INTERNAL ORIGINATORS OF FUNCTIONS FLUCTUATION IN MULTI-CELLED ORGANISM

Grygoryan R.D., Lissov P.N.
Cybernetics Center of National Academy of Sciences, Kiev, Ukraine. graf@isofts.kiev.ua

Objectives: Organisms' reactions to each external factor have their specific primary effects and several secondary, mainly non-specific behavior that is a result of internal homeostatic systems (HS) activation aimed to parry these primary changes to stabilize homeostatic characteristics in general. As far as the external environment is mostly unstable with a random dynamics of characteristics, reacting to these factors, organisms appear fluctuations of their internal state. To understand the main principles that determine reliable function of human-operator and fluctuations in physiological state of human organism under its interaction with unstable environment, the relationships between different homeostatic and functional systems were analyzed taking into account local and global effects of cellular adaptation mechanism (CAM). **Methods**: Systemic analysis was combined with computer simulations. A hypothesis according to which CAM is the only responsible mechanism that determines all local and integral processes of physiological adaptation (PH) was used in model. CAM is presented in model as an "egotistic" mechanism functioning independently and based on a non-symmetric intracellular mechanism tuned against stable trends of negative balance (NB) between anabolism and catabolism. An over-threshold level of NB is considered as an originator of special moving forces necessary and enough to activate CAM. To minimize NB, the single cell needs additional energy and structural components. To expand its productiveness by activating of sub-cellular structures that already existed in their passive stage and also by building new such units, the NB-cell try to provide the necessary rate of biosynthesis. **Results**: The model has shown that using such simple presentation of PH, we able to simulate practically all known integral adaptation effects that were observed by researchers on organism level under different changes of external environmental factors (temperature, oxygenation, gravity e. a.). Nonlinear relationships that are characteristic for complex organisms are mainly caused by functional diversities that normally are presented even in frame of relevant cells of one single multi-celled organ (population). There are four main factors that determine such a diversity of cells: 1) current phase within the cell's life cycle; 2) reactivity of cell to unstable exogenous factors with random characteristics; 3) concentration of resources in close interstitial environment necessary to provide the needed rate of biosynthesis; 4) the current ability of the cell to provide chemicals transport into the cell and to support appropriate rate of biosynthesis. The activation of CAM increases the last ability of BD-cell and thus re-distributes the flows that issued in previous episodes of cell life. Each partial HS is a fixed structure that contains populations of specific cells in its structural links. Therefore, every local reaction of these cells to extra-cellular factors will activate their CAM, and thus will change the flows of substrates towards cells both within this HS and in frame of the whole multi-celled organism. The so-called homeostatic constants are sooner variables than really stable characteristics. Their current level reflects general needs of multi-celled organism or its several structural-functional units in substrates and oxygen. No one HS able to set the level of control characteristics. The only function of specialized HS is to minimize the violation of its output variable under random changes of its input loading that able influence functional changes in cells presenting both the external or internal receptors and other links of HS-contour. The complex changes in different indicators of organism's current state reflect the inside of regulator relationships based on nervous and humoral channels involved in providing of organism's integrative reactions.
Conclusion: Fluctuations of functional activity usually indicated by changes of homeostatic constants of multi-celled organism will be considered as its normal reactions both to external and internal environments. Under essential and long-term shifts of environmental characteristics the adaptive responses of multi-celled organism are mostly determined. Therefore, they will have stable trends and could be mainly forecasted if only we can find adequate measurement methods.
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