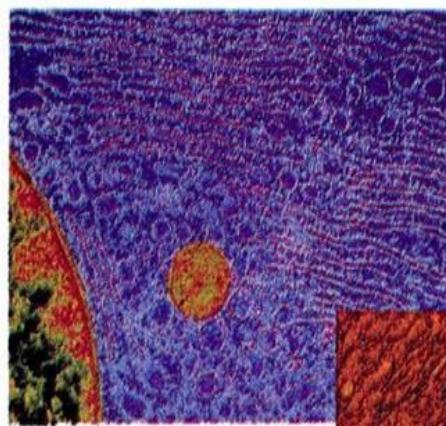
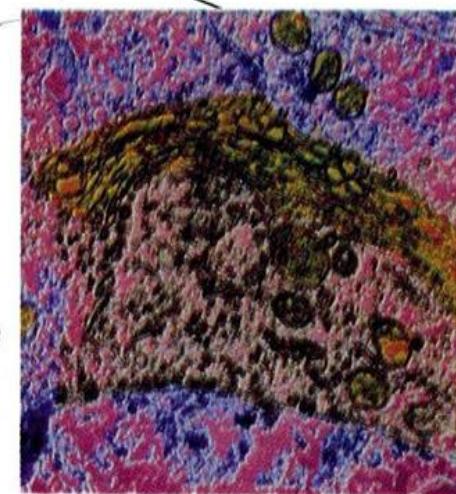
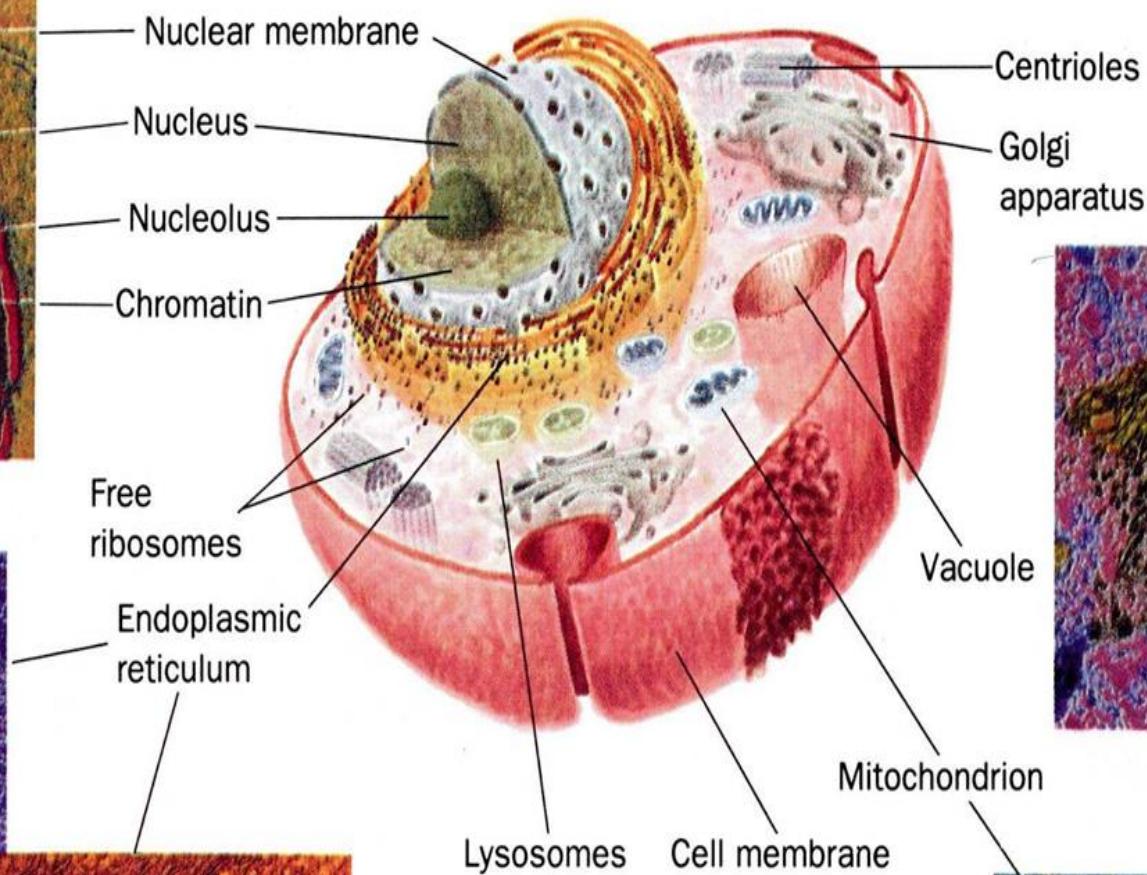
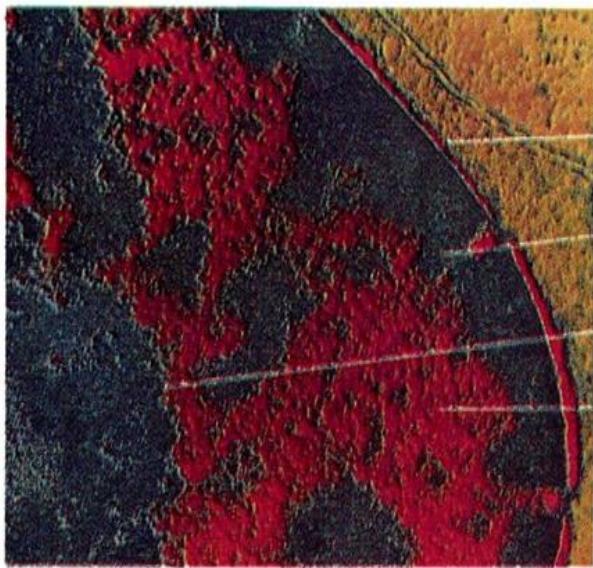
DEFINITION:

- Chemistry of living organisms.
OR
- The study of biology at the molecular level.
OR
- Study of chemical processes that take place in organisms.
OR
- Study of molecules of living organisms and their habitats

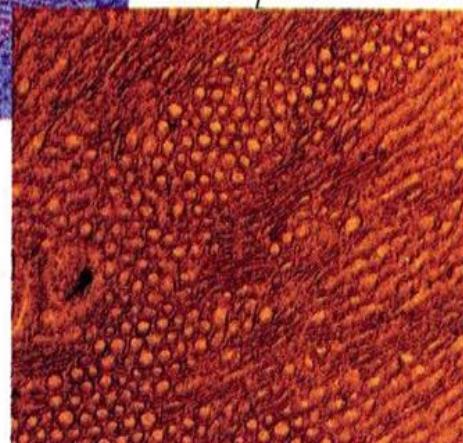


Cells are the structural and functional units of life
A cell is the basic unit of life

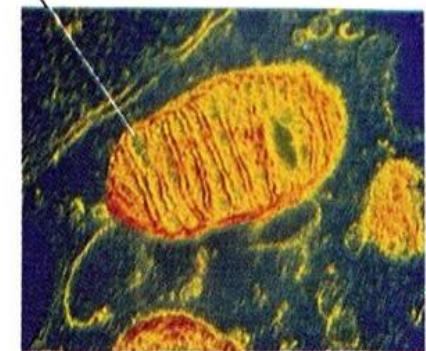
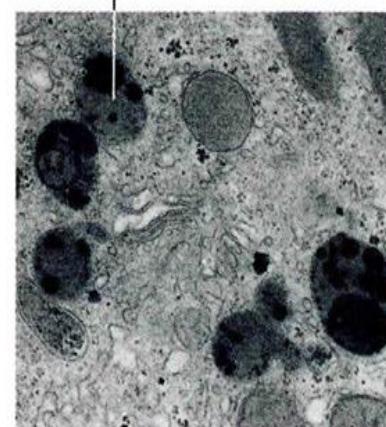


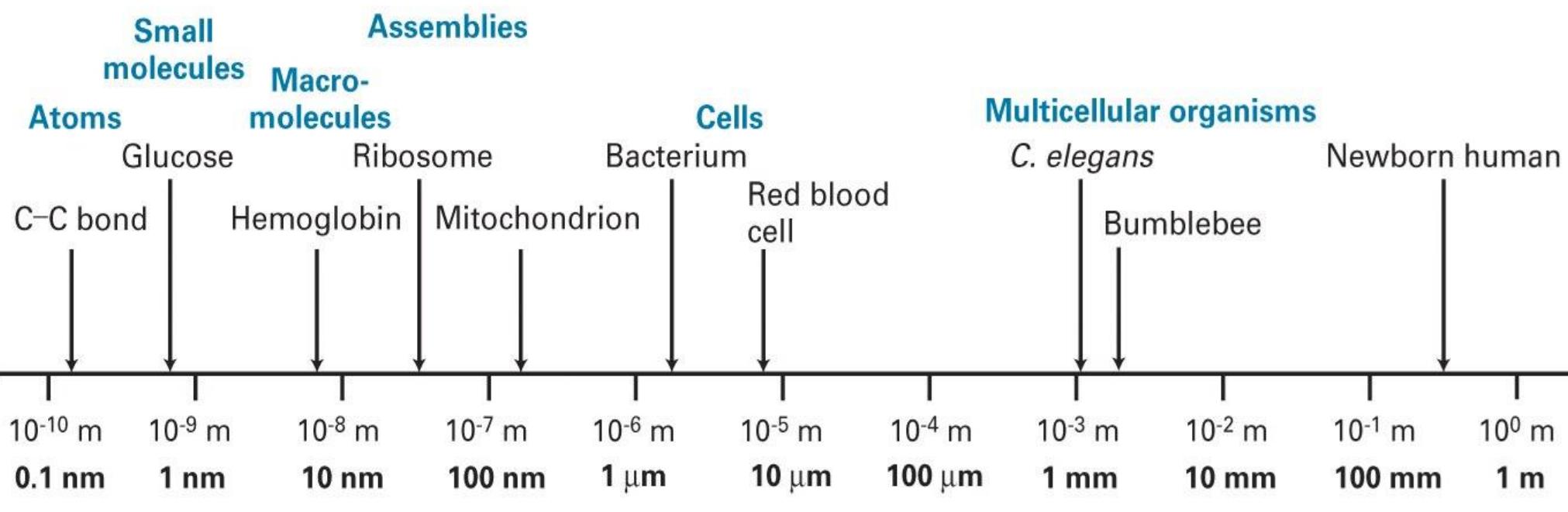
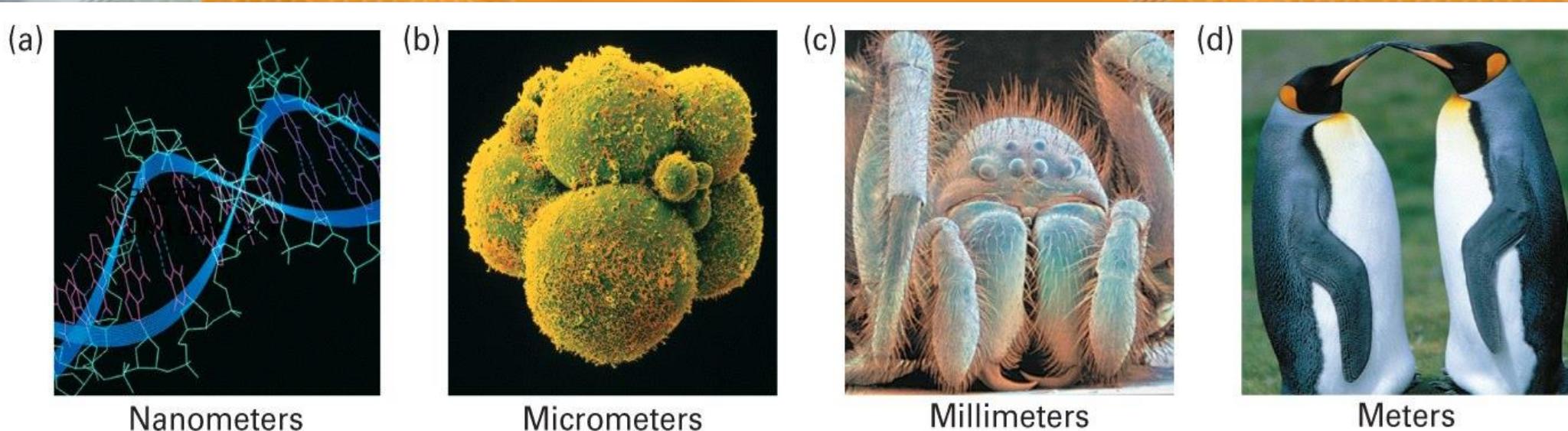


Rough endoplasmic reticulum



Smooth endoplasmic reticulum

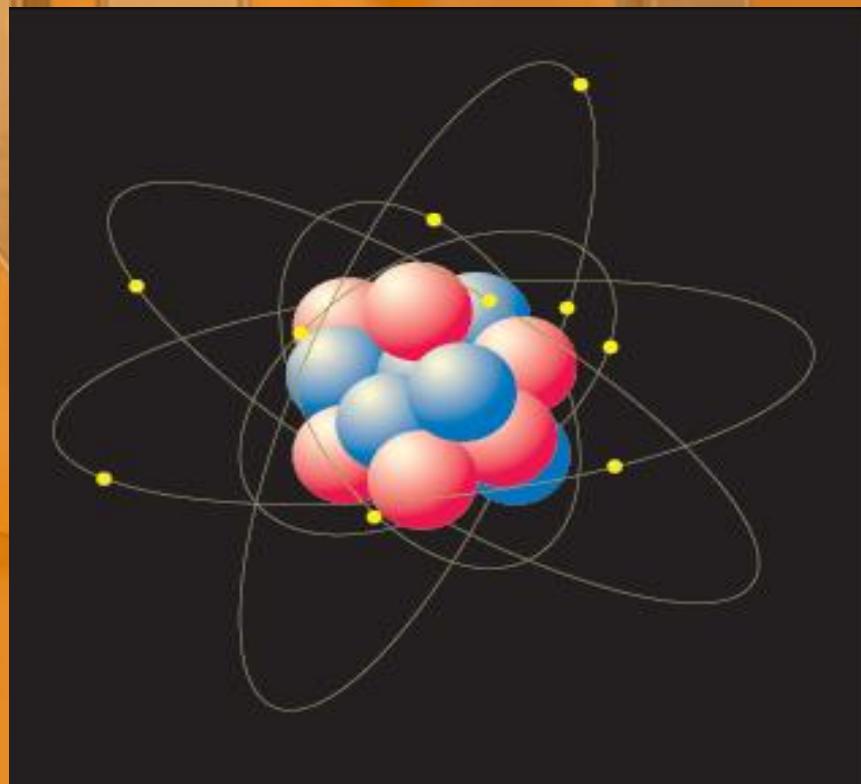


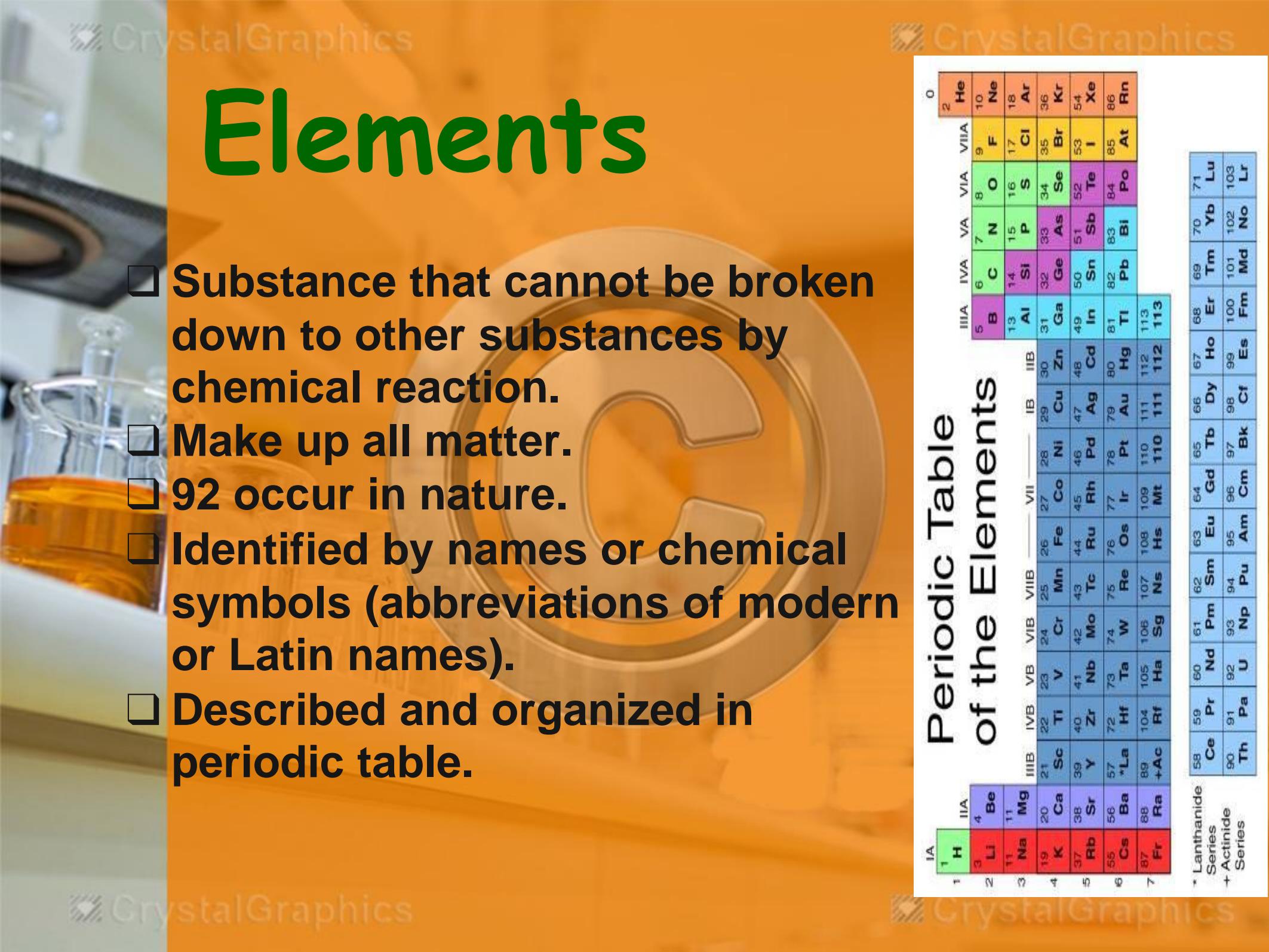


Biochemistry

Atoms

- Subunits of elements.
- Smallest complete units of matter.
- Cannot be broken down or changed by ordinary chemical and physical means.





Elements

- Substance that cannot be broken down to other substances by chemical reaction.
- Make up all matter.
- 92 occur in nature.
- Identified by names or chemical symbols (abbreviations of modern or Latin names).
- Described and organized in periodic table.

Periodic Table of the Elements																				
		IA			IIA		IIIA		IVA		VA		VIA		VIIA		0			
		1	H	2	Li	3	Be	4	B	5	C	6	N	7	O	8	F	9	He	
1	Hydrogen	2	Lithium	3	Boron	4	Carbon	5	Nitrogen	6	Hydrogen	7	Fluorine	8	Neon	9	Fluorine	10	Neon	
2	Helium	3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Neon	11	Neon	
3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
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72	11	12	13																	

Elements cont. .

- Among 92 nature elements, only 25 elements are essential to life.
- Only 4 elements: C, H, O, N make up 96% of living matter.

Table 2.1 Naturally Occurring Elements in the Human Body

Symbol	Element	Atomic Number (See p. 29)	Percentage of Human Body Weight
O	Oxygen	8	65.0
C	Carbon	6	18.5
H	Hydrogen	1	9.5
N	Nitrogen	7	3.3
Ca	Calcium	20	1.5
P	Phosphorus	15	1.0
K	Potassium	19	0.4
S	Sulfur	16	0.3
Na	Sodium	11	0.2
Cl	Chlorine	17	0.2
Mg	Magnesium	12	0.1

Trace elements (less than 0.01%): boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), and zinc (Zn).

□ **Trace elements** = elements that are required by an organism in only minute quantities.

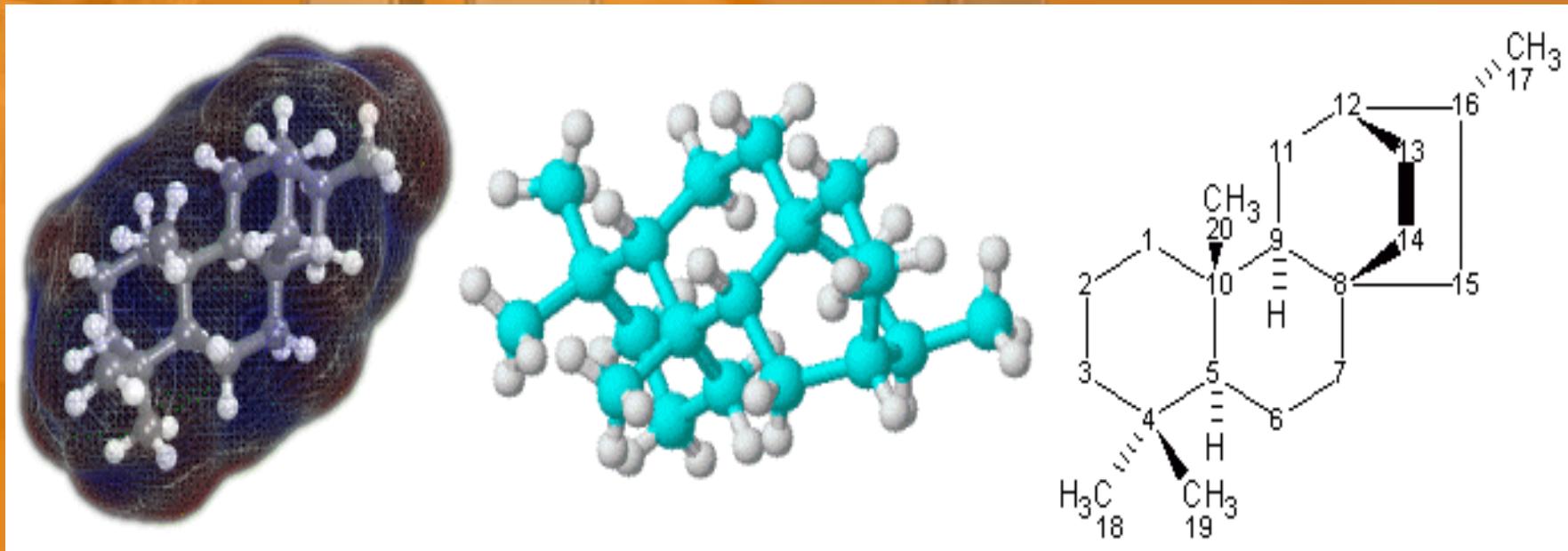
I = an ingredient of thyroid hormone
(need 0.15mg/day)

Goiter due to iodine deficiency



Molecules

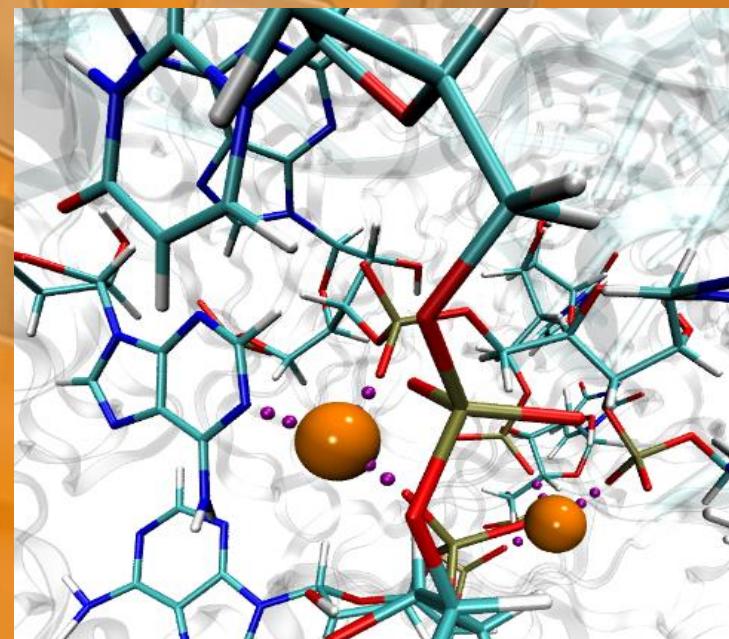
- Formed when two or more atoms unite on the basis of their electron structures
- Can be made of like atoms or atoms of different elements



Biomolecules

- A biomolecule is any organic molecule that is produced by a living organism.
- As organic molecules, biomolecules consist primarily of **carbon and hydrogen, nitrogen and oxygen**, and, to a smaller extent, phosphorus and sulfur. Other elements sometimes are incorporated but are much less common. A diverse range of biomolecules exist, including:

- Carbohydrates
- Lipids
- Proteins
- Nucleic acid



Biomolecules cont..

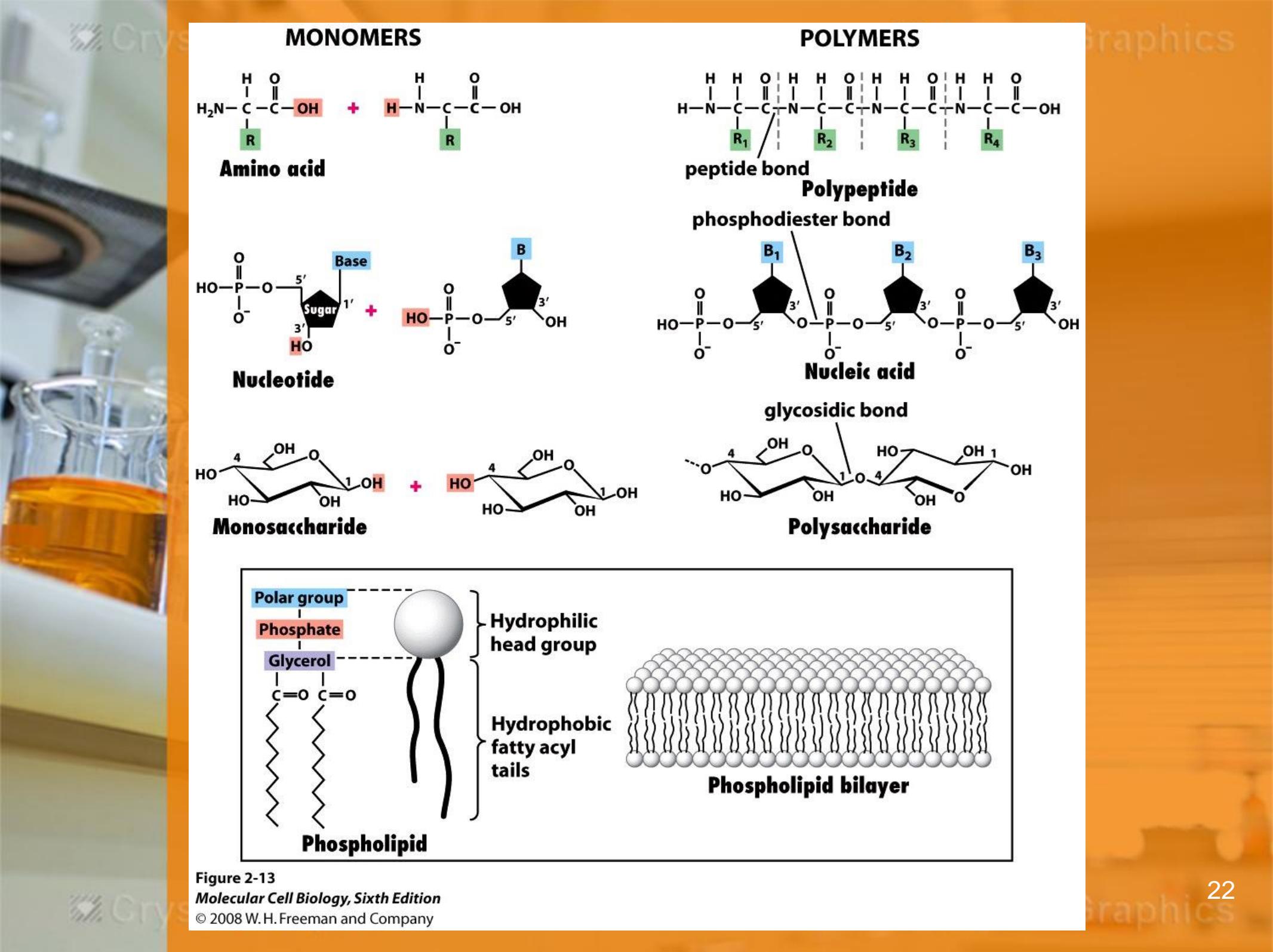
- Just like cells are building blocks of tissues likewise bio-molecules are building blocks of cells.
- Animal and plant cells contain approximately 10, 000 kinds of molecules (bio-molecules)
- Water constitutes 50-95% of cells content by weight.
- Almost all other kinds of bio-molecules are organic (C, H, N, O, P, S)
- Infinite variety of molecules contain C.
- Most bio-molecules considered to be derived from hydrocarbons.

Biomolecules - Structure

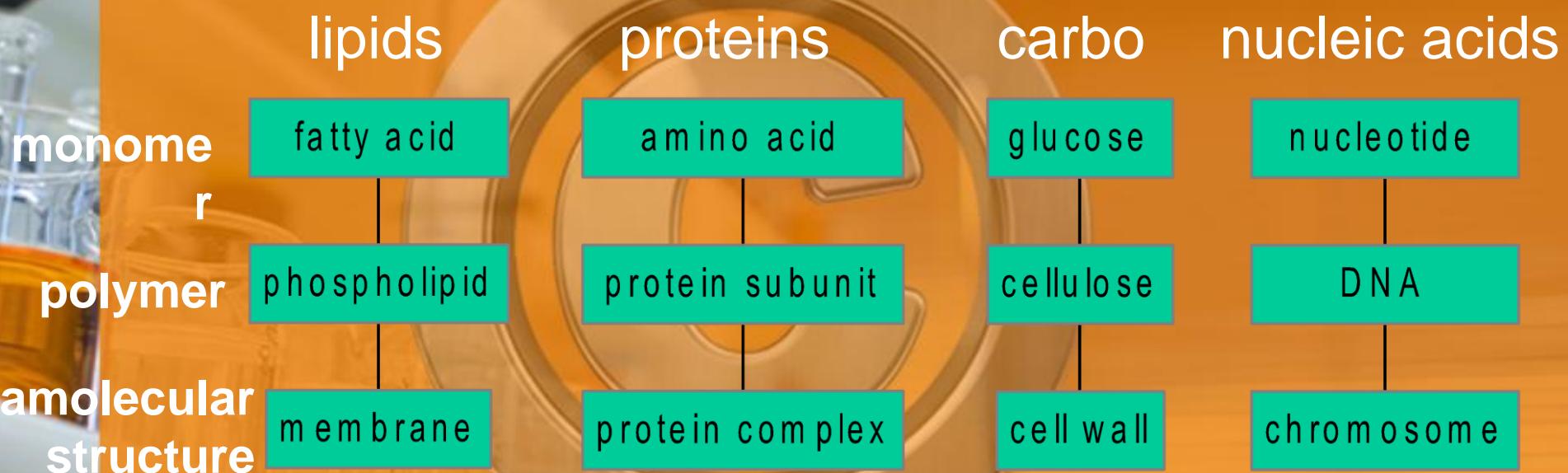
- Building block
- Simple sugar
- Amino acid
- Nucleotide
- Fatty acid

- Macromolecule
- Polysaccharide
- Protein (peptide)
- RNA or DNA
- Lipid

Catabolic

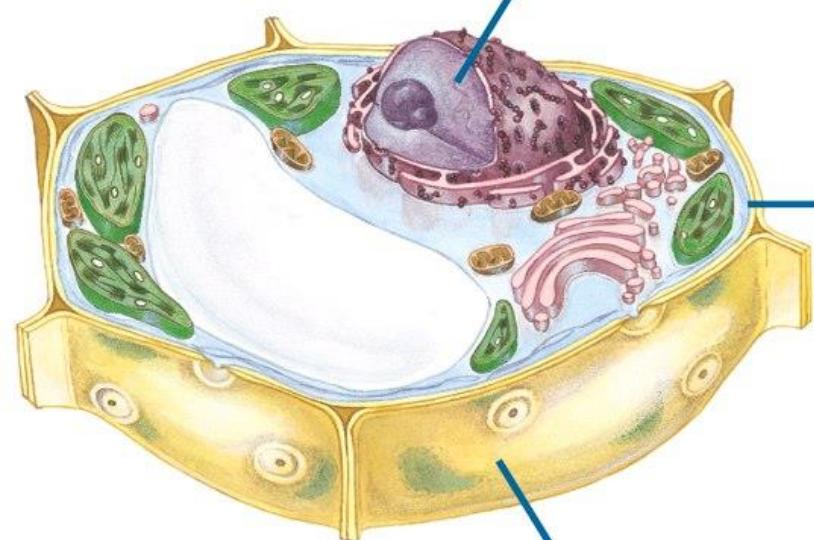


Many Important Biomolecules are Polymers

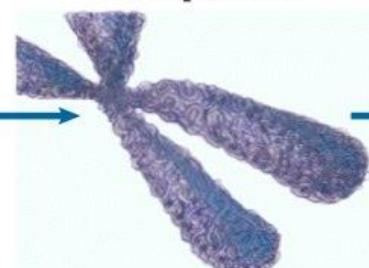


Molecular Organization of a cell

Level 4:
The cell
and its organelles

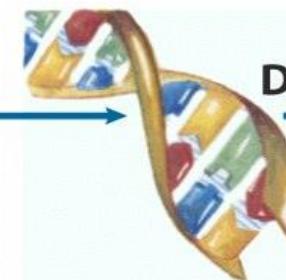


Level 3:
Supramolecular
complexes



Chromosome

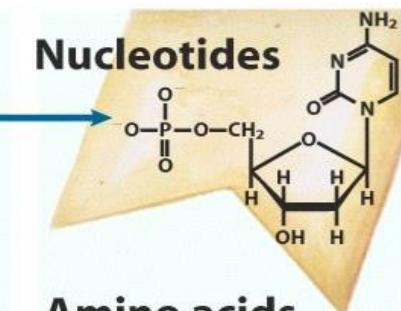
Level 2:
Macromolecules



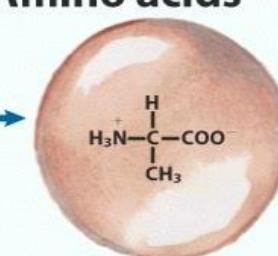
DNA

Level 1:
Monomeric units

Nucleotides

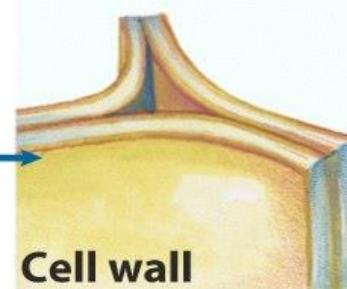


Amino acids



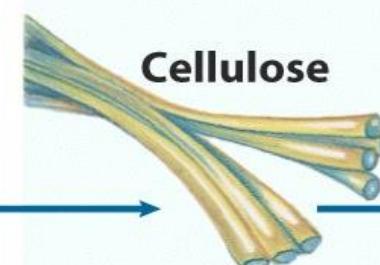
Protein

Plasma membrane

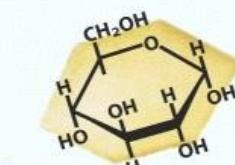


Cell wall

Cellulose

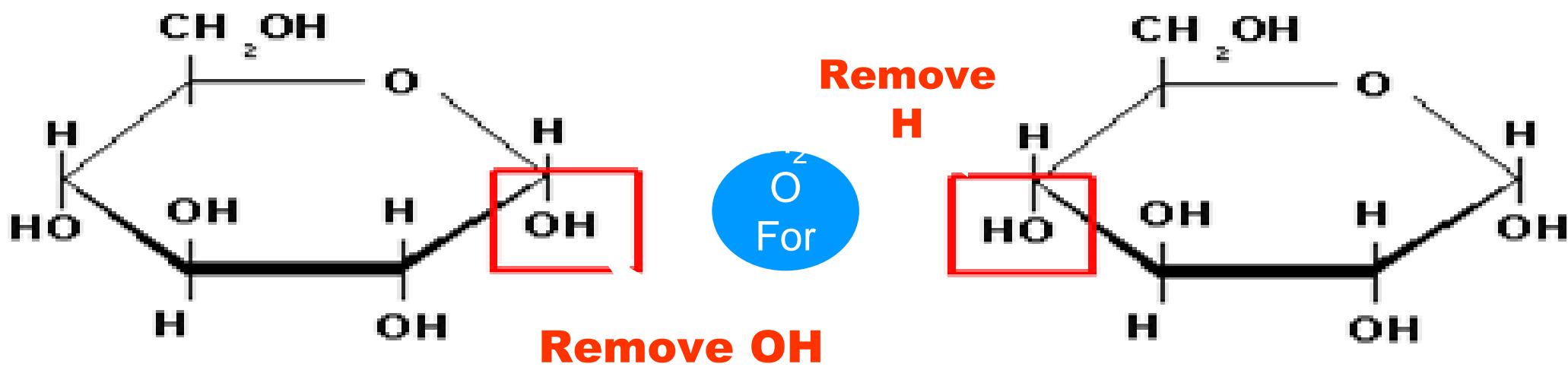


Sugars



Linking Monomers

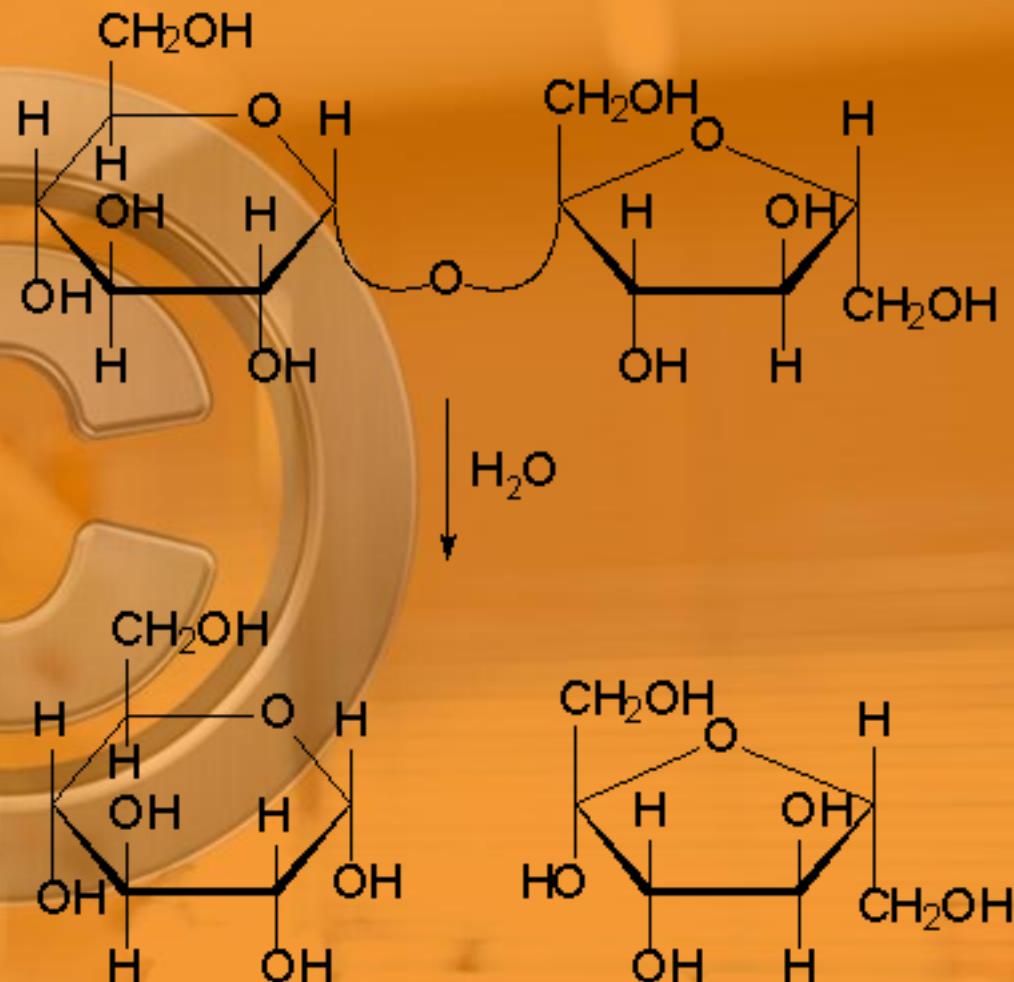
Cells link monomers by a process called dehydration synthesis (removing a molecule of water)



This process joins two sugar monomers to make a double sugar

Breaking Down Polymers

- Cells break down macromolecules by a process called hydrolysis (adding a molecule of water)



Water added to split a double sugar