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Proteins

Proteins

- Proteins are the group of organic compounds of carbon, hydrogen, oxygen and nitrogen. All the biologically active proteins comprise nearly 20 different amino acids, which are called building blocks of proteins.
- Proteins are chains of amino acids that are linked together by peptide bonds. Each protein has specific and unique sequence of amino acids

Structure Of Proteins

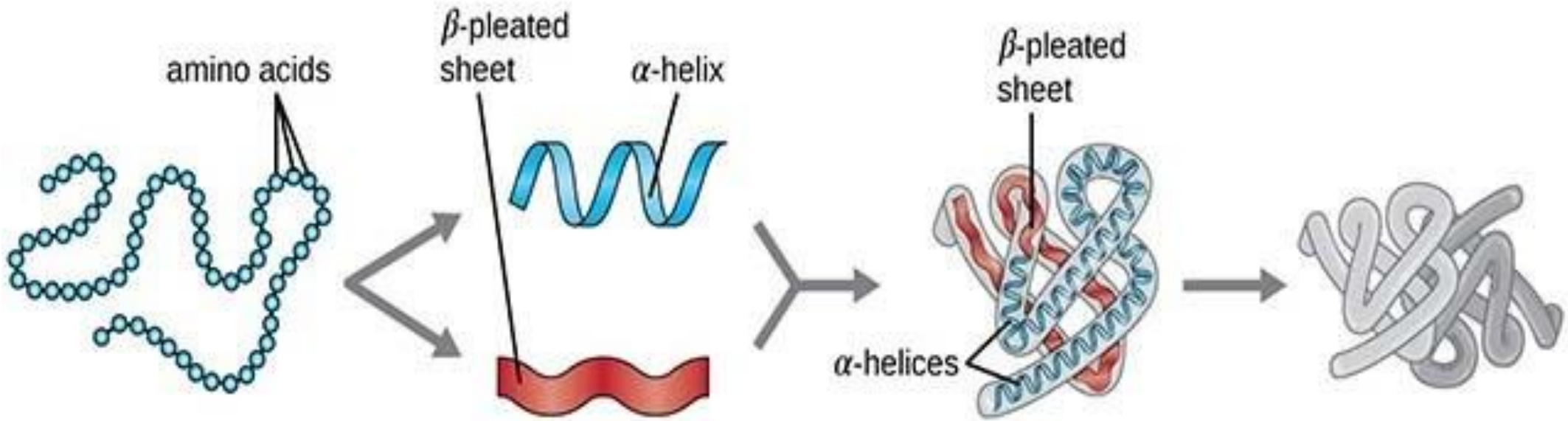
- Proteins are made up of one or more polypeptide chains. Four levels of structural organization can be recognized in proteins:
- 1. Primary structure
- 2. Secondary structure
- 3. Tertiary structure
- 4. Quaternary structure.

- **Primary structure:** Primary structure of proteins refers to the order and sequence of amino acids in a polypeptide chain in which these different amino acids are linked through the peptide linkage.
- **Secondary structure:** Folding or twisting of the large polypeptide molecule possessing primary structure forms the secondary structure (a-helix, b-pleated sheets).

- **Tertiary structure:** Refolding of the polypeptide chain possessing secondary level of structure like a-helix, b-pleated sheets, and random coils lead to the formation of tertiary structure

- **Quaternary structure:** Some proteins contain more than one-polypeptide chain. They are known as oligomeric (multi-subunit) proteins.

Structure of Proteins



Primary Protein Structure
Sequence of a chain of amino acids

Secondary Protein Structure
Local folding of the polypeptide chain into helices or sheets

Tertiary Protein Structure
three-dimensional folding pattern of a protein due to side chain interactions

Quaternary Protein Structure
protein consisting of more than one amino acid chain

Function of proteins

Proteins serve many functions, including the following. Given are examples of each.

- **Structure:** collagen and keratin are the chief constituents of skin, bone, hair, and nails.
- **Catalysts:** virtually all reactions in living systems are catalyzed by proteins called enzymes.
- **Movement:** muscles are made up of proteins called myosin and actin.
- **Transport:** hemoglobin transports oxygen from the lungs to cells; other proteins transport molecules across cell membranes.
- **Hormones:** many hormones are proteins, among them insulin, oxytocin, and human growth hormone.

DIGESTION AND ABSORPTION OF PROTEINS

The protein does not undergo any digestion in the mouth. When it enters the stomach, it stimulates the secretion of the hormone **gastrin, HCL and pepsin**

- Pepsin secreted by chief cells as pepsinogen and later converted to pepsin by HCl. **Pepsin** converts protein into smaller peptides.
- When the acidic contents from the stomach pass into the small intestine it stimulate pancreatic secretion of proteolytic enzymes (**trypsin** and **chymotrypsin**) for further digestion of proteins and peptides into amino acids which then absorbed by intestinal mucosal cells.

NITROGEN BALANCE

Catabolism of amino acids leads to a net loss of nitrogen from the body. This loss must be compensated by the diet in order to maintain a constant amount of body protein. Nitrogen balance studies evaluate the relationship between the nitrogen intake (in the form of protein) and nitrogen excretion.

Three situations of nitrogen balance are possible as follows:

1. Nitrogen equilibrium

- In **normal adults**, nitrogen intake is equal to nitrogen excretion.

2. Positive nitrogen balance

- nitrogen intake > nitrogen excretion as in growing **children** and **pregnancy**

3. Negative nitrogen balance.

- nitrogen intake < nitrogen excretion as in **burn** and **serious illness**

Formation of Urea

- Urea is the end product of protein metabolism. The nitrogen of amino acids removed in the form of ammonia is detoxified by converting it to urea.

- Formation of urea by "**urea cycle**" is an ultimate route for the metabolic disposal of ammonia.

- Urea is produced exclusively by the liver and then is transported through blood to the kidneys for excretion in the urine so urea can be used as a marker for assessment of renal function

- Enzymes catalyzing the urea cycle reactions are distributed between the mitochondria and the cytosol of the liver

The first two reactions of urea cycle occur in the mitochondria, whereas the remaining reactions occur in the cytosol.

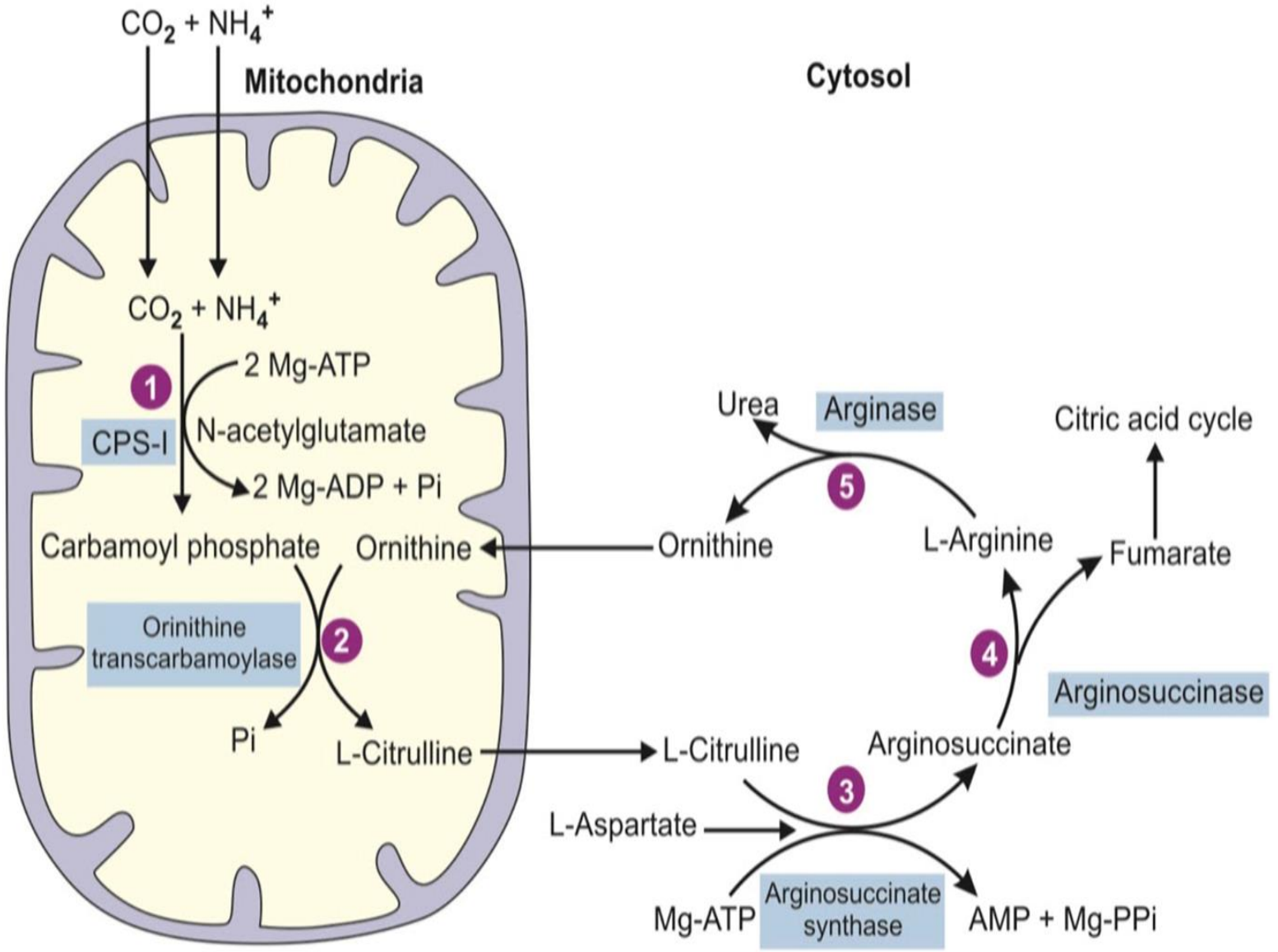


Figure 14.10: Reactions of urea cycle
where, CPS-I: Carbamoyl phosphate synthase-I

Good luck