

зуются такие устойчивые выражения: 胆小如鼠 становится маленьким, как мышь; 兔子胆 заячий желчный пузырь; 膝语蛇行 змея говорит из-под ног. Если человек двуличный, лицемерный, можно сказать 笑面虎 улыбающийся тигр; 长虺成蛇 маленькая змея остается змеей (даже маленькая змея опасна и может отравить); 虚与委蛇 обманывать и извиваться змеей (о человеке, лишь создающем видимость деятельности, при творщике). Есть такие качества, которые описывает только одно животное, например дракон является символом величия, красоты, благородства: 龙威 власть дракона (величественная осанка, манеры), а мягкотелого человека описывает овца: 温顺得像一头小绵羊 кроткий как ягненок (нежный как овечка) [6].

В заключение можно сказать, что китайский гороскоп – это уникальное культурное явление, это вся мудрость Востока. Он был создан много веков назад и по сей день остается востребован-

ным. Он определяет судьбу, характер, помогает вести хозяйство, отражает культуру страны. Животные шэнсяо наделены качествами, чертами характера, вследствие чего возникли фразеологизмы с их элементами. Устойчивые выражения также являются кладезем знаний, отражают самобытность китайской культуры.

Список литературы

1. Сомкина Н.А. Двенадцать животных «китайского зодиака». Шэнсяо. Институт Конфуция». 2015. № 2. С. 41-46.
2. Чжао Байяо. Шизэр шэнсяо мяньмянь гуань. (趙伯陶. 十二生肖面面觀. —濟南 : 濟魯書社, 2002). Всестороннее рассмотрение двенадцати зодиакальных знаков. Цзинань: Цзилу шушэ, 2000. 335 с.
3. <https://www.chinahighlights.ru/kakoy-god-kakogo-zhivotnogo/>
4. Сомкина Н.А. Двенадцатиричный цикл шэнсяо в контексте китайской культуры. 2015. С. 1-6.
5. Zhang Fang. Animal Symbolism of the Chinese Zodiac. Beijing, 1999. 158 p.
6. Готлиб О.М., Му Хуаин Китайско-русский фразеологический словарь. 2-е изд. М.: Издательство ИГУ, 2019. 596 с.

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THE INCREMENT OF ENTROPY IN THE HUMAN BODY

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In the light of results obtained during the last years, it appears that some of the tools of nonlinear dynamics, first developed for the physical sciences are well suited for studies of biological systems. We believe that, considering the level of order or complexity of the anatomical apparatus by measuring a physical quantity, which is the entropy, we can evaluate the health status or vice versa fragility of a biological system. The second law of Thermodynamics that is the entropy can be use to determine the different stages of the most dangerous diseases. Many laws proved that the pathological condition of patients can be analyzed based on thermodynamic equations.

Open system is characterized by fluxes of energy and matter order can arised as long as the entropy of surrounding and system increases [1]. The Carnot efficiency limits the rate at which entropy is produced by the heat flux in to the system as human body is open system [2, 3]. For the last 150 years there has been speculation that universal extremal principle determine what happen in nature [4–6] most prominent being maximum entropy production principle by Paltridge, Ziegler [7, 8]. Maximum entropy production explain different convection like Rayleigh Benard convection flow regimes in plasma physics the laminar turbulent flow with respect to blood vessel. Entropy deals with the randomness of system that is human body [9, 10-12].

$$\Delta S = \frac{\delta Q}{T}. \quad (1)$$

Here S is the entropy change. Q is the heat received by the body through various sources like sun, food, mechanical and T is the temperature of body.

However at the non-equilibrium steady state the time average rate of entropy change is zero $\frac{dS}{dt} = 0$.

And entropy production rate $\frac{dSi}{dt} = -\frac{dSe}{dt} \geq 0$ is positive with the second Law of Thermodynamics.

The human body is governed by various macroscopic variable molecules.

$$\Delta S \leq \Delta Si + \Delta Se. \quad (2)$$

Here the ‘Se’ is the external entropy the entropy received by our body through food. Looking from physiological point of view here we can say that if the external entropy increases then the internal functioning of the body will have no negative effect instead it will have only positive effect on the health of the patient. But if the internal entropy increases then the physiochemical environment can be disturbed of the human body that can be even more fatal.

This total internal energy is obtained from surrounding sources. In this only the kinetic energy can be converted to do work because the potential energy is stored in the body in the form of fats. There are various ways in which the internal entropy of the human body increases above normal which can be due to vigorous exercises heat produced in our body or the best explained by the shivering of body through the Sliding Filament Theory which tells that the two filaments that are actins and myosins present in our muscles starts sliding over each other hence producing heat. But when this sliding is due to abnormal condition due to some damage to the

Central Nervous System or due to some defect in the sensory or motor neurons.

Entropy change through blood pressure. Let us consider the human physiological system characterized by blood pressure (BP), heart rate(HR), skin temperature(ST). For this work done is given by

$$W = P \times dV = BP \times dHR, \quad (3)$$

where pressure is blood pressure(mmHg), V is volume and HR is the heart rate (beats per minutes). The heart rate is indirect measure of stroke volume of blood in the heart. Here heart rate is equal to stroke volume.

The partial derivative is approximated to form a modified Maxwell relation that is used in the present study to compute the physiological entropy change ΔS resulting from change in blood pressure (BP), heart rate (HR) and skin temperature (ΔT_{skin}) [10].

$$\Delta S(BP) = \frac{\Delta BP \times \Delta HR}{\Delta T_{skin}}. \quad (4)$$

In this equation the skin temperature (ΔT_{skin}) in the denominator acts as a temperature at the boundary of the thermodynamics system and provides the physiological reflection of emotional response to the surrounding. The deviation from the relaxed state may be positive or negative depending on the external factors.

Many result have proved the estimation of entropy generation during human lifespan. The main idea proposed by most of these investigation is that entropy can be related to aging through irreversible cell damage entropic aging or thermal denaturation which indicates structural changes with heat thereby affecting the normal functioning of cell. The studies also suggest that there is a limit of entropy generation that can be correlated to life span [13].

In principle life is supported by the energy provided by the nutrients. If we account for the entropy generated during the metabolism of said nutrients we potentially obtain a good approximation of the entropy generated by the process of supporting life. What is needed is an estimate of entropy production during metabolism including the effect of metabolic efficiency and the amount of energy required by an average human over lifespan.

Conclusion

Human disease corresponds to a non-stationary state with increased entropy reproduction. According to the mathematical theory of catastrophes, in acute diseases, it is necessary to move from a «bad» stable state to a «good» one. In this case, large doses of medications are used. In the phase of fading exacerbation of diseases, the role of small influences, such as acupuncture and homeopathic remedies, which have a positive effect, increases.

Entropy has its various uses in the field of medicine. It determines various factors related to the patient health:

- Various Physics laws are applicable in medicines. In drug molecule binding or the molecular

interaction entropy increases which sharp focuses on in a biomedical system drives the direction of all chemical reaction towards disorder. Therefore it is this phenomenon that determines how binds to its target. When the drug binds to the target receptor the internal entropy decreases that leads to the good health of patient.

- The next one of the most important application of the entropy is in the field of Oncology. As the entropy is a state function it depends only on the initial and final state of the system. Now taking human body as a system the tumors formed it is generally not determined. It is noticed at the last stage that we called as the malignant tumors. Malignant tumors have the ability to spread from its initial place to many body parts. This random increase in the tumor cells leads to increase in internal entropy thus fatal to the patient.

- Malaria now-a-days becoming sever problem in our society. Most common and dangerous malaria is caused by protozoan parasite Plasmodium. When they are in small amount they can be controlled through certain drugs bust once the number of malarial parasite the patient must be immediately shifted to Intensive Care Unit.

- Entropy related to the increase in the number of the sugar molecules in blood leads to diabetes mellitus. It is very fatal leading to atherosclerosis thus analyzing blood entropy shows us the normal condition of the patient health.

- Entropy generated is determined for the metabolism of typical components of human diet, total entropy generated is estimated through numerical integration of average population.

References

1. Schrodinger E. What is life? (Cambridge University Press, 1944).
2. Yoshida Z., Mahajan S.M. Maximum entropy production in self organized plasma boundary layer. A thermodynamics discussion about turbulent heat transport. Phys Plasmas (2008).
3. Kawazura Y. & Yoshida, Z comparison of entropy production rates in two different types of self- organized flows: Bernard convection and zonal flow.
4. Helmholtz H. Zur Theorie der stationaeren Strome in reibenden Flussigkeiten. Wiss. Abh 1,223-230 (1968).
5. Rayleigh L. On the motion of viscous fluid. Phil. Mag. 26, 776-786 (1913).
6. Onsager L. Reciprocal processes in reversible processes 1 & 2. Phys. Rev. 37, 405-426 & 38, 2265-2279 (1931).
7. Paltridge G.W. The steady- state format of global Climate. Quart. J. Royal Meteorol. Soc. 104, 927-945(1978).
8. Ziegler H. An Introduction to Thermomechanics (North- Holland Publ. Co., New York, 1977).
9. Whitfield J. Complex system: order out of chaos. Nature 436, 905-907(2005).
10. Lorenz R.D., Lunine J.I., Withers P.G. Titan, Mars and Earth: entropy production by latitudinal heat transport. Geophys. Res. Lett 28, 415-418 (2001).
11. del Jesus, M., Foti, R., Rinaldo, A. & Rodriguez-Iturbe, I. Maximum entropy production, carbon assimilation and the spatial organization of vegetation in river basins. Proc. Natl. Sci. USA 109, 20837-20841(2012).
12. Martyushev L.M. Some interesting consequences of the maximum entropy production principle. J Exp. Theor. Phys. 104, 651-654 (2007).
13. Aoki I. Entropy flow and entropy production in human body in basal condition. Journal of Theoretical Biology. 1989. vol. 141. no. 1. P. 11-21.