Biological Proof of the Mechanism of “Quantum Theory” of Biological Processes in Vivo

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Abstract: A great amount of results obtained from the experiments carried out by a number of scientists and by us especially have been subjected to modeling which enabled to implement analysis according to the method of dialectics “cause↔consequence”. A variety of numerous factors (chemical, physical, etc.) that engender the same biological process have been characterized by a single vector-energy (E) which along with the time (T) parameter defines the dose: \( D = E \times T \). Dose (D) as a cause and biological process as a consequence revealed a number of interrelated regularities such as discontinuity, continuity, homogeneity, heterogeneity, relativity, successiveness, abruptness, spontaneity and correlation between biological processes. Thus, the life cycle in vivo was based on these regularities. Besides, these regularities are necessary and sufficient to prove biologically the bioprocess realized by the mechanism of “quantum theory”.

Key words: Discontinuity, continuity, homogeneity, heterogeneity, relativity, successive, abruptness, spontaneity, correlation, life cycle.

1. Introduction

It is well-known that up to now any mechanism of bioprocess is explained in terms of organic and inorganic chemistry [1, 2]. Such kind of mechanism not only resolves the issues occurring day by day in biology, medicine, agriculture and other disciplines, but also makes their solutions more complicated. Nevertheless, the number of studies carried out in this direction is increasing which are lacking in the modeling of results [3] and analysis according to the method of dialectics “cause↔consequence”.

Taking into account this observation and the necessity of revealing the mechanism of bioprocesses, the study of bioprocesses has been carried out based on the methodology of dialectics. This study is based on the modeling of results obtained experimentally and the analysis according to the method of dialectics “cause↔consequence”.

Firstly, attention was drawn to a number of diverse affecting factors (chemical, physical, etc.) that engender the same biological process and on the contrary, certain affecting factor which causes various biological processes. This led to the fact that a number of various affecting factors (chemical, physical, etc.) were characterized by a single vector-energy (E) which along with the time (T) parameter defined the affecting total dose: \( D = E \times T \).

Dose (D) is the basis of “dose-effect” method. The experiments were carried out towards two directions:

1. when energy was a certain value (\( E = \text{cost} \)), time was changeable \( f(T) \);
2. when time was a certain value (\( T = \text{cost} \)), energy was changeable \( f(E) \).

These two directions of the method enabled to have complete dynamics of any bioprocesses experimentally, i.e. min-max-min values which occurred in the organism in vivo.

Thus, the emergence of a biological process is stipulated by energy (E) and time (T), the interconnection of which results in the dose \( D = E \times T \). It was proved by the fact that the same biological process with its kinetics (min-max-min) occurred with equal values by the influence of certain dose intervals.
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stipulated by two directions of “dose-effect” method:
(1) \( D = E = \text{cost} \times f(T) \)
(2) \( D = f(E) \times T = \text{cost} \)

A specific bioprocess occurred in the organism in vivo by the influence of doses, various bioprocesses and certain bioprocess in various organisms in vivo with their complete kinetics (min-max-min) as a result were subjected to modeling which enabled to carry out the analysis according to the method of dialectics “cause↔consequence”.

As a result, interrelated regularities were obtained which biologically defined the physical nature of the mechanism of bioprocess in the organism in vivo set forward by E. Schrodinger [4] in 1944 by “quantum theory”. Currently, it is developing slowly both in terms of physics and mathematics [3, 5, 6].

2. Materials and Method

Bearing that in mind, the authors are making changes having following conditions:
(1). “dose-effect” was chosen as a study method;
(2). as a learning tool the authors use agents of different nature (physical, chemical, etc.);
(3). mainly the micro-organism in which biological process (mutation) can be studied, taking place inside the organism and as well as processes of morphologic changes of cell normally having a homogenous shape (Fig. 8 (pic. 1)) in morphology served as a test-object of study [5];
(4). cause process of complete kinetics, i.e. the process of frequency rate min-max-min (Fig. 1);
(5). use the method of modeling results for the organisms in vivo obtained by us and other researchers to analyze them according to the “cause↔consequence” method.

I. Before the start of experimental work, let us pay attention to the action of various agents (physical, chemical), their concentration, and irradiation intensity. Since agents of different nature, their concentration (C) and intensity of irradiation (I) cause the same biological process in the organisms in vivo, they have a single vector of actions which can be only the energy. Therefore in the study, it is used as a common vector of action (E_c, E_i).

II. To get a biological process with complete kinetics with frequency rate (min-max-min), experiments were conducted by the method of “dose-effect” with two forms of processing (Fig. 1):
(1) the authors received biological process with complete kinetics (min-max-min) with frequency rates \( F_{0\text{min}}-F_{2\text{max}}-F_{4\text{min}} \) (Fig. 1) by the influence of a certain time size \( (T = \text{cost}) \) and energy interval \([E_{c0}-E_{c4}]\) or \([E_{I0}-E_{I4}]\), energy interval caused by the various concentration (C) or irradiation intensity (I) of agents of different nature (chemical, physical), \( T = \text{cost} \) and \( f(E_c) \) or \( f(E_I) \);
(2) the authors received biological process with complete kinetics (min-max-min) with frequency rates \( F_{0\text{min}}-F_{2\text{max}}-F_{4\text{min}} \) (Fig. 1) by the influence of a certain energy size \( (E = \text{cost}) \) caused by the concentration \( (E_c = \text{cost}) \) or intensity \( (E_I = \text{cost}) \) and time interval \([t_0-t_4]\), i.e. \( E_c = \text{cost} \) or \( E_I = \text{cost} f(t) \).

III. To obtain a bioprocess with complete kinetics (min-max-min) by two directions of “dose-effect” method:
(1) \( D = E = \text{cost} \times f(T) \)
(2) \( D = f(E) \times T = \text{cost} \)

fix dose intervals which result in this process with equal values show modeling graphically (Fig. 2).

IV. To obtain several bioprocesses with complete kinetics (min-max-min) in a single organism in vivo, fix dose intervals which result in these bioprocesses show overall modeling graphically (Fig. 3).

V. To obtain one particular bioprocess with complete kinetics (min-max-min) occurred in various organisms in vivo, fix dose intervals which result in this bioprocess show overall modeling graphically (Fig. 3).

VI. To obtain a certain bioprocess with complete kinetics (min-max-min) in different variants depending on dose intervals where energy is constant \( (E_1 = \text{cost}, E_2 = \text{cost}, E_3 = \text{cost}, \text{etc.}) \) and time is changeable \( f(T) \), fix
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Fig. 1  Any biological process with complete kinetics (min-max-min) in vivo stipulated by two directions of “dose-effect” method: $E = \text{cost} \times f(T)$ and $f(E) \times T = \text{cost}$.

Fig. 2  The same biological process with complete kinetics (min-max-min) in vivo with equal frequencies ($F_0 = F_0^1$, $F_1 = F_1^1$, $F_2 = F_2^1$, $F_3 = F_3^1$, $F_4 = F_4^1$) by two directions of “dose-effect” method: $E = \text{cost} \times f(T)$ and $f(E) \times T = \text{cost}$.
Fig. 3 Several biological processes with complete kinetics (min-max-min) occurred in a certain organism in vivo or a single biological process with complete kinetics (min-max-min) occurred in various organisms in vivo by the influence of corresponding dose intervals ([D₀-D₁], [D₀-D₂], [D₀-D₃]).

VII. To obtain bioprocesses with different characterizing features (genotypic or phenotypic) that occur in a single organism in vivo, fix dose intervals which result in these bioprocesses, show their modeling using different dimensions of graphics (Figs. 5 and 6) in order to reveal the correlation between bioprocesses (Fig. 1).

3. Results and Discussion

The same biological process with complete kinetics (min-max-min) specified by equal frequencies $F_0 = F_0^1$, $F_1 = F_1^1$, $F_2 = F_2^1$, $F_3 = F_3^1$, $F_4 = F_4^1$ occurred by the influence of selected corresponding doses ($D_0$, $D_1$, $D_2$, $D_3$, $D_4$) which were stipulated by two directions of “dose-effect” method: ($D = E \times \text{cost} \times f(T)$ and $D = f(E) \times T = \text{cost}$) (Fig. 2). This proved that dose was a result of interconnection of two parameters: energy and time ($D = E \times T$) which led to a biological process. The biological process with complete kinetics (min-max-min) of dose interval ($D_0-D_4$) was exposed to the analysis according to the method of dialectics “cause ↔ consequence” (Figs. 1 and 2).

First, particular size of the dose $[D_0; D_1; D_2; D_3; D_4]$ (Fig. 1) caused biological process specific frequency rates ($F_0; F_1; F_2; F_3; F_4$), demonstrating that the biological process, as well as the dose has a discrete character;

Second, different dose sizes $D_0; D_1; D_2; D_3; D_4$ of the interval $[D_0-D_4]$ (Fig. 2), causing the same process, are homogeneous with respect to the process, and heterogeneous with respect to different frequency rates of the same process.

Third, the same process, caused by dose interval $[D_0-D_1]$ with respect to different dose sizes of this interval is homogeneous, and heterogeneous with respect to different frequency rates of the same process.
Fourth, Figs. 1 and 2 show that biological process with complete kinetics (min-max-min) with frequency rates $F_0, F_1, F_2, F_3, F_4$ in fact, is continuously caused by influence of continuous sizes of doses $D_0, D_1, D_2, D_3, D_4$, which demonstrates that the dose as well as biological processes is continuous, which cannot be subjected to experimental study, and is a result of logical thinking.

Of particular interest is the analysis of the results obtained in the study of biological processes with complete kinetics (min-max-min) for example, various biological processes (A, B, C) occurring in the same organism in vivo that gives an opportunity to identify regularities of relationship between these processes.

(a) Fig. 3 shows that separate processes A, B, C with complete kinetics (min-max-min) in the same organism are taking place under the influence of interval dose $[0-D_1]$, $[0-D_2]$, $[0-D_3]$ discretely.

(b) A continuous increase in the number of dose intervals $[0-D_1], [0-D_2], [0-D_3]$ leads to a continuous increase in the number of the causing process (A, B, C), that is biological processes are continuous in nature (Fig. 3).

(c) Different dose size intervals $[0-D_1]$, $[0-D_2]$, $[0-D_3]$, causing various biological processes with complete kinetics (min-max-min) in the organism provide alternation of these processes $A \rightarrow B \rightarrow C$ (Fig. 3).

(d) In Fig. 3 if the authors pay attention to the certain size of dose ($D_0$) close to zero, in which different biological processes A; B; C are being induced, these processes take place at the same time by different rates of frequency $F_A$, $F_B$, $F_C$. This means that dose ($D_0$) has relative and heterogeneous nature with respect to these processes. And these processes A; B; C in their turn being caused to be under the influence of the certain value of the dose ($D_0$) are characterized by heterogeneity and relativity.

On the basis of these data, the author can conclude that these regularities: discontinuity, continuity, heterogeneity, homogeneity, relativity and alternation of the biological processes and doses provide interrelation between processes occurring in the organism. Interrelation between organisms which can
be revealed by a study of a certain biological process in different organisms— A, B, C (Fig. 3) is caused by the same regularities.

Interrelation of interaction of two parameters of dose (D = ET) has essential value when inducing biological process in organism in vivo. A parameter of dose-energy as a general vector of different agents’ action (chemical, physical etc.) with different concentrations (C) and irradiation intensities (I) and with different sizes of energy can be presented respectively: \( E_1 > E_2 > E_3 \) and \( E_{11} > E_{12} > E_{13} \).

The results obtained by “dose-effect” method in Fig. 4 show that under the influence of certain sizes of the parameters: \( E_1 = \text{cost}; E_2 = \text{cost}; E_3 = \text{cost} \) and \( E_{11} = \text{cost}; E_{12} = \text{cost}; E_{13} = \text{cost} \), which is made by value decreasing sequence on the one hand and increasing sequence on the other hand:

\[
\infty \leftarrow E_{11} > E_{12} > E_{13} > \ldots > E_1 > E_2 > E_3 \rightarrow 0
\]

induce a biological process with complete kinetics (min-max-min) changing the time interval \([0-t]\), during which the process in vivo occurs, on the one hand energy increase decreases the time interval, on the other hand energy decrease increases the time interval (the time interval of the occurring process has speed (V)):

\[
0 \leftarrow [0-t_1] < [0-t_2] < [0-t_3] < \ldots < [0-t_4] < [0-t_5] < [0-t_6] \rightarrow \infty
\]

Time interval approaches zero \([0-t] \rightarrow 0\) when energy size infinitely increases \((E \rightarrow \infty)\), wherein biological process in vivo takes place spasmodically, and on the other hand time interval approaches infinitely \([0-t] \rightarrow \infty\) when energy size approaches zero \((E \rightarrow 0)\), wherein biological process in vivo takes place spontaneously.

These actual existing properties, spasmodic and spontaneity, being origins of the biological process in vivo, cannot be subjected to experimental study, since they are the result of logical thinking.

Based on the fact that phenotype and genotype processes are of special and important interest in cognition of the essence of mechanism of the biological process, the authors carry out a study of the process of morphological changes by “dose-effect” method like the study of biological process taking place in the organism in vivo using the same conditions of study.

Under the influence of dose morphological changes were induced in microorganism, cell suspension of which was in norm being homogeneous (Fig. 8 (pic. 1)). These cells were changed under the influence of dose and became big and round (Fig. 8 (pic. 2)), rod-shaped (Fig. 8 (pic. 3)) undividable cells (Fig. 8 (pic. 4)). Every single one of these changes occurs as a process with complete kinetics (min-max-min) under the influence of dose interval \([D_0-D_4]\) (Figs. 1 and 2), and for different changes in the morphology (a, b, c) of the respective dose interval \([0-D_1]; [0-D_2]; [0-D_3] \) (Fig. 3).

Wherein analysis has revealed that the process of the morphological changes, as well as the biological process has all the regularities occurring in the organism in vivo: discontinuity, continuity, homogeneity, heterogeneity, relativity, abruptness, spontaneity and alternation, besides they provide interrelation between the processes of morphological changes (big circle cells—a \( \rightarrow \) rod-shaped—b \( \rightarrow \) undividable cells—c) caused by dose \((D = E \times T)\) (Fig. 6, Fig. 8 (pics. 2-4)).

VII. Based on the fact that the key of revealing the mechanism essence is interrelation between the processes of phenotype and the processes of genotype [4], the author had to study it by the “dose-effect” method keeping strictly the processing conditions in which mutational processes and processes of morphological changes in vivo were taking place at the same time (Figs. 5 and 6).

(a) Inducing certain mutational process (for example mutations of amino acid leu \( \rightarrow \) leu’ - A) and process of morphological changes (forming of big round cells—a) with complete kinetics (min-max-min) in microorganism in vivo (Fig. 5) the author found that these two processes take place with complete kinetics.
Fig. 5  Correlation between genotypic and phenotypic processes occurred in the organism in vivo in case of certain dose intervals ([0-D_2]) having simultaneously min-max-min values.
Fig. 6  Correlation between genotypic and phenotypic processes occurred in the organism in vivo at dose intervals ([0-D1], ([0-D2], [0-D3]) having simultaneously min-max-min values.
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(min-max-min) with the general interval influence of dose \((D_0-D_2)\) (Fig. 5) at the same time simultaneously taking frequency rates \(F_{\text{min}} - F_{\text{max}}\) in doses respectively \(D_0-D_1-D_2\) of this interval. These results evidence that there is a straight correlation connection between biological mutational process \((\text{leu}^-\rightarrow\text{leu}^+--A)\) occurring within the organism \textit{in vivo} and process of morphological changes—of the same organism.

(b) A deep study of this phenomenon, of the correlation by the “dose-effect” method in the same conditions of the processing has revealed that alternating different mutational processes \((\text{leu}^-\rightarrow\text{leu}^+--A; \text{arg}^-\rightarrow\text{arg}^+--B, \text{lys}^-\rightarrow\text{lys}^+--C)\) (Fig. 6) and alternating different processes of morphological changes (forming of big round—a \rightarrow\text{ rod-shaped—b} \rightarrow undividable cells—c) pass by the dose interval actions at the same time respectively \([D_0-D_1]; [D_0-D_2]; [D_0-D_3]\) (Fig. 6) in the same organism for which mutational process—A is correlated with the process of morphological changes—a, mutational process—B is correlated with the process of morphological changes—b, mutational process—C with the process of morphological changes—c accepting at the same time min-max-min frequency rates from the same organism \textit{in vivo}. Stating the results obtained by the analysis according to the law of dialectics (reason↔consequence) the author gets: energy \((E)\) as a single vector characterizes all the agents of different nature, different concentrations and radiation intensities differing by size which is one of the parameters dose action \((D = E \times T)\). And dose in its turn is a result of interaction of two parameters energy and time \((D = E \times T)\) with the help of which a number of regularities are found characterizing both dose and biological process: discontinuity, continuity, homogeneity, heterogeneity, relativity, alternation, abruptness and spontaneity and phenomenon of correlation as interrelation (interconnection) between the process of genotype occurring in the organism and the process of phenotype (morphological changes) \textit{in vivo}. All these are necessary and sufficient conditions for the approval of the “quantum theory” \([8]\) that mechanism of the biological process \textit{in vivo} having physical nature represents a quantum transition in the biological material \textit{in vivo}. This quantum theory has developed insensibly and is developing up to nowadays \([2-5, 7]\).

It is hoped that such mechanism of biological process with its regularities has been subjected to a deep study and leads to directed solving of the emerging problems in biology, medicine, agriculture etc.

It is known that genotypic and phenotypic processes are biochemical, morphological, physiological, etc. All these bioprocesses separately occur with the complete kinetics of frequency rate min-max-min (Fig. 1). The relationship between these bioprocesses is due to alternation, discreteness, continuity, relativity, spasmodic nature and correlation, which as a result are revealed by the method of “dose-effect” —\(D = Y, C, \times T\) (Fig. 1).

Fig. 7 presents the genotypic processes: different biochemical processes \(A_1, A_2, A_3, \text{ etc.};\) different morphological processes \(B_1, B_2, B_3, \text{ etc.};\) different physiological processes \(C_1, C_2, C_3, \text{ etc.}\). The phe-notypic processes are presented: different biochemical processes \(a_1, a_2, a_3, \text{ etc.};\) different morphological processes \(b_1, b_2, b_3, \text{ etc.};\) different physiological processes \(c_1, c_2, c_3, \text{ etc.}\). The property of alternation of these bioprocesses is carried out in this way: \(A_1\rightarrow A_2\rightarrow A_3, \text{ etc.}; B_1\rightarrow B_2\rightarrow B_3, \text{ etc.}; C_1\rightarrow C_2\rightarrow C_3, \text{ etc.}; a_1\rightarrow a_2\rightarrow a_3, \text{ etc.}; b_1\rightarrow b_2\rightarrow b_3, \text{ etc.}; c_1\rightarrow c_2\rightarrow c_3, \text{ etc.}\), by the effect of doses intervals, respectively \([0-D_1], [0-D_2], [0-D_3], \text{ etc.}\), which provide discreteness, continuity, relativity, spasmodic nature of these bioprocesses (Fig. 7). The dose interval \([0-D_1]\) provides the bioprocesses \(A_1, B_1, C_1, a_1, b_1, c_1, \text{ with complete kinetics, at the same time taking frequency rate min-max-min; the dose interval } [0-D_2] \text{ provides the bioprocesses } A_2, B_2, C_2, a_2, b_2, c_2, \text{ with complete kinetics, at the same time taking frequency} \)
Fig. 7 Complete life cycle (min-max-min) occurred by genotypic, phenotypic, physiological bioprocesses which are interrelated by the regularities of discontinuity, continuity, homogeneity, heterogeneity, relativity, successiveness and abruptness.
Fig. 8  Pic. 1. Control cells; Pic. 2. Big round cells; Pic. 3. Rod-shaped cells; Pic. 4. Nondivided cells.
rate min-max-min; the dose interval \([0-D_3]\) provides the bioprocesses \(A_3, B_3, C_3, a_3, b_3, c_3\), with complete kinetics, at the same time taking frequency rate min-max-min, i.e. the dose interval \([0-D]\) reveals the correlation between the relevant bioprocesses.

In sum, the author can conclude, that the revealed regularities of the bioprocesses of the genotype and phenotype carry out the life cycle of the organism \textit{in vivo}.

4. Conclusion

This study is based on the results obtained from the times of Darwin up to present day and the ones obtained by us. Thus, it is impossible to present these studies in references because of a great number of scientific papers.

To reveal the molecular mechanism of biological process in these studies, the analysis of the obtained results is based on the assumptions made according to organic and inorganic chemistry and not through the method of dialectics “cause↔consequence”. Thus, the issues arose up to present day have no solutions due to the absence of molecular mechanism of biological process. These observations enabled to make modeling of results and analyze them according to the method of dialectics “cause↔consequence”.

As a result, having the biological process \textit{in vivo} and dose interconnection the authors obtained the regularities (discontinuity, continuity, homogeneity, heterogeneity, relativity, successiveness, abruptness, spontaneity) that proved biologically a quantum nature of the molecular mechanism of biological process \textit{in vivo}. Possessing and perceiving these regularities, it is possible to resolve those issues the number of which is increasing due to geometric progression in biology, medicine, agriculture, etc.

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