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As method for understanding the general state of human health

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Introduction

Currently the concept of aging can be described as a less individual capacity to deal new environmental stress situations. This reduced ability of continuous adaptations that manifests itself through a progressive deterioration of the control mechanisms which supervise the physiological functions that take place and interact at the sub-cellular, cellular and histological and organ level is the basic mechanism for transitioning to a state of less health. Therefore, the aging of an individual is usually a continuous collection of health problems that increases with a personal frequency.

The concept of frailty, in recent years, has found its place in the international community to describe the risk of compromised health status of an individual.[1,2] Frailty is not intended in itself as a disease state, but an increase in the risk of the realization of a disease, associated with alterations of the complex network of human physiological functions.

In this conceptual framework, frailty is not a disease sinsu stricto, but an intermediate position between a good functional state and a deteriorated state, or between a state of health and one of disease. Other authors[3–5] have imagined the individual fragility as number of deficits accumulated in the course of its existence.

In past years many scientists have believed that living systems, as also other fields of study, could be understood with a reductionist approach. Indeed, reductionism he obtained huge successes in recent decades in many other scientific disciplines, in particular, the idea was to analyze small parts of the entire biological systems, considered entirely too complex. But, despite the in-depth knowledge of subsets of the system under study, the full understanding of the biological system has not reached, and it is now clear that we must have an "integrated" point of view, a model to explain the whole phenomenon.

Other authors[6] have believed that it is possible a more precise approximation to the real state of health or aging of an individual, assessing the level of order or complexity of the anatomical apparatus through the evaluation of entropy.

Discussion

The aging process causes a continuous deterioration of control systems of the human body, which are present at different levels: molecular, cellular, organ and systemic. These control mechanisms govern the complex network of physiological functions.

The processes is continuous, and in this way the body responds immediately to any type of environmental stress through a process called oleodynamic,[7] introduced by Yates,[8] which aims to bring back the system to the normal state of homeostasis through the continuous interaction of several mechanisms of regulation and control,[9,10] Recently, several authors have proposed new concepts to describe the dynamics of physiological systems in order to predict future health states.[11–13] These concepts, are generally based on the use of methods used in physics in the field of nonlinear dynamics (chaos theory) and statistical physics and use the concept of fractals[14,15] to try to understand, quantify and model the aging of human body, seen as a variation of the complexity of physiological dynamics. In fact, it has been observed that different physiological processes (heart rate, anatomy of the respiratory tract, vascular system and the intricate network of the neurological system) have fractal properties (temporal and spatial) of self-similarity,[16,17] therefore, it's becoming clear that, is necessary to consider them as complex systems, and their development over time, cannot be fully understood without using new techniques.

A proper method to understand the complexity of a system is to measure entropy. This method is conceptually linked to the classical physics of a thermodynamic system and indicates the degree of overall order of the molecules that compose it.

Complex systems can give rise to collective behaviours, which are not simply the sum of their individual components[18] but involve any single units constantly interacting with their environment. The way in which this happens is still a mystery. Understanding the emergence of ordered behaviour of spatio-temporal patterns and adaptive functions appears to require global concepts and tools.

Beyond its common use, the physical meaning of the word chaos does not mean disorder or confusion. It indicates a specific system with dynamical behaviour. Today, several methods are available to characterize chaotic systems. An important physical quantity it's just entropy.

Entropy is a major thermodynamic quantity describing the amount of order in a system, and it supplies an important approach for the analysis of a system that evolves in the time which can be regarded as a source of information. From a microscopic point of view, the second law of thermodynamics tells us that a system tends to evolve towards a condition which has the largest number of accessible states compatible with the macroscopic conditions. Maximum entropy corresponds to the maximum number of possible microscopic positions (high fractal complexity).

In recent years, many researchers and clinicians investigating human aging seen as a loss of fractal complexity of anatomical structures and physiological processes, have used the concept of entropy to estimate changes in fractal complexity or irregularities in the dynamics of physiological systems.[19,20]

Recently other authors[21] believe that it's possible a more accurate calculation of the real state of health or frailty of an individual, assessing the level of order or complexity of biodynamic signals through the measurement of entropy set as variable within a Poisson

distribution. In this case the poisson distribution, which can predict the level of personal vulnerability, is considered a valid conceptual model to describe the evolution of the state of health of a particular organ or whole body.

Conclusion

In recent years, many research groups are trying to quantify the physiological signals of an individual, proposing new models to assess the complex dynamics of biological control systems. These new methods could improve overall understanding of the physiological system of the human organism, by adopting new models and experimental paradigms, such as those of fractality and entropy, who have the ability to direct from an organ medicine to a modern systemic medicine.

The conceptual hypothesis that links aging, frailty and disease, suggests new methods for identifying possible future health conditions in relation to biodynamic signals described as changes in the values of entropy. In fact, considering the level of order or complexity of the anatomical apparatus by measuring a physical quantity, which is the entropy, we could evaluate the health status or vice versa fragility of a biological system.

A relevant aspect is that such knowledge is early compared to those who can supply the traditional methods of clinical investigation.

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Conflict of interest

The authors declare that they have no conflict of interest.

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