One of the directions of Biophysics is studying the physical foundations of the organization and functioning of living systems, as well as the principles and mechanisms of performing "useful work" by biological machines. A molecular machine is a hierarchical device that cyclically conjugates the transformation of the energy form necessary to perform useful work and a series of symmetry transformations in its regular structural elements, realizing "selected (quasi)mechanical degrees of freedom" during self-assembly and functioning. Molecular machines are hierarchically organized dynamic chiral constructs.

The concept is proposed and substantiated according to which the chiral dualism of carbon compounds is the physical symmetry basis of structure formation and systemic interactions in molecular biology. In macromolecular systems, sign-alternating hierarchies of chiral structures in sequences from the “lower” asymmetric carbon atom in sp3-hybridization to helices, supercoils, and helical supramolecular structures of the cytoskeleton have been identified as chiral invariants. The uniqueness of homochirality, evolutionarily selected by living systems, lies in the possibility of self-assembly of molecular machines - converters of energy, matter, and information. Spatial folding of a protein machine is considered as an autowave process of self-organization in an active medium, where the distributed resource of free energy is contained in the initial homochirality of the system as a whole. The chain of structural transformations forms the optimal trajectory of movement along the surface of the potential energies of the funnel. The revealed regularity makes it possible to predict the development of biotechnology for the self-assembly of molecular machines with desired properties.