

# Quantum phenomena in biological systems

## Abstract

The functioning of a biological systems, maintaining the dynamic stability of its homeostasis, is provided by regulatory systems. Traditionally, such systems include the nervous and humoral systems of regulation. The third regulatory system of the body, which provides communication in the body, distance interactions according to the “informational” principle, is not considered. For this reason, the understanding of the law of nature – “substance-energy-information”, uniting the foundations of any matter, is very limited in biology. This article provides a summary of the basic rules and principles of the interaction of Matter, Energy and Information from a quantum perspective.

Volume 5 Issue 1 - 2020

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**Received:** November 30, 2020 | **Published:** December 29,  
2020

## Condensed state of matter, non-locality and information

Condensed matter physics is a large branch of physics that studies the behavior of complex systems (i.e., systems with a large number of degrees of freedom) and strong bonds between particles in such systems. A fundamental feature of quantum systems is that the dynamics of their behavior due to certain influence from the outside is instantly reflected on the entire system at once and on all the particles at the same time regardless of the distance between them. This mechanism is non-local in nature, provided that there is a condensed state of information and matter between quantum biological objects. Such a mechanism of interaction of quantum particles is called as non-local because quantum particles are not located at any point in space but they are represented as waves. Non-locality is a property associated with the transmission of information.<sup>1-6</sup> It is characterized by the immediate reaction of particles (or systems) to the change of parameters of one of them which is simultaneously changing the parameters of the others, no matter how far the particles (or systems) are from each other. As early as 1935 was formulated so called Einstein's paradox. It stated that “unlike the principles of the theory of relativity, quantum equations point to the immediate connection of all parts of space as a whole.”

## The Limits of applicability within the laws of classical and quantum physics

### Description of effects and properties of macro-, micro- and biological objects

Classical physics considers radiation as an emission of electromagnetic waves with accelerated moving electric charges. Classical theory explained many characteristics of radiation processes, but could not give a satisfactory description of number of events particularly thermal radiation of organisms, microsystems (atoms and molecules). Such a description turned out to be possible only within the framework of the quantum theory of radiation, which showed that radiation is the production of photons during the change of state of the quantum system (for example atoms). Quantum theory, having penetrated more deeply into the nature of radiation, simultaneously indicates the limits of applicability of the classical theory. It provides a very good approximation for describing radiation, remaining, for example, the theoretical basis of radio engineering.

Physicists have found out that quantum mechanics practically does not work in the macrocosm and only applies to objects no larger than atoms and charged particles (molecules), since for larger objects the action of the force of gravity is manifested, which is reflected in the inhomogeneous deceleration of time flow rate. According to Einstein's theory of general relativity, time flows non-uniformly in the presence of gravitational fields. The stronger the field, the slower time flow rate. Under gravity, coherent connections between objects of large systems are destroyed and begin to depend on distance of these objects at the current time in relation to the center of mass. The behavior of most objects, systems of the world visible to us can be described using simple laws of classical physics, without taking into account the possible influence of quantum factors, which is suppressed by gravity and associated with its phenomena.

However, in many cases, we are able to observe the manifestation of quantum effects in systems consisting of subatomic, atomic particles charged particles (molecules), photons and even cells. In such systems, the non-local nature of interaction can be manifested between its objects. Currently, the nonlocality of quantum objects is a proven experimental fact many times over. For example lasers operating at the same frequency exhibit interaction with each other for no apparent reason. Nowadays the property of photon non-locality is used in the creation of quantum cryptographic systems. The main work resource of such systems are entangled (connected) states of photons and their instant non-local connection (quantum correlations), which allows providing absolute protection of information from unauthorized access. The connection between entangled photons is not just “superluminal”, namely the infinite, instantaneous, but in this case it is used not to transmit information, but to control the security of the communication channel. When accessing the transmitted information “from the outside”, the coherence of photons (quantum entanglement) is disrupted. Such systems use a fiber optic communication channel.

Scientists are currently working on a quantum computer. Entanglement between qubits (a quantum computer uses quantum bits – qubits) and “entanglement” is nothing more than a correlation, non-local connection of two or more objects separated in space - this is a necessary condition for a quantum computer to work, this is a key factor responsible for quantum parallelism and determines the advantage of a quantum computer over a conventional one. The quantum communication channel, in fact, unites the source and the successor (transmitter and receiver) of information into a single unit with individual degrees of freedom.

## Non-locality in biological systems

Such a deeper distant interaction mechanism is also propagating at the quantum level of biological structures and systems. Since the 60s. In Novosibirsk, Academician V.P. Kaznacheev and his colleagues conducted studies that confirmed the presence of distant intercellular interactions. In the course of these studies, the so-called mirror cytopathic effect was discovered, when cultures of living cells and tissues, hermetically separated by quartz glass, exchange regulatory wave information related to the functions of the genetic apparatus. It was shown that external information has a correlating effect on the cell, and the mechanism of transmission of the control information signal and intercellular interactions are non-local.

In the macrocosm, any movement is continuous, and therefore has a trajectory of movement. There is no concept of trajectory in quantum mechanics particles. The location of a quantum object can be characterized only by the probability function of finding a given object in a certain region of space. In this regard, the description of the processes of quantum objects and the mechanisms of their interaction can be assessed only as probabilistic. The processes and states of biological systems considered as nondeterministic, stochastic, nonlinear, can be described on the basis of probability functions and fully correspond to the approaches in describing quantum objects and systems. Note that the brain also works in accordance with the principle of “non-locality”. For the manifestation of the effect of nonlocal interaction for quantum systems, a necessary condition is to maintain a high degree of coherence (synchronization) between the particles that form these systems - atoms, molecules, cells.<sup>7-9</sup>

The significant synchronization of oscillations of their structures and processes allows these systems to effectively respond to weak regulatory signals and to form their own response signals of sufficient intensity in the system of communication links and interactions. The system acquires the properties of a condensed state of matter. This also reveals the property of additivity from their cooperative coordinated functioning. We have already noted that under normal conditions of physiological processes, the normal state of biological tissues and environments is observed relative significant synchronicity between the structures that form these biological systems. With pathologies and conditions preceding it, a similar synchronous connection is violated.

## Analytical cloud system ERI

The practical output of our research represents the Analytical Cloud System ERI. The task of compensatory correction in ERI technology is purposefully, in many cases with a high degree of selectivity to restore broken synchronization of structures of systems and processes. The quantum nature of this mechanism of action is manifested in the

technical implementation of a regulatory signal based on the formation of a dynamic electric field strength corresponding to a certain probability function, complementary to such a system or process. If the amplitudes of the probability density of the regulatory signal and the process coincide in phase, then they enhance each other, folding, and if they are in antiphase, then, on the contrary, extinguish each other, decreasing. The quantum mechanism of the regulatory impact of KME-ERI in the first place aims at restoring non-local communication in individual quantum systems of the body by restoring their coherent (synchronous) state. Due to this the information links and regulatory processes are restored between structural elements, both within these systems, and subsequently between other systems as well.<sup>10-12</sup>

## Acknowledgments

None.

## Conflicts of interest

None.

## Funding

None.

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