

Protein Metabolism and Its Flow in Ecosystem

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Abstract - Proteins occupy a central position in the architecture and functioning of living matters. They are intimately connected with all phases of chemical and physical activity, that constitute the life of cell. The ecosystem is an integrated unit or zone of variable size, comprising vegetation, fauna, microbes and the environment. Food chain is a part of the ecosystems. In good chain the living is the food of other living. Protein is also transferred from one living (herbivore) to other living (carnivore). Protein with its metabolism is also transferred with Food in the food claim of the ecosystem.

Keywords: Proteins, Biosynthesis, Flowing, Food chain and Food web.

I. INTRODUCTION

Metabolism is the totality of chemical reactions occurring within a cell. Metabolism is the overall process through which living systems acquire and utilize the free energy they need to carry out their various functions. They do so by coupling the exergonic reactions of nutrient oxidation to the endergonic processes required to maintain the living state such as the performance of mechanical work. The active transport of molecules against concentration gradients, and the biosynthesis of complex molecules.

Phototrophs acquire free energy from the sun through photo synthesis, a process in which light energy powers the endergonic reaction of Carbon dioxide (CO₂) and Water (H₂O) to form carbohydrates and Oxygen (O₂) chemotrophs obtain their free energy by oxidizing organic compounds (carbohydrates, lipids, proteins) obtained from other organisms, ultimately, phototrophs. This free energy is most often coupled to endergonic reactions through the intermediate synthesis of light "high-energy" as phosphate compounds such as Adenosine triphosphate (ATP). In addition to being completely oxidized, nutrients are broken down in a series of metabolic reactions to common intermediates that are used as precursors in the synthesis of other biological molecules.

A remarkable property of living systems is that, despite the complexity of their internal processes, they maintain a steady state. This is strikingly demonstrated by the observation that over 40 year time span, a normal human adult consumes literally tons of nutrients and inhales over 20,000 L of water,

but does so without significant weight change. This steady state is maintained by a sophisticated set of metabolic regulatory system.

Metabolic pathways are series of consecutive enzymatically catalyzed reactions that produce specific products for use by an organism. The free energy released by degradation (catabolism) is, through the intermediacy of ATP and NADPH, used to drive the endergonic processes of biosynthesis (anabolism). Carbohydrates, lipids, and proteins are all converted to the common intermediate acetyl-CoA, whose acetyl group is then converted to carbon dioxide (CO₂) and water (H₂O) through the action of the citric acid cycle and oxidative phosphorylation. A relatively few metabolites serve as starting materials for a host of biosynthetic products. Metabolic pathways have five principal characteristics:

1. Metabolic pathways are irreversible
2. If two metabolites are inter convertible, the synthetic route from the first to the second must differ from the route from the second to first.
3. Every metabolic pathway has an exergonic first committed step. All metabolic pathways are regulated, usually at the first committed step.
4. Metabolic pathways in eukaryotes occur in specific sub cellular compartments.

Smith (1966) emphasized the following general characteristics of most ecosystems:-

1. The ecosystem is a major structural and functional unit of ecology.
2. The structure of an ecosystem is related to its species diversity, the more complex ecosystems have high species diversity.
3. The function of the ecosystem is related to energy flow and material cycling through and within the system.
4. The relative amount of energy needed to maintain an ecosystem depends on its structure. The more complex the structure, the lesser the energy its need to maintain itself.
5. Ecosystems mature by passing from fewer complexes to more complex states. Early stages of such succession have an excess of potential energy and a relatively high energy flow per unit biomass. Later

(mature) stages have less energy accumulation and its flow through more diverse components.

6. Both the environment and the energy fixation in any given ecosystem are limited and cannot be exceeded without causing serious undesirable effects.
7. Alternations in the environments to represent selective pressures upon the population to which it must adjust. Organisms which are unable to adjust to the changed environment must need vanish.

- f. Enzymes
- g. Nutrient Proteins

The ecosystem is an integrated unit or zone of variable size, comprising vegetation, fauna, microbes and the environment. Most ecosystems relatively potential characteristically possess a well-defined soil, climate flora and fauna and have their own potential for adaptation, change and tolerance.

Fibrous or Febrile Proteins have axial ratio greater than 10 and hence forth, resemble long ribbons or fibres in shape. These are mainly of animal origin and are insoluble in all common solvents such as water, dilute acids alkalis and salts and also in organic solvents. Most fibrous proteins serve in a structural or protective role. The fibrous proteins are extremely strong and possess two important properties which as characteristic of the elastomers, these are – That they can stretch and later recent to their original length, and they have a tendency to creep. It is a heterogeneous group and includes the proteins of connective tissues, bones, blood vessels, skin, hair, nails, horns, hoofs, wool and silk. The important examples are

II. PROTEIN CLASSIFICATIONS

Animal Proteins are the proteins derived from animal sources such as eggs, milk, meat and fish. They are usually called higher - quality proteins because they contain adequate amounts of all the essential amino acids.

Plant proteins are called lower quality proteins since they have a low content of one or more of the essential amino acids. The four most common limiting amino acids are methionine, lysine, threonine and tryptophan. Although plant proteins have limiting amounts of some amino acids at should not be construed that they are poor protein sources.

- (i) **Collagens** - These are mesenchymal origin and from the major proteins of white connective tissues and of bone.
- (ii) **Elastins** - also of mesenchymal origin form the major constituents of yellow elastic tissues (ligaments, blood vessels).
- (iii) **Keratins** - are of ectodermal origin usually contain large amount of Sulphur in the form of cystine human hair has about 14% cystin.
- (iv) **Fibroin** - principal constituent of the fibres of silk, composed mainly of glycine, alanine and serime units.

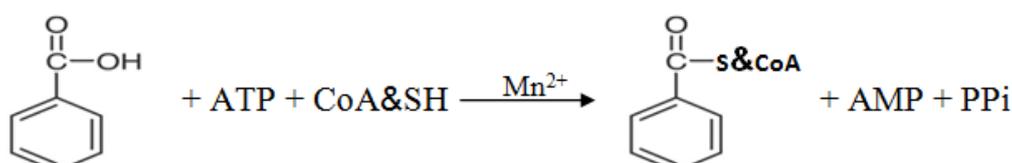
Globular or corpuscular Proteins have an axial ratio of less than 10 and henceforth possesses a relatively spherical or ovoidal shape. These are usually soluble in water or a sequence media containing acids, bases, salts or alcohol, and diffuse readily. According Conn and Stumps (1976) followings are globular proteins.

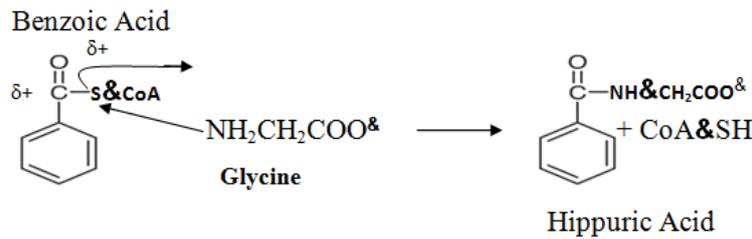
III. BIOSYNTHESIS OF PROTEINS (Glutamine, Hippuric acid Glutathione and Cyclic Polypeptides)

- (i) Cytochrome
- (ii) Blood Protein
 - a. Serum albumin
 - b. Glycoprotein's
 - c. Antibodies (= Immunoglobulin)
 - d. Haemoglobin
 - e. Hormones

Glutamine is synthesized by glutamine synthetase, an enzyme found in plants, animals, and microorganisms. The first step is believed to be the formation of γ -glutamyl acylphosphate-enzyme complex. In the second step ammonia, a good nucleophile, attacks the complex and displaces the acylphosphate group to form glutamine and inorganic phosphate only the γ -amide is formed, Iso-glutamine, the compound with the α -carboxyl group amidated is never found. The enzyme is not only highly specific, since aspartic acid cannot replace glutamic acid as a Substrate.

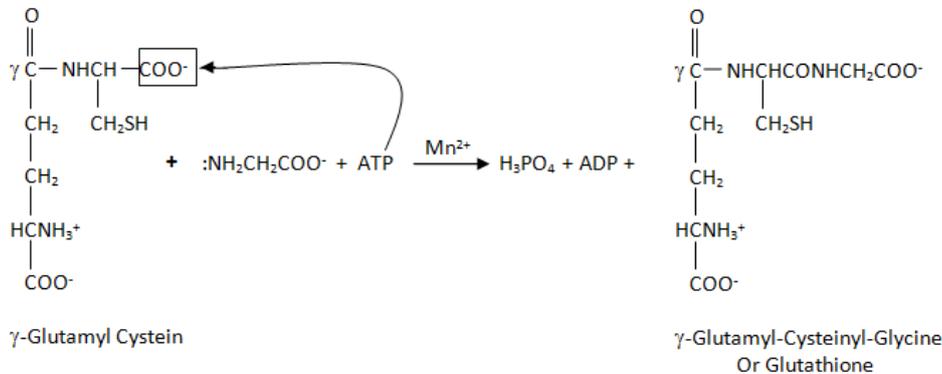
The enzymatic synthesis of hippuric acid, a common urinary product in mammalian animals involves the formation of a peptide bond between the carboxyl group of benzoic acid and the amino group of glycine.





Glutathione a tripeptide occurs in yeast, plants, and animal tissues and requires two discrete or enzyme to form its two peptide bonds. The first enzyme γ -glutamyl cysteine synthetase (a) catalyzes the condensation of glutamic acid and cysteine with the formation of the first peptide bond. Then, a second enzyme, glutathione synthetase (b) adds glycine to the previously synthesized dipeptide to form the second peptide

bond. In each step the carboxyl group is presumably activated by ATP as already outlined for glutamine synthesis. Cysteine does not directly attack the γ -carboxyl group glutamic acid since the $-O^-$ of the carboxyl group is a poor leaving group, if a phosphate group as placed on the carboxyl carbon at the expense of ATP, then, as with glutamine synthesis, we have an excellent leaving group.

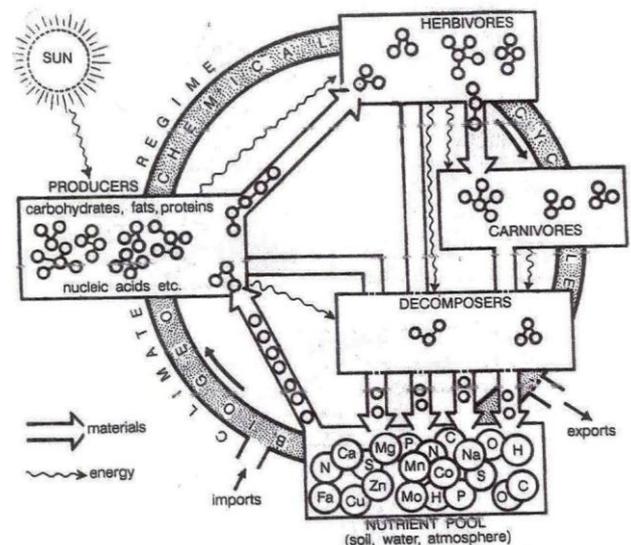


Extracts of *Bacillus brevis* strains that synthesize S contain two protein fractions that, on the addition of ATP, Mg^{2+} and the appropriate amino acids, readily catalyze the synthesis of the cyclic polypeptide, protein I has a molecular weight of 280,000 and protein II activates and racemizes D- or L-phenylalanine. It also becomes charged with D-phenylalanine via a thioester linkage. Protein I activates the other amino acids, namely, proline, ornithine, valine and leucine, via the sequence.

with respected eating and being eaten, is known as food chain. Producers utilise the radiant energy of sun which is transformed to chemical form, ATP during photosynthesis. Thus in any food chain, green plants occupy the first trophic (nutritional) level - the producers level, and are called the primary producers.



There is new evidence that Protein I is actually a polyenzyme consisting of at least four separate specific amino acid activating enzymes, each with a molecular weight of about 65,000 to 70,000. Each enzyme activates its specific amino acid, Each amino acid is bound covalently as a thioester to the protein. A fifth protein is the additional component of the polyenzyme and it contains are 4'-phosphopentetheine functional group per protein (MW17,000).



IV. FOOD CHAIN IN ECOSYSTEM

The transfer of food energy from the producers, through a series of organisms (herbivores to carnivores to decomposers)

A generalized model of an ecosystem to show its structure and function (Sharma P.D., 2013)

The energy, as stored in food matter manufactured by green plants, is then utilized by the plant eaters - the herbivores which constitute the second trophic level and are called the primary consumers (herbivores).

Herbivores in turn are eaten by the carnivores, which constitute the third trophic level-the secondary level, and are called the secondary consumers (carnivores). These in turn may still be eaten by other carnivores at tertiary consumer level i.e. by the tertiary consumers (carnivores). Some organisms are omnivores eating the producers as well as the carnivorous at their lower level in the food chain. Such organisms thus may occupy more than one trophic-level in the food chain in ecosystem.

V. CONCLUSION AND RECOMMENDATIONS

Proteins play an enamours variety of Roles : Some carry out the transport and storage of small molecules, others make up a large part of the structural framework of cells and tissues, Muscle contraction, the immune response, and blood clotting are all mediated by proteins. Proteins are polypeptides of defined sequence. Every protein has a defined number and order of amino acid reduces. As with the nucleic acids, this sequence is referred to as the primary structure of the protein. The protein and its metabolism are also continuing of flowing in the food chain from producer to herbivores to carnivores to de composers.

The rapid advances and technology have put the scientists and technologists on their heels to cope up with the simultaneous changes that have occurred during the past decades. Various types of revisions, rectifications as well as modifications and sometimes even together innovated ideas that developed in numerous fields of specializations have required to be incorporated with the advanced to the concerning field of the study. The innovative techniques have put the researches on consistent "think and rethink" level with entertain high concepts related to the life Science. The study

of such concept as protein is to be considered with biosynthesis of protein and it's of flow in ecosystems of land, aquatic, mountains, desert and air etc. and inter relationship in between plants, animals and biosphere.

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