

## Systemic and physiological concepts of information medicine and control signal concept

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### annotation

New physiological concepts have been formulated - a virtual state, a reaction of anticipatory adaptation and a reaction of an advanced representation of an organism when it interacts with a control signal. Approaches to the concept of information carried by a control signal, arising from the practical needs of information medicine, are proposed.

### Introduction

To date, only one situation is known in science in which there is an excess of the reaction energy of the system over the energy of action on it [1]. This is a situation in which the system, which is influenced, is a self-regulating system with a certain program of actions (self-fulfillment program), and the impact is carried out by a signal transmitting to it information about the conditions under which this self-fulfillment takes place or will proceed. Then the system will carry out current or anticipatory adaptation to self-fulfillment, depending on whether it receives information about the current or future conditions in which it takes place. This adaptation is carried out by the system:

- on the one hand, taking into account the information transmitted to the system by the control signal;
- on the other hand, using its internal energy sources, which allows it to carry out adaptive reactions that require more energy than the transmitted signal.

It is known that a biological system, in particular the human body, is a self-regulating system that perceives and uses information received from the environment [2]. In addition, it can be viewed as a system with a program of self-fulfillment [3]. P.C. Anokhin showed that any biological system, in particular the human body, is also capable of perceiving information about the possible (modeled by it) future and use it, implementing advanced adaptation to the tasks that it has yet to solve. The corresponding property of the biological system was called by him the anticipatory reflection of reality [2].

The above provisions are ideological information medicine (IM, see [1]), proceeding from the provisions that the human body is a self-governing (biological) system with a program of self-fulfillment (at least maintaining various forms of homeostasis, as in [3]), and a control signal (CS), changing its behavior, by a signal containing information about under what conditions or their changes this program should be implemented.

## Expansion of the physiological paradigm associated with information medicine

Acceptance of MI as a real and meaningful phenomenon requires an expansion of the physiological paradigm. From our point of view, it is necessary to introduce only two new, but basic physiological concepts: the virtual state of the organism and its reaction of anticipatory adaptation (the following reaction, or forced adaptation, according to M.G. Abakarov [4]) in relation to this state.

Recall that from the point of view of the general theory of control, an organism can be considered as a reflecting system that:

- models the surrounding reality, including itself, as a part of it;
- uses the obtained model for the purpose of subsequent self-fulfillment, in particular, adaptation to one's inner state with the aim of further self-fulfillment.

In this case, there is always a certain "gap" or, as we will say, "discrepancy" between the objective state of the surrounding reality and its reflection, used by the body for control with the aim of further self-realization. Its cause is, first of all, the inevitable incompleteness of the body's reflection of the surrounding reality. This circumstance is not surprising for physiology. In particular, most modern theories of aging are based on the concept of either incomplete or internally contradictory reflection by the body of aging processes in it, which does not allow it to develop an adequate adaptive response. Moreover, in the case of aging processes, such a reaction may not even be foreseen by the physiology of the organism. However, the adoption of the 2nd postulate of MI entails the need to recognize one more reason, according to which such a "discrepancy" may appear. This reason may be the assimilation by the organism of the US, which, as already mentioned, delivers to it information about the need to adapt to the additional condition of self-fulfillment, although, from an objective point of view, this condition is absent.

The state of the organism, in which the model of the surrounding reality, created by it, has a "discrepancy" in relation to the objective state of this reality, conditioned by the assimilation of a certain CA, we will further call it its virtual state.

The adaptive reaction of the organism in relation to some of its virtual state is called the following reaction, or, what is the same, the subsequent adaptive reaction, or the reaction of forced adaptation to this state, as well as to the CA that determines it.

It is obvious that any virtual state of an organism inevitably determines a certain follow-up reaction. Indeed, being in a virtual state, the organism perceives the information entered into it as a really existing additional condition for self-realization. Adaptation to this condition is necessary, therefore, adaptive

reaction towards him. But since the condition under consideration is present only at the information level, that is, its "natural source", always observed in situations studied by traditional physiology, is absent, the observed change in the state of the organism seems to be caused neither by its state, nor by the state of the surrounding reality, which is distinctive a sign of follow-up reactions.

The mechanism of the development of the following reaction in relation to the virtual state has analogs in the traditional physiological paradigm. It is in many ways similar to the processing by the body of information coming from its sensory-perceptual systems, and can be considered not only at the physiological level, but for higher organisms and at the level of psychology. Figuratively speaking, a virtual state can be compared with a "sweet dream" or, on the contrary, a "notion of a threat" arising in our psyche and conditioning behavior - an analogue of follow-up reactions, which may seem completely unrelated to the real environment. Modern psychology suggests that the awakening of such a "dream" or "threat" is always associated with a certain subthreshold signal, coming from the external environment or even from the organism itself and creating a kind of "psychophysiological resonance". In our analogy, this subthreshold signal plays the role of an EOS, which is sometimes also difficult to detect. However, one should not go too far with this analogy, because the mechanisms of assimilation and influence of the EOS are still far from being investigated and may contain many surprises.

MI began with the discovery of a class of ES, for which the subsequent reaction to them was obviously clear. Historically, its first section was Hahnemann's homeopathy [5]. Hahnemann postulated that:

- for the treatment of a disease, it is necessary to use small doses of poisons that cause symptoms similar to a healed disease in healthy people;
- most effective are "infinitely small" doses of such drugs, obtained using the procedure of potentiation developed by Hahnemann himself, usually multiple.
- a potentiated homeopathic remedy can cure those and only those diseases, the manifestations of which are similar to poisoning by its "tincture" - the material carrier from which it is made.

Thus, Hahnemann experimentally discovered a method of manufacturing a sufficiently large class of EOS with a predetermined follow-up reaction and, at the same time, a uniform way of describing their effect on the body.

Since Hahnemann used only poisons as "material prototypes", the follow-up reactions generated by them actually modeled all kinds of resistance reactions of the organism. Indeed, an adaptive response to the ingress of a poison into the body will be, on the one hand, its binding and elimination, and on the other, compensation for the damage inflicted by it. If the substrate of the poison is absent in the body, and the US, transmitting information about its presence in the body, takes place, then we will observe the following reaction in the form of a reaction to compensate for the destruction caused by the absent poison. V

traditional physiology, such a situation is impossible, the body cannot react to what is not. Therefore, it is impossible to describe and study it without expanding the physiological paradigm. The lack of the necessary expansion of the paradigm, in our opinion, also causes significant difficulties in the interaction of homeopathy with official medicine, even with the expressed desire of the latter to accept the former "into the mother's embrace". The idea of the reaction of resistance, as an adaptation of the organism to an additional condition of self-fulfillment, made it possible to develop a number of new EOS of the homeopathic type of action. We especially note the EOS of the proliferation of the growth of various cellular tissues and structures, in particular fibroblasts [6], and the drug "Syvstar" [7] - a signal of resistance to premature aging.

At the same time, follow-up reactions are not necessarily resistance reactions. The presence in the body of any substance or process does not necessarily have to cause a defense reaction against them. However, an adaptation response to a substance or process will always be observed. This can be used to create fundamentally new follow-up reactions that are not defensive, that is, homeopathic reactions. Accordingly, whole classes of effective non-homeopathic RS are possible. An important example of such a class of EOS are regeneration signals [8], made by copying control signals from regenerating animals: sea cucumber, earthworm, newt, and lizard. In accordance with the concept of the follow-up reaction, these drugs can cause an increase in the regeneration reactions in the human body, and these representations do receive confirmation [9]. Moreover, it seems that this is not so much about the acceleration and enhancement of regenerative processes, but about the suppression of physiological blocks to their full course, for example, the proliferation of connective tissue ahead of true regeneration, respectively, a more complete and more complete from the morphological point of view of the regeneration reaction.

The concept of follow-up reactions allows us to link the concept of MI with the theory of functional systems in its original interpretation given by P.K. Anokhin. Indeed, the following reaction can be unambiguously associated with the initialization of a functional system, the purpose of which is to implement this reaction. In this case, the signal of initialization of this functional system is exactly the US, which creates the corresponding virtual state of the organism. From a technical point of view, diagnostics and therapy of this organism are reduced to "turning on" and "turning off" the corresponding functional systems [10]. The concept of following reactions allows one to associate MI with reflexology, moreover, to consider it a part of reflexology, even if it is unusual.

#### Approaches to objectification of information transmitted by managers signal

The concept of the virtual states of the organism and the follow-up reactions caused by the EOS makes it possible to significantly detail the idea of them. But even it, taken by itself, is not sufficient for carrying out correct

physiological experiments and medical research. To provide the methodological apparatus of information physiology, it is necessary to consider in more detail the concept of information transmitted by the ES, and this should be done precisely from the point of view of the specifics of experiments of one type or another.

In principle, there are four different approaches to the objectification of information transmitted by the RS, and, accordingly, 4 classes of correct experiments and research, in which the storage, transmission, assimilation and "processing" (adaptation) of the RS by the biological system are studied.

1. In the first approach, as objective changes occurring in the human body or other biological system under the influence of US, the change in the indicators of electropunctural diagnostics (EAP) or other systems of representation of the anticipatory display of reality by the body is considered. In VRT-BRT, for example, it is possible to track the change in a set of resonance test pointers from a fixed list with a predetermined measurement method (VRT interface). The consistent development of this idea leads to a mathematical interpretation of the information transmitted by the control signal as a change in the measure of uncertainty of the "state vector" of a representative system, for example, a set of resonant test indicators in the case of ART-BRT. In particular, one can introduce the number of algebraic information transmitted by the US under tracking conditions (using VRT-BRT) dynamics of some ART interface of the body. This approach (it can be called syntactic) relies only on the results of formal measurements a certain group of VRT test indicators or others, for example, biochemical indicators of the state of the body. It is convenient when it is necessary to have numerical estimates of the measure of the change in the state of the organism under the influence of the US. In particular, it is adequate in clinical trials of information drugs or information therapy techniques. At the same time, the syntactic approach does not connect the observed characteristics of US with its clinical effect on the body and does not include any, even hypothetical, assumptions about the mechanisms of such an effect. In particular, it does not allow predicting the IP action based on the method of its manufacture. All this significantly limits the applicability of the syntactic approach, at least at the current level of our knowledge.

2. The second approach, essentially developing the original ideas of homeopathy, is modeling the adaptive response of the body depending on the message about an additional condition of self-fulfillment (an additional condition, when which he needs to continue his self-realization), transmitted by the CA. This approach, in contrast to the first one, could be called semantic, since it is based on the idea that the ES introduced into the body has meaning (content) for him, as for an integral system. Namely, DC indicates how the body should adapt in order to continue its self-realization - the implementation of its inherent biological program - in the changed conditions. Information about what constitutes a change in the conditions of self-fulfillment is the content (meaning) of the CS, "from the point of view" of the organism.

The disadvantage of the second approach is the impossibility of describing in detail the information on the "additional condition of self-fulfillment" contained in the IP based on the description of the "native preparation" used for its manufacture. That is, even having guessed how the IP acts, in many cases we do not know why it acts this way.

In the case of the third approach, we are only interested in those links of interaction between the informational preparation and the organism, at which the assimilation of the EOS transforms into an adaptive reaction of the organism. Let us assume that some chemical substance is considered as the RS. Entering into a chemical interaction with the substances of the body, this substance gives rise to a metabolic sprout - a time-ordered change in the quantitative and qualitative characteristics of all chemical reactions in which it participates directly or indirectly, up to its inactivation and removal from the body. It follows from this that in particular, that a metabolic germ generated by a substance can be described in biochemical language as a complete reaction of an organism to its introduction. Moreover, this reaction can be both successful and unsuccessful, the introduced substance can be both useful and harmful to the body.

The metabolic germ generated by a substance can be subdivided into two interacting, but not overlapping parts:

- firstly, these are reactions in which the introduced substance or its metabolites are directly involved. This part of the metabolic germ will be called its active part;
- secondly, these are reactions in which the introduced substance itself or its metabolites are not directly involved, but which, nevertheless, are due to its ingress into the body, in other words, biochemical reactions for which this substance is a signal (to their occurrence, inclusion). This part of the metabolic germ will be called the reactive or adaptive part of the considered metabolic germ.

An example of a metabolic germ, in which the division into two parts - active and reactive - is clearly visible, is the process of production of antibodies by the body in response to the introduction of an antigen into it. With the development of a reaction to an antigen, antibodies are produced that no longer contain the injected antigen. However, their very existence, as well as the chain of chemical transformations already taking place with them, prior to their utilization and withdrawal, is entirely due to the fact of its introduction. If somehow the systems of the body that produce antibodies (for example, helper T-lymphocytes) were able to "convince" that a certain antigen was introduced into the body, then they would produce antibodies to it, despite its actual absence.

In "orthodox" medicine, it is believed that, having no chemical substrate that generates the active part of the metabolic germ, it is impossible to obtain and its reactive part. Indeed, from any biochemical reaction located in the reactive part of the metabolic germ, a certain chain of biochemical reactions must go to the active part of the germ.

Therefore, for each biochemical reaction belonging to the reactive part of the metabolic germ, there must be a "borderline" biochemical reaction such that:

- the "previous" reaction belongs to the active part of the sprout (the substance that gave rise to the sprout or its metabolites is involved in it);
- the "subsequent" reaction belongs to the reactive part of the sprout (the substance that gave rise to the sprout, or its metabolites do not participate in it). Of course, in the general case for a reaction from the reactive part of the metabolic germ, the existence of several "borderline" and, accordingly, "preceding" chemical reactions lying in its active part is possible.

Further, with the orthodox way of reasoning, it is asserted that if the active part of the metabolic germ is empty (does not contain any biochemical reactions), then for any supposed biochemical process in its reactive part there is not a single corresponding "previous" reaction in its active part. Therefore, there can be no "borderline" reactions to this biochemical process, and therefore the reactive part of the metabolic germ is empty.

The error in the above reasoning lies in the fact that, in addition to the biochemical reaction, the phenomenon of generalized catalysis can act as a "previous" biochemical process - a change in the rates of biochemical reactions in the body, which nevertheless occurs under its (substance) influence, in which the considered the substance (or its metabolites) is not directly involved. The phenomena of generalized catalysis can both mediate the transition from the active part of the metabolic bundle to its reactive part, and generate metabolic bundles without an active part. These latter include, in particular, all metabolic beams generated by sensory-perceptual signals, for example,

images or texts.

We know that MDs used in information medicine, in particular in ART-BRT, are not chemical substances. It is assumed that they are weak electromagnetic signals, since their recording, storage and reproduction is currently provided by electronic equipment. Consequently, they certainly do not generate metabolic germs of chemical reactions with a non-empty active part. How, then, can an adaptive response of the organism to such a weak electromagnetic signal arise? From a biochemical point of view, US is a modulator of the rate of biochemical reactions in the body - it accelerates the course of some of them and slows down the course of others. In turn, the acceleration or deceleration of reactions, the rate of which is influenced by the US, causes in the body the subsequent response in the form of triggering "normal" biochemical reactions, which and become "borderline" for the metabolic germ generated by the US. Such a metabolic germ evidently consists of one reactive part. In order for the described hypothetical mechanism for the generation of metabolic germs, consisting of one of its reactive parts, to exist and be effective for

self-regulation, it is necessary that in the process of evolution the organism accumulates a sufficient number of peculiar "transition locks" - matrices of acceleration or deceleration of ordinary biochemical reactions, under the influence of which new biochemical reactions are triggered. Each such "transition lock" is unlocked by its own "transition key" - a signal from a group of RS of a certain type. The "key of transition" acts on the body as a generalized catalyst (OC), which implements the matrix of slowing and accelerating biochemical reactions.

The concept of "biophysical level of control" often referred to in the literature on ART-BRT means that the body has a sufficient number of "transition locks" encoded by generalized catalysis matrices and "transition keys" encoded by USs for effective self-regulation, including - in a therapeutic aspect.

Suppose that the OC matrices for the EOS and its "prototype" - the initial chemical substance from which it was obtained, coincide or, at least, are close enough. In MI it is customary to say that these matrices are "similar". Then the reactive part of the metabolic germ generated by the considered control signal is close ("similar") to the reactive part of the metabolic germ generated by its prototype. Then, knowing the structure of the reactive part of the metabolic germ generated by a chemical, we also know the structure of the metabolic germ generated by the US obtained from it. At the same time, metabolic sprouts generated under the influence of US do not have an active part. Therefore, the effects on the body of a chemical substance and the US obtained from it, in the general case, may turn out to be completely different.

Actually, MI began with the above construction - historically, homeopathy became its first section.

It is advisable to compare second and third approaches To the description informational content of the RS, which has a "material prototype". The reactive part of the metabolic germ of the "material prototype" (the considered US) is the biochemical level of the description of the adaptation response to its entry into the patient's body. In this case, the corresponding US, introduced into the organism, creates in it, figuratively speaking, the "illusion" of the introduction of the "material prototype of the US". The body responds to this illusion with some adaptive response. In [17], these reactions were called non-equilibrium, since they lack an active part of the metabolic germ. A paradoxical situation is created: there is no substance, but there is an adaptive reaction of the organism's resistance to illusory poisoning.

In the general case, follow-up reactions are by no means limited to resistance reactions. The latter can be considered only as a very special case of follow-up reactions in a situation where the presentation of an additional condition for self-fulfillment to the body requires both its immediate elimination and the elimination of its consequences.

We have the right to call the fourth approach objective-physical. Here us interested in the physical differences between the IP - the carrier of a certain US - from the same, but, from the information point of view, "empty" media, on which no US is recorded. It means:



- a description of a physical experiment in which this US would be found recorded on a chemically neutral medium;
- a description of the characteristic results of such an experiment, which make it possible to detect and recognize this EOS, in particular, to distinguish it from white noise and other signals similar to it.

The described four approaches correspond essentially to the four stages of transformation of information contained in the EOS and the corresponding IP, when trying to control the body with its help. In this case, these stages are listed in reverse order in relation to the "natural" sequence of transformation of this information in the process of managing the state of the organism.

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