

細胞のストレス応答－熱対応タンパク質のシステム生物学的解析
Responses of Cell to Stress—Analysis of Heat Shock Protein from System Biology—

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[Introduction and Objective]

The living things are keeping life activity corresponds to the external and internal environment changes which expressed as homeostasis or robustness. The enormous protein network maintains organism in homeostatic state. It is necessary for the proteins to keep correct conformation for to have functions. Recently, the proteins called a chaperon participating in the physiological function along on the side of functional proteins by fold these proteins appropriately. Heat shock proteins (HSP) was found in many types of cells that responded heat shock, and known as one of the chaperon, concerning with newly synthesized protein folding, refolding of denatured proteins and resulted in regulation of biological processes. In the responses of cells to stresses, e.g. heat, UV and chemical substances, changing of HSPs levels and types are one of the most sensitive one.

It is crucial to elucidate and understand pathophysiological phenomena and mechanisms for therapy of diseases, such as cancer and metabolic syndrome. These physiological and pathological processes are involved in many molecules which related each other and formed complicated networks. And we need to know dynamical change on cell and of proteins, too. For these reasons it is difficult to understand diseases correctly. So, analysis of cell growth, death and related protein changes such as HSPs on the viewpoint of system biology. it make us easy to reveal biological phenomena.

[Results and Discussion] The mathematical model of HSP constructed based on the conceptual molecular models show HSP converges to constant. We measured HSP levels of HepG2 cell with and without stress using western blotting method. The HSPs levels were changed under stress and convergence was confirmed. The expression levels of HSP genes (HSP90AA, HSP90AB, HSP90B, TRAP, HSP72) show different expression pattern among HSPs. The fluctuation of HSP72 concentration after stress is recurred additional term of cell death to the reaction equation of protein mathematically. The results of effects under starve condition on HSPs are not same pattern of those of heat stresses. Those results showed stresses effect on cell growth and expression of HSPs and proteins, but it is not clear the alterations of HSP concentration or protein critically for effects on proliferation or cell death, yet.