**The method of analysis of the structural-dynamic properties of a natural objects using the example of *Rhodobacter sphaeroides* reaction centers**

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The aim of the work is to develop a method for detailed analysis of the main reaction of an object to an external effect, which makes it possible to determine the kinetics and features of the substation population of an object, its hidden parameters.

Structural-dynamic properties of biological macromolecules are important for their functioning. For example, conjugated electron-conformational interactions in the protein globule of an enzyme are of great importance in enzymatic catalysis. A similar situation occurs for the reaction centers (RC) of photosynthesis, whose electronic states simultaneously influence and depend on the conformational state of the RC protein complex. Such space-time motions of biological macromolecules have complex multicomponent kinetics, which experimentally represents the main reaction of the system to the effect of the control parameter. This character of the reaction can be caused both by the influence of the hidden parameters of the object and by the influence of the reaction itself on the structure of the object, which is of scientific interest. The analysis of the basic reaction is carried out by building kinetic reaction schemes and studying the properties of the conformational substates of macromolecules. Often the kinetics of the main reaction is expressed by the sum of various exponential functions with negative values of decrements. Parameters of exponential functions are used to analyze the basic reaction of the system, to identify independent conformational substates of macromolecules, effects of structural self-regulation. Such substates are characterized by a change in the symmetry, degree of charge transfer, the size of the π-conjugate part of the electronic subsystem, multiplicity, and other parameters. As a rule, the values of weights and decrements of exponential components depend on each other and the characteristics of the control parameter of the main reaction, and the form of the exponential dependences, due to the conditions imposed on them, does not have pronounced singularities. The problem arises of analyzing the kinetics of the main reaction. If the experimental kinetics of the basic reaction of an object can be represented as a sum of exponential functions, then it can correspond to some system of differential balance equations. The task of the paper is to construct such a system. To solve it, it is necessary to develop an algorithm and a computer program for determining the values of the rate constants of the balance equations. The isolated RC of ***Rhodobacter sphaeroides*** was used as the object, the structure of which is well studied, and the main reaction of which can be represented as a sum of three exponential functions. As a result, a computer procedure has been developed that uses the parameters of the experimental kinetics of cyclical electron transfer of the RC, determines the values of the rate constants of the four balance equations, the kinetics of the population of four electron-conformational states of the RC. It is shown that the experimental and calculated kinetics of the donor population of the RC for the various photoexcitation parameters of the RC are in good agreement. For them, identified the values of the rate constants of the balance equations, the kinetics and the features of the population of substates of the RC

It is concluded that the RCs correspond to the system of four electronically conformational states, and the features of the kinetics of the population of substates of the RC characterize the space-time motions of the RC.