Enhancement of Health and Life Span Controlling Entropy of Living Systems (Reduce Entropy Gain Health)

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Abstract: **- The Article presents the empirical significance of entropy in living systems considering open thermodynamical systems. The living system can control entropy in instructive way and enhance the health and life span. Releasing free energy in the form of work against consumed energy in balanced way can cause healthy and disease (caosness) frees life. The negative entropy is unattainable for long term but in short term it is significant to increase life.**

Keywords: **Entropy, living open thermodynamical systems, Free energy, self potential energy**

I. INTRODUCTION

A thermodynamic system is described in explicit way by the thermodynamic variable entropy, which measure the change of state or caosness of the system. An open biological system can be considered as a thermodynamic system to measure its caosness (growth or decay).

In view of thermodynamics, the open biological or living systems exist in a state of unstable dynamic equilibrium [1]. This system passes through a series of precisely unbalanced states in the process of functioning. The state of an open system effected with change of thermodynamic variables. The unbalanced state of the systems is maintained on the probabilities at the expense of creating flows of energy and matter in between the biological system and surrounding environment. In this paradigm of flows, the parameters of systems may be considered as time functions. The change in entropy of living systems (ΔS) is composed of entropy change of the system with the surrounding environment (ΔS_e) and entropy change in the system itself (ΔS_i) as a result of inner irreversible processes.

II. EQUATIONS

Erwin Schrödinger introduced [2], the notion that the general change of entropy of an open system made up by two ways i.e. the entropy exchange with surroundings and change of entropy with internal processes.

Mathematically,

$$\Delta S = \Delta S_i + \Delta S_e \qquad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

As $\quad S = S(t) \qquad \ldots\ldots\ldots\ldots\ldots\ldots(2)$

i.e. for open systems entropy is time dependent.

Now, differentiating equation (i) with respect to time with infinitesimal change of S with t.

We have

$$\frac{d(S)}{dt} = \frac{d(S_i)}{dt} + \frac{d(S_e)}{dt} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

In above equation the first term of RHS is given by –

$$\frac{d(S_i)}{dt} = \frac{d}{dt}\int \frac{dQ_i}{T} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Where, dQ_i is energy consumed/ taken by the system for internal processes in the form of meal.

And T is Absolute temperature of the system which remains almost constant for all living systems during internal processes. Like 98.6˚F for human beings.

Therefore the first term in RHS of equation (4) represents the time rate of change of entropy or speed of entropy of internal processes towards caosness.

And second term of RHS is given by-

$$\frac{d(S_e)}{dt} = \frac{d}{dt}\int \frac{dQ_e}{T} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

As the temperature of the surrounding changes; therefore using II law of thermodynamics-

$$dQ = dU + dW$$

$$dQ_e = C_V dT + PdV$$

$$\therefore \frac{d(S_e)}{dt} = \frac{d}{dt}\int \frac{(C_V dT + PdV)}{T} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(6)$$

The system maintains temperature T constant.

Hence the probable expression for change of entropy with environment is given by-

$$\Delta S_e = C_V \ln\left[\frac{P_f}{P_i}\right] + C_p \ln\left[\frac{V_f}{V_i}\right] \qquad \ldots\ldots\ldots\ldots(7)$$

Thus second term represents the speed of entropy with exchange of energy with surrounding environment.

In equation (7) pressure on system changes rarely and this term is negligible hence; only second term of this equation contribute in entropy with exchange of energy.

III. RESULT AND DISCUSSION

Case-I:

For inner irreversible processes the energy is required i.e. dQ_i is always positive.

Hence $\frac{d(S_i)}{dt}$ = (+)ve

If the system gaining energy from the environment, whenever temperature of the surrounding of system be greater.

Hence ΔS_e will be (+)ve

Overall,

$\frac{d}{dt}(S) = (+)ve$ ……………………..(9)

Therefore in whole system the caosness increases and tends rapidly towards death.

Case-II:

Whenever the temperature of surrounding environment be less than to the system.

Then,

$\Delta S_e = (-)ve$ ………………….(10)

And $|\Delta S_e| < |\Delta S_i|$

Overall, $\frac{d}{dt}(\Delta S) = (+)ve$ but less than that of case-I

Hence slow increase of entropy of the system i.e. system tends towards caosness slowly or the living systems grows with slow rate.

Case-III:If $\Delta S_e = (-)ve$

And $|\Delta S_e| \geq |\Delta S_i|$

Then either

$\Delta S = 0$ ……………………..(a) (11)

Or

$\Delta S = (-)ve$ …………………..(b) (11)

Hence using equations 11(a) & 11(b) equation (3) gives the results

Either $S = Constant$

Or $S = (-)ve$

using II law of thermodynamics is given by-

$$dU = TdS - dW$$

As the system exchanges heat with the surrounding and is thereby maintained at constant temperature T,

Then $TdS = d(TS)$

And $d(U - TS) = -dW$

Or $dF = -dW$

Where $F = U - TS = -W$ is called Helmholtz free energy, released from the system to do work.

IV. CONCLUSION

In result section we found that if the temperature of the surroundings is more than that of the open living system, the system takes energy not only through meal also takes energy from the environment. Hence according to equation (9) the speed of entropy-increase increases i.e. the caosness (growth, decay) sharply increases so life span become short. It can be seen in every living systems lie in equatorial and its nearby region.

The equation 11(a) reveals that if the surrounding environment has low temperature then there is negative change of entropy with energy exchange to the environment, which results the slowdown of growth and decay processes. Hence the life span of system increased.

If by some means the entropy of the internal process of system be minimized by minimum required meal and negative entropy of exchange of energy with environment be maximum through workout or releasing free energy then, the system has constant entropy with time. Hence life span increases without any randomness or disease.

On the other hand from equation 11(b) if the entropy of whole system becomes negative, the paradox arises. Therefore this state is unattainable for long time interval because the system cannot release free energy beyond the self potential energy. But for the short interval it may be possible and it can be seen through dieting and workout applying on humans to regain shape and weight.

If the entropy of the system changes as of equation 12(a), the open systems attain stability and it cannot go out spontaneously out of state. The constancy of entropy in living systems is provided by free energy, which released when nutrients consumed from the outside dissociate [3] i.e. at the expenditure of sun energy. Thus the flow of negative entropy is important to compensate for inner destructive processes slowdown and decrease of available free energy dissipated by spontaneous metabolic reactions. This is the key issue of circulation and transformation of free energy; it derives the functions of free energy. Thus for the metabolic reactions the free energy should consumed as work function to maintain the entropy constant.

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