

SCOPE OF BIOCHEMISTRY IN PHARMACY

## ❖ Introduction

- The term biochemistry was first introduced by German chemist Carl Neuberg in 1903 from Greek word "bios" means life.
- Father of modern biochemistry- Carl Neuberg
- Biochemistry is a discipline of Chemistry that deals with the
  - Chemical composition of living organisms and
  - The interactions between living organic cells and their surrounding fluids/matter and
  - The important chemical processes occurring within living organisms.
- Biochemistry is the subdivision of Biology and chemistry that can further be divided into three segments, namely metabolism, structural Biology and enzymology. By the end of the 20th century, these three variants together have been able to successfully explain the process of living.
- It is the study of how living things are made, how they work, and what chemicals they have. It also looks at the human body's muscles and bones. In a Biochemistry Class, students can learn how cells are made or how blood works.

## ❖ Objectives of biochemistry-

- i) To complete understanding at the molecular level of all the chemical processes associated with living cells.
- ii) To attempt to understand how life began

## ❖ Fields of biochemistry-

## i) Metabolism

- Sum of all the reaction taking place in the cell is called metabolism
- Catabolism + anabolism = metabolism
- Glycolysis
- Protein formation in body
- Bioenergetics- is **the branch of biochemistry that focuses on how cells transform energy, often by producing, storing or consuming adenosine triphosphate (ATP).**

## ii) Enzymology

- What are enzymes ?
- What are their function ?
- How enzyme act together ?
- What are the different types of enzymes ?
- How enzyme work ?
- How enzymes speed up the reaction and upto what extent ?

## iii) Genetics

- DNA structure
- Replication
- Transcription
- Translation
- Genetic abnormalities
- Mutation of all kind

## iv) Cell biology

- What are the component of cells ?
- Structure and function of cell organelles
- Coordination among various component of cells

## v) Immunology

- What is immunity ?
- Why is it needed
- Which chemicals are responsible for immune system ?
- Which cells are responsible for body defence?
- How the invaders attack
- Why are pathogens dangerous and how to cope with them ?

## vi) Animal biochemistry

- Composition, properties and reactions of compounds in animals
- Function of cells
- Inheritance study
- Disease diagnosis
- Extraction of energy from food
- Utilisation of compounds for body growth and development.

## vii) Molecular biology

- What are molecules of life?
- Properties and functions of molecules
- Energy release from bonds
- Structure of molecule

## viii) Plant biochemistry

- Photosynthesis
- Conversion of glucose to other product
- Generation of heat
- Respiration and glycolysis study
- Chemical effects of disease
- Need and functions of bio-elements

❖ **Scope in Pharmacy-**i) **Drug constitution-**

- Biochemistry gives an idea of the constitution of the drug, its chances of degradation with varying temperature etc.
- How modification in medicinal chemistry helps in improving efficiency and minimizing side effects of drugs etc

ii) **The half life**

- This is a test done on biochemical drugs to know how long a drug is stable when kept at different temperature.

iii) **Biochemical test**

- These tests help to fix the specific half life or date of expiry of drugs.

iv) **Drug storage**

- The storage condition required can be determined by biochemical test.
- For example many enzymes and hormones are stored for dispensing and these get deteriorated over the time due to temperature or oxidation, contamination and also due to improper storage

v) **Drug metabolism-**

- It also gives idea about how drug molecule are metabolised by many biochemical reactions in the presence of enzymes. This helps to avoid drugs which have poor metabolism or those with excessive side effect.

❖ **Importance in Pharmacy**

- It gives idea about the constituents of drugs
- It gives idea about the degradation of drugs with varying temperature
- How drugs are metabolised by biochemical reaction in presence of enzyme.

❖ **Scope in other fields**1. **Medicine**i) **Physiology:**

- Biochemistry helps one understand the biochemical changes and related physiological alteration in the body.
- Pathology of any disease is studied through biochemical changes.

ii) **Pathology:**

- Based on the symptoms described by the patient, the physician can get a clue on the biochemical change and the associated disorder.

- For example, if a patient complains about stiffness in small joints, then the physician may predict it to be gout and get confirmed by evaluating uric acid levels in the blood as uric acid accumulation in blood results in gout.

iii) **Nutrition deficiency:**

- In the present scenario, many people rely on taking multivitamin & minerals for better health. The function and role of the vitamin in the body are described only by biochemistry.

iv) **Hormonal deficiency:**

- There are many disorders due to hormonal imbalance in especially women and children. The formation and role of hormones in the normal body function is taught in biochemistry by which the physician can understand the concerned problem during treatment.

**2. NURSING:**

i) **Kidney function test:**

- For example in kidney disorders, other chemotherapy treatment, etc. urine test help understand the extent of excretion of drugs or other metabolites, the change in pH, the colour of urine, etc.

ii) **Liver function tests** help understand the type of disease or damage to the liver, the effect of any medication on the liver, etc.

iii) **Blood test:**

- In diabetes, biochemical analytical test for blood glucose level (above 150mg/deciliter) helps to understand the severity of diabetes disorder.
- Another biochemical analysis for ketones bodies in urine also indicates the stage of diabetes. The appearance of ketone bodies or ketone urea is mostly the last stage of diabetes.

iv) **Serum cholesterol test:**

- Evaluation of blood cholesterol level and other lipoproteins helps to understand the proneness of the patient to cardiovascular diseases.

**3. AGRICULTURE:**

i) In animal husbandry, the quality of milk can be checked by biochemical tests. It also helps diagnose any disease condition in animals and birds.

ii) In fisheries, the water quality is regularly monitored by biochemical tests. Any drastic change in water chemistry & composition of fishery ponds can lead to the vast death of fishes and prawns. Hence the tests are done regularly to see salt content (calcium content), pH, accumulation of waste due to not changing water for long, etc.

iii) Prevent diseases: It helps for prevention, treatment of diseases and also increases the production or yield.

iv) Enhance growth: Biochemistry gives an idea of how the use of fertilizers can increase plant growth, their yield, quality of food, etc.

v) Enhance Yield: Some hormones promote growth, while others encourage flowering, fruit formation, etc. In fisheries, the use of substances to promote fish growth, their reproduction, etc. can be understood.

vi) Adulteration: Biochemistry tests help prevent contamination.

vii) Biochemical tests: for the pesticide residues or other toxic waste in plant, food grain and soil can be evaluated. Hence during import and export of food grains, a biochemical check of the toxic residues is done to fix the quality.

**4. NUTRITION:**

i) Food chemistry: gives an idea of what we eat, i.e., its components like carbohydrates, proteins, fats, etc. and also the possible physiological alteration due to their deficiency.

ii) The role of nutrients: Due to biochemistry the importance of vitamins, minerals, essential fatty acids, their contribution to health were known. Hence there is a frequent recommendation for inclusion of crucial amino-acids, cod liver oil, salmon fish oil, etc. by physicians and other health and fitness experts.

**5. PLANTS**

- i) **Photosynthesis:** This describes how carbohydrates are synthesized by the use of sunlight,  $\text{CO}_2$ , and water in the green leaves of plants. It explain about different complex enzymes involved in the process to combine the energy of sun within the molecules  $\text{H}_2\text{O} + \text{CO}_2$  in the formation of carbohydrates.
- ii) **Plants secondary metabolites:** Biochemistry also describes how the plant products like gums, tannins, alkaloids, resins, enzymes, phytohormones are formed inside the plant. Further, how the different plant cell parts are involved in physiology. The conversion of different biochemical over some time like lignin, chitin to harden the dead vascular vessels, etc.
- iii) **Different sugars:** Biochemistry defines different types of carbohydrates formed in plants like trioses (3 carbon sugars, i.e., glyceraldehyde), tetroses(4), pentoses (5), hexoses(6= glucose), heptoses (7), etc. Tetroses are the carbohydrates which go on to form the nucleic acids, i.e., deoxyribonucleic acid (DNA), ribonucleic acid (RNA).