**Nanochemistry and biotechnology**

**Hydrogen bonds and molecular recognition**

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The emergence and development of life on Earth are based on incredible physical and chemical stability and, at the same time, the unique conformational mobility of the molecular building blocks of life, namely, proteins and nucleic acids. These properties of biopolymers are the basis for the implementation of a variety of intermolecular interactions, the results of which are the high efficiency and selectivity of molecular biological processes, as well as fast and accurate mechanisms of reproduction of living organisms.

The mechanisms of accurate molecular recognition are directly connected with the formation of intra- and intermolecular hydrogen bonds in biomolecular systems. It is hydrogen (H-) bonds that underlie the interactions of biopolymers with the molecular environment and the formation of both nonspecific and specific intermolecular complexes. The specificity is usually due to the simultaneous formation of several H-bonds between the spatially complementary donor and acceptor groups, which form a unique pattern depending on the sequence of monomers of the biopolymer chain (for example, patterns of donor-acceptor groups in the major groove of DNA double helix). The formation of the nonspecific H-bonds in molecular biological systems is also necessary because they are the basis for the formation of the secondary structure of proteins, the formation of the “spine” of hydration in the minor groove of the DNA double helix, or for the implementation of the indirect mechanism of protein-nucleic acid recognition. The intra- and intermolecular H-bonds formation are the key factors influencing both the stability of the DNA-ligand and DNA-protein complexes. They determine the specificity and binding affinity of such complexes as well as define the successful molecular recognition. H-bonds are observed in different nanosystems, for example, in associates of organic molecules. In particular, the description of the molecular mechanisms of the stability of such associates is a necessary step for the prediction of the changes in the biological activity of some drugs upon interaction with target molecules. This information is also necessary for the implementation of targeted drug delivery using nanocomposites.

In conclusion, it should be emphasized that the implementation of the processes described above is substantially determined by the possibility of the formation and disruption of H-bonds typical of the nanosystems in which the processes occur. Apparently, H-bonds are one of the essential fundamental conditions for the successful self-organization of some nanosystems «from bottom to up».