

Biochemistry and medicine

Biochemistry : *chemistry of life* to the study of ^{العمليات البيولوجية} biological processes [Structure, composition and chemical reactions of substances in living systems] at the ^{الخلوي} cellular and ^{الجزيئي} molecular level.

The **Combination** between ^{علم وظائف الأعضاء} chemistry, ^{علم الأحياء} physiology and ^{علم الأحياء} biology allows **investigating the chemistry of living systems** :-

- 1- Studying the ^{ترتيب} structure and ^{سلوك} behavior of the **complex molecules** found in biological material.
- 2- The **ways** these **molecules interact** to form **cells, tissues** and whole organism. ^{كعلية الترتيب}

* Biochemistry ^{تتضمن} involves and ^{يدمج} incorporates with :-

- 1- ^{بيولوجيا الخلية} Cell biology
- 2- ^{البيولوجيا الجزيئية} Molecular biology
- 3- ^{علم الوراثة الجزيئية} Molecular genetics

~ It describes ~

- ^{الأصل} Origin
- ^{وظيفة} Function
- ^{تكوين} Formation
- ^{نقص} Deficiency
- ^{اعراض} Symptoms

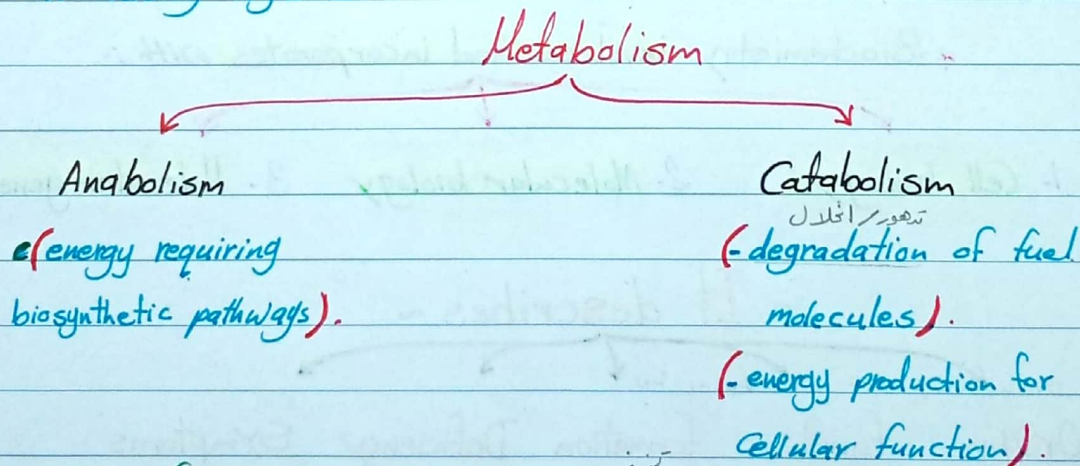
~ All of these descriptions ^{تتضمن} involves the **macromolecules** [proteins, carbohydrates, fats, nucleic acids, enzymes, etc...] and **their building units**.

- Types of biomolecules

'Small molecules'	'Monomers'	'Polymers'
<ul style="list-style-type: none">* Lipid, phospholipid, glycolipid, sterol, ...* Vitamin* Hormone, neurotransmitter* Carbohydrate, sugar	<ul style="list-style-type: none">* Amino acids* Nucleotides* Monosaccharides	<ul style="list-style-type: none">* peptides, dipeptides, polypeptides, proteins* Nucleic acids, i.e.: DNA, RNA* Oligosaccharides, Polysaccharides [including Cellulose]

Biochemical reactions

Metabolism :- total sum of the chemical reactions happening in a living organism.



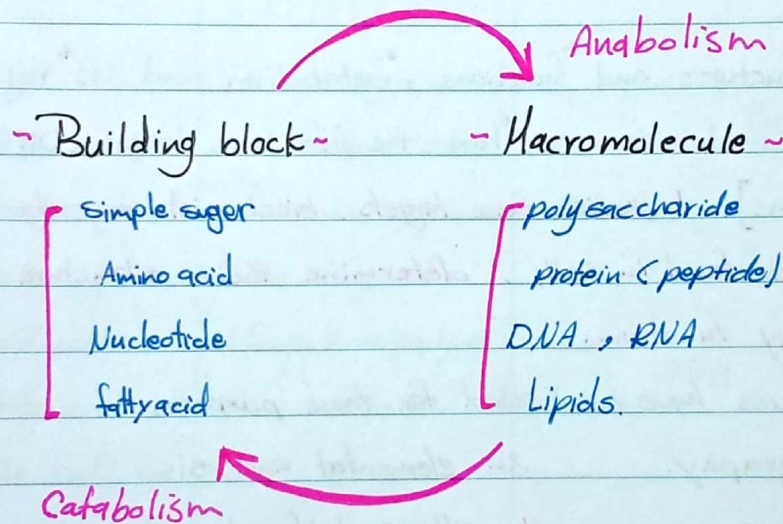
Most of the reactions are catalyzed by enzymes.

{Primary functions of metabolism}

Utilization of energy.
استغلال

Synthesis of molecules needed for cell structure and functioning
[as proteins, nucleic acids, lipids, & CHO].

Removal of waste products.



~ مبادئ principles of Biochemistry

Cells basic structural units of living organisms are highly organized and constant مصدر source of energy is required to maintain the ordered state.

* Living processes contain thousands of chemical pathways.

[the regulation and integration of these pathways are required to maintain life].
التنظيم التكامل

✓ Certain important pathways e.g. [glycolysis] تلك موجودة في جميع الكائنات الحية

~ All organisms use the same type of molecules

Carbohydrates proteins lipids nucleic acids

~ Instructions for growth and reproduction for each organism is encoded in their DNA.

The aim of biochemistry

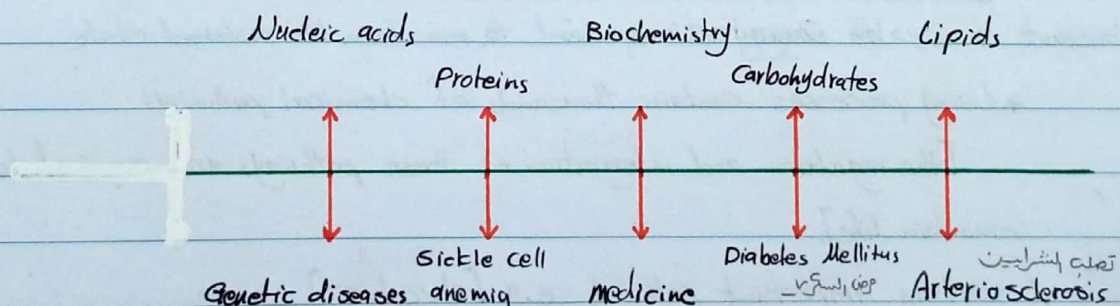
Complete understanding, at molecular level all the chemical processes associated with living cells.

Also, ¹⁻ structures and ²⁻ functions, ³⁻ metabolism and its ⁴⁻ regulation, ⁵⁻ gene expression modulation and ⁶⁻ how the life has begun [DNA → RNA → proteins]. to realize these targets, biochemists have to isolate numerous molecules found in cells, determine their structure, and analyze how they function.

~ Techniques have been used for these purposes ~

- 1) chromatography.
- 2) electrophoresis
- 3) elemental analysis.
- 4) ultracentrifugation
- 5) mass spectrometry.
- 6) X-ray crystallography.

~ Interrelationship of biochemistry and medicine ~

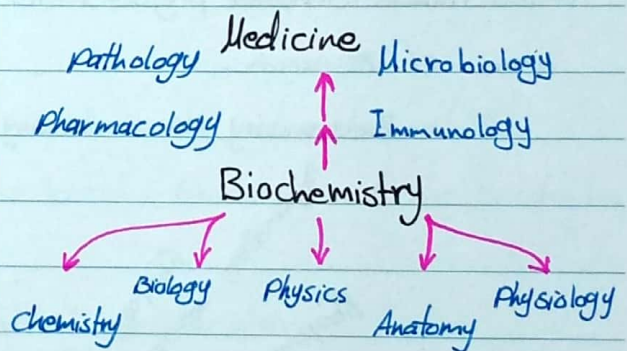


Biochemistry ; and life sciences

GENETICS nucleic acids, their structures, and functions constitute the core of genetics.	PHYSIOLOGY the study of biological processes and functions.	IMMUNOLOGY deals with defense mechanisms against diseases, is considered a branch of biochemistry.	PATHOLOGY biochemistry explains, at the molecular level, the symptoms and pathogenesis of diseases.
--	---	--	---

PHARMACOLOGY & TOXICOLOGY depend primarily on knowledge gained from biochemistry as drugs and poisons are metabolized inside the body in enzyme-catalyzed biochemical reactions.

BIOLOGICAL SCIENCES [microbiology, botany and zoology] use biochemical approaches in the study of different aspects of these sciences.



* Normal biochemical processes are (the basis of health)

• World Health Organization [WHO] :- (situation in which all intra- and extracellular reactions that occur in the body are proceeding at rates with maximal survival of the organism in the physiologic state).

الطب الوقائي
الوقاية
Biochemical research, nutrition and preventive medicine.

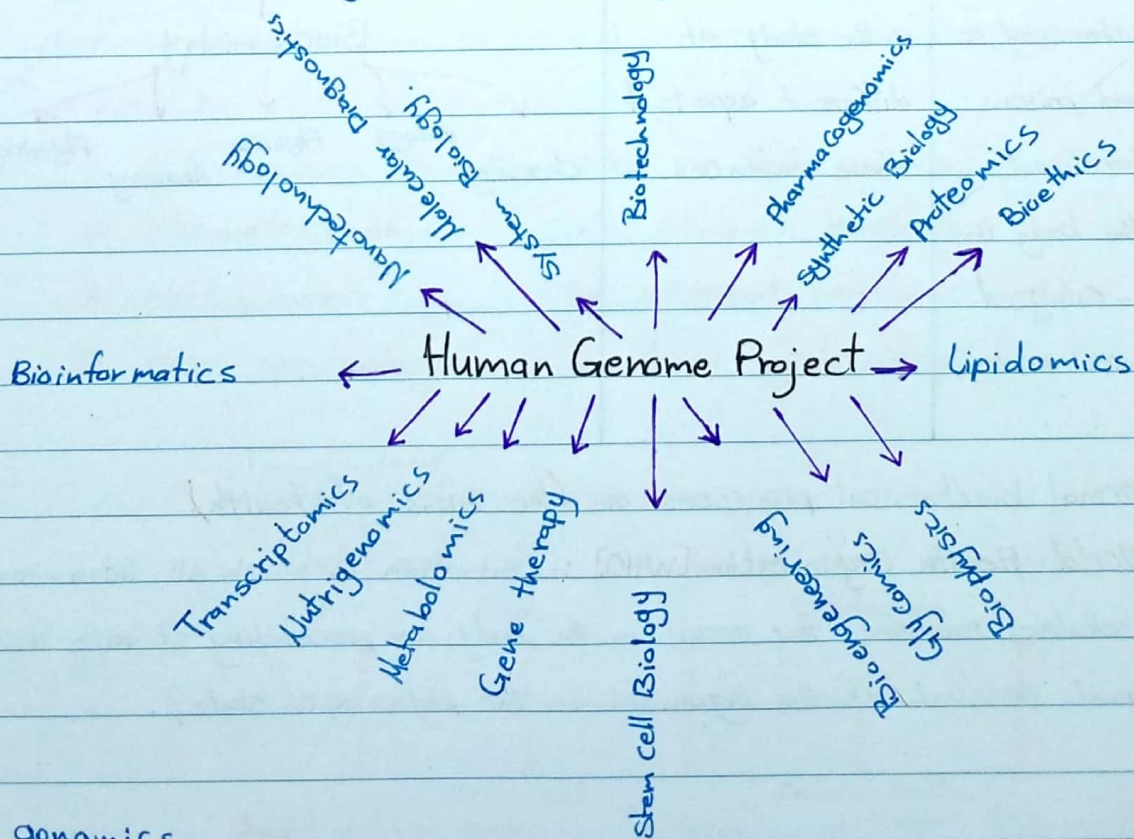
One major item for the maintenance of health is that there be optimal dietary intake of a number of chemicals; (Vitamins, certain amino acids, certain fatty acids, various minerals, and water).

° PREVENTIVE MEDICINE :- the systematic attempts to maintain health and prevent disease.

[nutritional approaches depend to a great extent on a knowledge of biochemistry].

↪ The Human Genome project [HGP] :- has influenced many disciplines and areas of research.

↪ Biochemistry was underway long before the [HGP] commenced.



genomics

- Most & perhaps all disease has a biochemical basis.
- Most if not all diseases are manifestations of molecules abnormalities, chemical reactions, or biochemical processes.
- The major factors responsible for causing diseases in animals and humans are affecting one or more (critical chemical reactions or molecules in the body).

The major causes of diseases

- 1- Physical agents: Mechanical trauma, extremes of temperature, radiation and electric shock.
2. Chemical agents: including drugs and toxic compounds.
3. Biologic agents: Viruses, bacteria, fungi, higher forms of parasites.
- 4- Oxygen lack: Loss of blood supply, depletion of the oxygen-carrying capacity of the blood, Poisoning of the oxidative enzymes.
- 5- Genetic disorders: Congenital, molecular.
- 6- Immunologic reactions: Anaphylaxis, autoimmune disease.
7. Nutritional imbalances: Deficiencies, excesses.
- 8- Endocrine imbalances: Hormonal deficiencies, excesses.

'Some uses of biochemical lab tests in relation to diseases'

Use

- To reveal the fundamental causes and mechanisms of diseases.
- To suggest rational treatments of diseases based on 1 above
- To assist in the diagnosis of specific diseases.
* كذا في الـ Myocardial infarction *
الذي في القلب من أسبابه
- To act as screening tests for the early diagnosis of certain diseases.
- To assist in monitoring the progress (eg. recovery, worsening, remission, or relapse) of certain diseases.
- To assist in assessing the response of diseases to therapy.

Example

- Demonstration of the causes of genetic defect as in cystic fibrosis.
- A diet low in phenylalanine for treatment of phenylketonuria
← انعدام وجود أو نقصه وتبطل لقمته يدت
تحتاج في الفينيل لاكتاميد
- Use of the plasma enzyme creatine kinase MB (CK-MB) in the diagnosis of Myocardial infarction.
الذي في القلب
- use of measurement of blood thyroxine or (TSH) in the diagnosis congenital hypothyroidism.
- use of the plasma enzyme [ALT] in monitoring the progress of infections hepatitis.
التهاب الكبد الوبائي
- use of measurement of blood [CEA] in patients who have been treated for cancer colon.
← سرطان في القولون