

INTERACTION OF THE STRUCTURE OF INDIVIDUAL PROTEINS AND THE STRUCTURE OF MULTIMOLECULAR PROTEINS, ISOFUNCTIONAL PROTEINS

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Annotation: The article provides general description, properties and structure of proteins and information on the interaction of the structure of multi-molecular proteins, isofunctional proteins.

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Skin, hair, nails, fur, and horns contain structural proteins that are involved in the formation of connective tissue. In particular, connective tissue, connective, and bone proteins have a simpler structure than globular proteins. The keratin protein polypeptide chain is a α -spiral, rope-like, or three-stranded cable, each fiber consisting of α -helix. Another structural protein, β -keratin, is in a partially fibrillar form, with a polypeptide chain conformation β -structure and layered. Connective tissue proteins such as collagen and elastin are the main structural proteins. The polypeptide chain of collagen protein has a three-band helical structure. Fibrillar proteins have three different levels of structure.

1. Primary structure.
2. Secondary structure: polypeptides have partial α -spiral and β -conformation.
3. The triangular conformation of fibrillar proteins tends to perform the specific biological function of proteins.

Proteins dissociate subunits in a molecule when exposed to various chemical and physical factors (organic solvents, diuretics, detergents, changes in pH, high concentrations of neutral salts, mercaptoethylene, etc.). For most proteins, when this process is reversed and the dissociating agent is released, the subunits of the protein molecule combine to return to their previous state and regain their biological activity. This phenomenon is called self-assembly of protein molecules.

An example is the tobacco mosaic virus protein, which accumulates spontaneously without environmental influences. It consists of one molecule of RNA and 2130 protein subunits. These subunits are wrapped around the RNA chain. Detergents break down RNA and protein subunits. If the detergent is removed, the separated RNA and the protein subunit combine to completely restore the quaternary structure of the protein, and all its physical properties and biological functions return to normal.

Variations in the function of different organ proteins, changes in organ protein composition in ontogeny and disease. The protein content of each organ depends on the function it performs. For example, muscles contain proteins that are involved in contraction. Liver proteins, on the other hand, are adapted to perform its function. The liver contains special enzymes involved in the metabolism of proteins, amino acids, fats, carbohydrates and the detoxification of various toxins. Structural proteins perform a basic function.

The protein content of a healthy adult is relatively constant, but the amount of some proteins may vary depending on physiological activity, food composition and diet, cyclical changes (biorhythms). During the development of the organism, especially in the very early stages (from the zygote to the formation of differentiated organs with specialized functions), the protein content changes significantly. The differences in the structure and function of specialized cells are based on their chemical composition, first of all, differences in the composition of proteins. For example, erythrocytes contain hemoglobin, which carries oxygen to the blood, muscle cells contain contractile actin and myosin proteins, rhodopsin protein, which is able to capture photons in retinal cells, and so on. Most proteins

are present in all or almost all cells, but can be present in varying amounts.

During disease, the protein content of the tissues changes. These conditions are called proteinopathies. There are two types of proteinopathies - hereditary and acquired proteinopathies.

Hereditary proteinopathies are the result of primary damage to the body's genetic apparatus. In any case, no protein is formed at all, or a "wrong" protein is synthesized with a different structure. An example of this is sickle cell anemia (a type of hemoglobinopathy) in which hemoglobin A is replaced by HbS, which is less able to carry oxygen. In many cases, even a single protein synthesis failure can be fatal or lead to serious illness. For example, children born homozygous for HbS die of anemia in infancy. During the individual development of the organism (ontogeny), the protein content changes. During embryogenesis, most enzymes in the liver are completely absent, and all enzymes begin to be synthesized in the liver after childbirth. The newly formed enzymes depend on the first intake of breast milk. The formation of enzymes that do not exist before occurs during the normal period of consumption of breast milk. During ontogeny, the isoenzyme spectrum of enzymes changes. For example, two of the five phosphofructokinase isoenzymes are found in the liver embryo (adults have five isoenzymes). Thus, individual development (ontogeny) is characterized by changes in enzyme forms. Protein content varies in different diseases. An example of this is the change in blood plasma proteins. Therefore, testing of serum proteins in clinical biochemistry is of great diagnostic importance. Acquired hereditary proteinopathies appear to persist with any disease, but only in cases that have been adequately expressed in clinical practice. In acquired proteinopathies, the primary structure of proteins does not change, the amount of protein or its distribution in the tissues changes, or the protein is not formed due to changes in cellular conditions. This can lead to severe anemia.

Determining the amount of a protein in body tissues and fluids is the most convenient and most accurate way to diagnose most diseases, especially in hereditary proteinopathies. For example, the presence of HbS in erythrocytes

indicates that the patient has sickle cell anemia, not any other form of anemia.

Biologically active peptides. Biologically active peptides are divided into four groups according to their effect:

1. Peptides with hormonal activity (vasopressin, oxytocin, adrenocorticotrophic, glucagon, calcitonin, melanin-stimulating hormone, releasing factor, etc.).

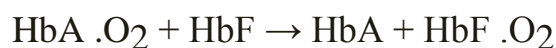
2. Peptides involved in digestion (gastrin, secretin, etc.).

3. Vasoactive peptides.

4. Neuropeptides.

Angiotensin, bradykinin, and kallidins enter vasoactive peptides and affect vascular tone. Angiotensin is formed from angiotensinogen by renin.

Isofunctional proteins. A protein that performs a specific function in a living cell can be in several forms, called isofunctional proteins or isooxyls. For example, several forms of hemoglobin have been found in human erythrocytes: the predominant forms in adult humans are HbA (96% of all hemoglobin), HbF, and HbA2 (about 2% each). Hemoglobin is a tetramer composed of different sets of protomers: a, b, g: HbA - 2 a 2b, HbF - 2 a 2g, HbA2 - 2 a 2d. A common feature of all hemoglobin is the presence of 2a protomers. Different protomers are similar in primary structure, and protomers are very similar in terms of secondary and tertiary structures. All forms of hemoglobin perform the same function - binding oxygen and delivering it to tissue cells, but these forms of hemoglobin differ to some extent in their functional properties. For example, HbF is closer to oxygen than HbA and can release oxygen from HbA:



HbF is characteristic of the period of human embryonic development (fetal hemoglobin); in the last weeks of pregnancy and the first weeks after birth, it gradually changes to HbA. Fetal blood does not mix with maternal blood; provides oxygen to the fetus through the diffusion of oxygen from the mother's blood vessels to the fetal blood vessels in the placenta. The closer proximity of fetal hemoglobin to oxygen allows diffusion to occur when the difference in oxygen

concentrations between the maternal and fetal vessels is small. Myoglobin is less closely related to hemoglobin: Unlike hemoglobin, which is very similar to protomers but circulates in the blood and delivers oxygen to the tissues from the lungs (or placenta), myoglobin is immobile in the muscles and in the delivery of oxygen from hemoglobin to mitochondria, as well as in the formation of oxygen reserves in muscles isofunctional proteins are generally a family of proteins that perform a homogeneous function, but it may be physiologically important for some members of this family to have smaller individual features. The many molecular forms of a protein found in the same species are called isooxyls; Proteins (homologous proteins) of organisms belonging to different biological species that perform the same functions in them are not included in the list of isooxyls. For example, human hemoglobin and rabbit hemoglobin are not isooxyls, although they perform the same function.

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