

Nonlinear Whole Medicine, Extensive Quantum Medicine and Three Basic Origins of Disease

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Abstract

First, based on the inseparability and correlativity of human body, we propose the nonlinear whole medicine and its three hypotheses and mathematics. The propagation of COVID-19 is a typical nonlinear process with fractals and chaos. Next, based on human physiological indicators and the extensive quantum biology, we discuss the extensive quantum medicine. Further, from corresponding nonlinear equations and their solutions, we may obtain three basic origins of disease, and corresponding therapeutic methods may be applied to COVID-19.

Keywords: *Medicine; Nonlinearity; Quantum; Disease; Whole; COVID-19*

Introduction

It is known that one essential characteristic of life is its cooperative behaviors. Living cells show coherent global dynamics. Based on the inseparability and correlativity of the biological systems and their most basic features whole and nonlinearity, we proposed the nonlinear whole biology and four basic hypotheses [1,2]. This may unify reductionism and holism, structuralism and functionalism on biology.

The nonlinear whole biology is consistent with systems biology [3-5], which integrates multiple different levels in biological systems, from multiple molecules, cells, individuals, to populations, communities, ecosystems [6]. Furthermore, it may quantitatively simulate the biological structure and physiological function from gene, cell to whole organ and system [7]. The hypercycle proposed by Eigen is a typical and perfect theory of the nonlinear whole biology [8]. In this paper, we further discuss the nonlinear whole medicine, the extensive quantum medicine and three general methods of disease based on some nonlinear equations and apply them to COVID-19.

Nonlinear whole medicine and its basic hypotheses and mathematics

Based on the nonlinear whole biology and combining general nonlinear theory, we propose the nonlinear whole medicine.

According to modern medicine, the human body is mainly divided into the respiratory system, circulatory system, digestive system, urinary system, blood system, metabolic and endocrine system, nervous system and motor system. For these systems, we must introduce various nonlinear terms that may represent interactions in a system and among this system and other systems and consider the circumstance factors as the boundary or initial conditions. Combining various known theories, research in various respects of medicine may spread out at different levels. The fundamental thought is based on human structure and holism. Further, we propose the three basic hypotheses of the nonlinear whole medicine:

1. First hypothesis: Everyone as a whole is obvious, and various systems, tissues and organs are all holistic. Inseparability always exists among different parts and different levels of body, which determines the whole of medicine. It corresponds to the holistic medicine and traditional Chinese medicine.
2. Second hypothesis: Various systems, tissues and organs are closely related and must have nonlinear interactions. The totality and nonlinearity necessarily exist at different levels.
3. Third hypothesis: Body and any systems are open. They and total surroundings must be a whole and possess various nonlinear relations. It is related to human ecology. Furthermore, people and people, we and environment, man and animal, total human, people and nature are all unified whole.

Totality and nonlinearity are two basic characteristics of the body. Because of the complexity, inseparability, and correlativity of the body, their description must apply nonlinear theory. Every physiological system is a paragon. The whole appears not only in synthesis from a lower level to a higher level, but also in the unified complete structure and function of the body. Conversely, if there is not the totality, one and one molecule cannot become a living thing, one and one organ separated is not man. Faust and Bairy reviewed nonlinear analysis of physiological signals [9].

For the dynamic characteristics of the DNA double helix structure, Englander, *et al.* proposed the model of a spring-connected pendulum [10] and Yomosa proposed solitary excitation in deoxyribonucleic acid DNA double helices [11]. DNA molecular dynamics equations derived from both models can be transformed into Sine-Gordon equations:

$$A \frac{\partial^2 \varphi}{\partial t^2} - \frac{\partial^2 \varphi}{\partial z^2} + B \sin \varphi = 0 \quad (1)$$

These nonlinear soliton models successfully explain the functions of DNA, such as replication, transcription and recombination, etc.

The nonlinear whole medicine is described totally by nonlinear mathematics. For the nonlinear equations, we may sum up two large types:

1. An equation possesses the self-interaction or other nonlinear terms, for example, the nonlinear Duffing equation:

$$x'' + Ax' + x + Bx^3 = F \cos \Omega t \quad (2)$$

Which reflects coupling and oscillation of the neural networks in the brain model, the nonlinear hydrodynamic equation in the blood circulation system [12]. A simplified form of the differential equation of second order is:

$$x'' + \alpha x' + f(x) = 0 \quad (3)$$

Where $f(x)$ includes some nonlinear terms, e.g., Bx^3 etc.

2. A set of coupled equations. A simplified form of two elements is:

$$\begin{aligned} x' &= a_1 x + b_1 y + F_1(x, y) \\ y' &= a_2 x + b_2 y + F_2(x, y) \end{aligned} \quad (4)$$

Here, $F(x,y)$ are some coupled terms on x and y . For example, the equations of the Lotka-Volterra model in the population dynamics [13], etc. The equations of infectious diseases, which include the SIR model and SIS model [14,15], are all nonlinear equations:

$$\frac{dS}{dt} = -\beta IS, \frac{dI}{dt} = \beta IS - \gamma I, \frac{dR}{dt} = \gamma I \quad (5)$$

$$\text{and } \frac{dS}{dt} = -\beta IS + \gamma I, \frac{dI}{dt} = \beta IS - \gamma I \quad (6)$$

We researched fractals and chaos in biology [16]. The propagation of infectious diseases, especially COVID-19, is a typical nonlinear process in which fractals have self-similarity for large or small cities and for large or small countries, and the corresponding control methods are also similar. This process is from bifurcation to chaos or intermittent chaos. A simple equation with chaos is:

$$X_{n+1} = 1 - \lambda X_n^2. \quad (7)$$

Thus, we may estimate that if the diseased members in society attain 37.5%, a dangerous double periodic bifurcation will appear, and tend to quickly chaos point 0.70057759...=70% (Figure 1).

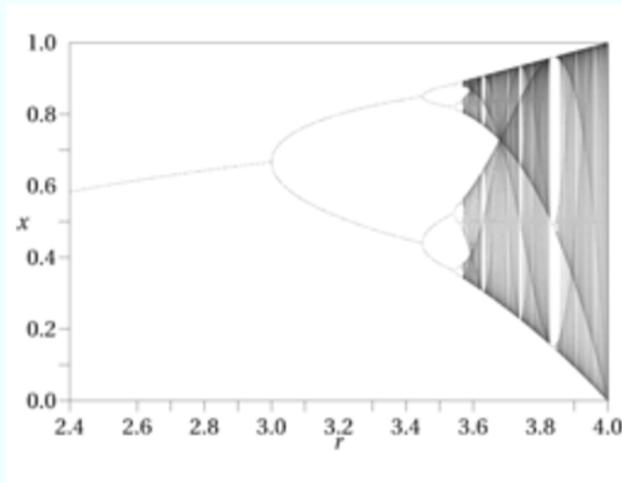


Figure 1: Bifurcation-chaos diagram.

The nonlinear whole medicine includes the nonlinear mathematical model of humoral immunity, rheology in the respiratory system [12], etc. In recent years, scientists have proposed that the structure of the lungs is one of the fractals, and it is already nonlinear.

Extensive quantum medicine and some nonlinear equations

Schrödinger tried to apply quantum medicine to biology in book *What Is Life* [17]. Quantum physics may use some principles such as non-locality, tangled hierarchy, and discontinuous leap in consciousness to better understand medicine.

Neurobiology applies widely to quantum theory, for example, the release of neurotransmitters is a quantum release, in which a vesicle is namely, a quantum. These form a new word: NeuroQuantology. From this, Pratt searched consciousness, causality and quantum physics [18]. Shan proposed a possible quantum basis of panpsychism [19]. Bernroider discussed quantum- neurodynamics and the relation to conscious experience [20]. Tarlaci researched quantum brain dynamics, general quantum neurodynamics, quantum field theory and consciousness, and discussed a historical view of the relation between quantum mechanics and the brain, assumed to be a quantum mechanical many-body system interacting with the macroscopic neuron system [21,22].

Tarlacı proved that we need quantum physics for cognitive neuroscience, and researched the probabilistic quantum thinking and obtained experimental results that are of basic significance in the fields of neuroscience and psychology [23,24]. Erol researched basics and concise relations between the Schrödinger wave equation and consciousness/mind [25]. Vimal systematically researched the subjective experience aspect of consciousness as an integration of classical, quantum and subquantum concepts for the emergence hypothesis and

discussed a theory of everything as an introduction of consciousness in the Schrödinger equation, standard model, loop quantum gravity and string theory and unification of experiences with fundamental forces [27-29]. Grandpierre., *et al.* proposed the universal principle of biology: determinism, quantum physics and spontaneity [30].

At present, quantum medicine is also applied to three fields: 1. Detection was performed using a quantum resonance spectrometer. 2. Applications in diagnosis, special examinations for tumors, cardiovascular diseases, viral infection, etc. 3. Applications in therapy, such as nasopharyngeal cancer and pancreatic cancer, and have acquired a certain therapeutic effect.

We proposed the extensive quantum theory [31,32] and its three laws: 1. Extensive quantum is its element in any system. 2. Its theory has similar quantum formulations with different quantum constants H. 3. Evolutions of systems may be continuous, but stable states are quantized [33]. From this, we discuss the extensive quantum medicine, and elements include various genes, cells, viruses, and people. It is known that the Heisenberg form of quantum mechanics is completely based on observable quantities. At present, various human physiological indicators are all observable quantities, so we may research the extensive Heisenberg equation:

$$\frac{dF}{dt} = \frac{\partial F}{\partial t} + \frac{1}{iH}(FE - EF) + J. \tag{8}$$

In quantum mechanics, F is the average of mechanical quantities, and E is the Hamilton-energy operator. In this form, various operators and actions are non-commutative. Further, we should search the physiological S-matrix theory in the quantum field.

Furthermore, we discuss some typical nonlinear equations related to quantum theory:

The nonlinear Schrödinger equation is:

$$i\hbar \frac{\partial \psi}{\partial t} + \frac{\hbar^2}{2m} \nabla^2 \psi + k |\psi|^2 \psi = U\psi. \tag{9}$$

Assuming that the potential U between the basic quantum of DNA is a simple linear potential U=Fr, and a nonlinear term k=0, we derived that the Schrödinger equation may become the Bessel equation, whose solutions are Bessel functions, which may form the double helical structure of DNA in three dimensional spaces [34,35].

The nonlinear Dirac equations are:

$$\gamma_\mu \partial_\mu \psi + m \psi - l_0^2 \psi (\psi^+ \psi) = J\psi. \tag{10}$$

It is the Heisenberg unified equation when m=0 [36]. The probability density $\rho = \psi^+ \psi = \overline{\psi} \gamma_4 \psi$ is the probability. According to the extensive quantum biology [32], it corresponds to the probability of illness. The probability of illness is $|\psi_2|^2$, the probability of health is $|\psi_1|^2$, the sum of both $|\psi_1|^2 + |\psi_2|^2 = 1$, which has unitarity. Therefore, ψ should be a complex function.

The equation of the Yang-Mills non-Abel gauge theory is:

$$D_\nu F_a^{\mu\nu} = D_\nu (\partial^\mu A_a^\nu - \partial^\nu A_a^\mu + GC_{abc} A_b^\mu A_c^\nu) = J_a^\mu. \tag{11}$$

Where C_{abc} are different structure constants of various gauge groups. This equation has derived various solutions: for instance, monopole solution, dyon solution, instanton solution, meron solution, vortex solution, dilaton solution and string solution, which may be related to biological string-brane theory [34,37], which may describe RNA, etc. Moreover, the Yang-Mills equation with the SU(2) group corresponds to Yin-Yang in traditional Chinese medicine.

It is known that the neurological system is a very complex nonlinear system. Many neurons construct neural networks (NNs), which are the origin of neural systems. Their models may be continuous or discrete. A connection model of artificial neural networks (ANNs) is figure 2.

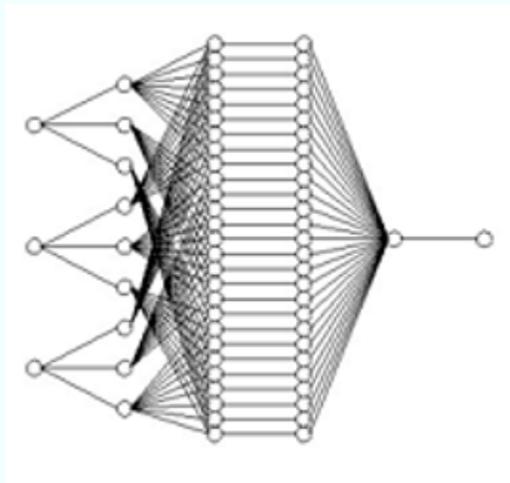


Figure 2: A connection model of ANNs.

Based on the extensive quantum biology, we proposed the biological lattice gauge theory as modeling of quantum neural networks. This method completely applies the same lattice theory in the quantum field, but whose two anomaly problems may just describe the double helical structure of DNA and violated chiral symmetry in biology. We discussed the model of neural networks (NNs) and quantum neural networks, which are related to biological loop quantum theory and researched some possible developments in the described methods of networks by the extensive graph theory and their new mathematical forms [38].

Three basic origins of disease and application to COVID-19

To date, wild COVID-19 continues to spread throughout the world, which is a sad result due to few hateful people. It not only has exceeded 200 countries and regions, but also endangers the whole human. This also forms current hot spot, which includes clinical features and epidemiology to genomic characterization and structures and probable origin, etc [39-43].

The above nonlinear equations are applied to medicine and obtain some general results, and each system-tissue disease may have three origins: 1). The disease of its own system corresponds to the main term of the equation, which is usually time-dependent, and may be derived from the smaller substratum, for instance, cell, gene, etc. 2). Various systems may have mutual interference, and interact with each other, which corresponds to nonlinear terms, and causes complications. 3). The effects of the environment correspond to J and U . They may be $J > 0$ on the external pathogenic viruses, etc., or $J < 0$ on therapeutic drugs and supplementary nutrients. If they are different, the solutions will also be different. Too much external force J can even lead to sudden death. $J = U = 0$ corresponds to the isolated system. Increased immunity and resistance can heal. These equations generally have periodic solutions, which correspond to biological rhythms.

From the view of the nonlinear whole medicine, the above classification of diseases possesses universality. The medical treatment methods for different diseases should possess some different characteristics. For example, external infections of the body should be separated from maleficent substances; diseases of internal infections make traditional medical treatments possess rationality and decrease in the randomness of occurrence of first diseases must be investigated with a smaller substratum.

Based on the loop quantum theory, we proposed a model of protein folding and lungs. In the model, we applied some known results and obtained four approximate conclusions: their structures are quantized, their space regions are finite, various singularities correspond to folding and crossed points, and different types of catastrophes exist [32].

The basic method of traditional Chinese medicine is diagnosis and treatment based on an overall analysis of the illness and the patient's condition. It is applied by the wholeness of the human body and the relevance of its parts. Rao and Jin researched the relationship between quantum medicine and the modernization of traditional Chinese medicine [44].

The pathogenic mechanism of COVID-19 is exogenous virus entering the body, quickly reproducing in the human cell system, seriously affecting the respiratory system and lung, causing damage to various organs, and finally life-threatening.

The diseases of the respiratory system are usually considered by two causes: 1) The lungs are invaded by maleficent substances from the outer side; 2) The diseases of other organs, such as the heart, liver, kidney and so on pass through the blood vessel-lymph systems to spread to the lungs.

To date, COVID-19 basic methods include home quarantine, which is cut off pathogenic viruses. Other reasonable diets and adequate nutrition, self-regulation and good spirits all increase physical fitness and immunity. Traditional Chinese medicine is treated with eliminating pathogens as the main focus, and strengthening vital Qi is auxiliary.

Modern medicine tends towards 4P medicine with predictive, preventive, personalized and participatory characteristics, which is closely related to traditional Chinese medicine.

Conclusion

Based on some basic theories on nonlinearity and quantum, we may obtain three basic origins of disease and are applied to COVID-19. The propagation of COVID-19 is a typical nonlinear process with fractals and chaos. A key of controlling COVID-19 prevents propagation from reaching an irreversible chaos point. This testifies that research on infectious diseases must apply the nonlinear whole medicine.

In a word, faced with wild COVID-19, we must apply various modern and traditional medicines widely, which will benefit the treatment of diseases.

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