



# Quantum Biology from Biomacromolecule to Cell, and Central Dogma Described by Quantum Theory

YF Chang\*

Department of Physics, Yunnan University, China

\*Corresponding author: Yi-Fang Chang, Department of Physics, Yunnan University, Kunming, 650091, China, Email: yfc50445@qq.com

Perspective

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## Abstract

First, based on the extensive quantum theory, quantum biology from biomacromolecule to cell is researched. The basic principle of quantum theory is quantization, while the biological and cellular basic principle is also one and one element in life system. Second, some quantum equations and spectrums are discussed. Third, we propose that quantum theory and their equations may describe the simplified central dogma in molecular biology. DNA is described by the Schrödinger equation of the 3D spatial component with the linear potential. RNA is simplified to a linear equation of time component. From DNA to RNA, i.e., from space to time is transcription. Proteins are Schrödinger equation adds the self-interaction and nonlinear term. Purines A-G and pyrimidines C-U-T are similar to diatomic and monatomic molecules. Fourth, cell aging, neural repair and new connections in neurons are studied. Fifth, some applications and predictions are searched.

**Keywords:** Biology; Quantum; Biomacromolecule; Cell; Central Dogma; Schrödinger Equation; Neuron; Evolution; New Connections

## Abbreviations

QED: Quantum Electrodynamics; QCD: Quantum Chromodynamics.

## Introduction

In 1944 Schrödinger [1] published a farsighted book about the concept of life. The book was devoted to the relations between physics and biology [1]. Life is based on physical laws, especially quantum laws. Cells are the fundamental units of life [2]. Cellular signal transduction is essentially a chemical reaction [3]. Protein folding is the lowest energy conformation.

Based on the inseparability and correlativity of the biological systems, we proposed the nonlinear whole

biology and four basic hypotheses. It may unify reductionism and holism, structuralism and functionalism. The loop quantum theory is applied to biology, and may form the model of protein folding and lungs [4]. In this paper, based on the extensive quantum theory, we research quantum biology from biomacromolecule to cell, and some quantum equations and spectrums. We propose that quantum theory may describe briefly the central dogma in molecular biology, and discuss some applications such as new connections in neurons.

## Quantum Biology from Biomacromolecule to Cell

Great physicist Feynman pointed out: "There are certain situations in which the peculiarities of quantum mechanics can come out in a special way on large scale." In a

special situation “quantum mechanics will produce its own characteristic effects on a large or ‘macroscopic’ scale” [5]. We proposed the extensive quantum theory [6] 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. Its mathematical base is fractal [7]. Using the geometric average method, three different values of the quantum constants of man, cell and macromolecule may be derived for biological, chemical and physical discrete systems with different scales. General quantum biology focuses on electrons in biology. In 2025 Nobel Prize in Physics three winner J Clarke, et al., affirmed the existence of macroscopic quantum effects.

Based on the extensive quantum theory, we proposed that energy and momentum are:

$$E = H\nu, P = H / \lambda \quad (1)$$

Assume that the wave function is:

$$\psi = A \exp\left(\frac{ip_{\mu}x_{\mu}}{H}\right) = A \exp\left[\frac{i(pr - Et)}{H}\right] \quad (2)$$

Such we obtain that the momentum-energy operators are:

$$p_{\alpha} = -iH \frac{\partial}{\partial x_{\alpha}}, E = iH \frac{\partial}{\partial t} \quad (3)$$

From  $E = \frac{p^2}{2m} + V$  we derived the extensive Schrödinger equation [6]:

$$iH \frac{\partial \psi}{\partial t} = -\frac{1}{2m} H^2 \nabla^2 \psi + V\psi \quad (4)$$

Its time-independent Schrödinger equation ( $H=1$ ) is:

$$\frac{d^2 \psi}{dr^2} + 2m(E - V)\psi = 0 \quad (5)$$

Biomathematics is the use of mathematical models to help understand phenomena in biology. We applied two new mathematical methods in biology, both are the simple joint relation of algebra in set theory, and the tree-field representation and the extensive Feynman diagrams in the graph theory. For the Cambrian life explosion originated from unicellular to bicellular to multicellular, we proposed that it can be explained by chaos. Based on the extensive quantum biology and the biological particles, we proposed the extensive quantum statistics of DNA and biology, and corresponding quantum equations, and discussed some new research of biology, such as the biological QED and QCD.

Various levels in the biological systems have all laws with randomness and statistics, for which the most similar physical theory will be general quantum theory [8].

Life can be defined as a unit with the chemical structures that can reproduce and evolve [9]. There are very similar structures in various forms of life. The basic principle of quantum theory is quantization, while the biological and cellular basic principle is also one and one element in life system. Genes of eukaryotes are mainly interrupted.

Molecular biology includes transcription, modification, translation, replication, repair, and recombination. Quantization may describe replication, repair, and growth. They simplify mergers in this case.

The size of the cell is about  $10^{-5} - 10^{-3}$ cm. The domain is a basic unit of protein structure [3]. We researched quantum systems and various extensions [6,7]:

- **Bohr Atom Model:** The Bohr radius is  $5.2917725 \times 10^{-11}$  m, the mass of proton is  $1.6726 \times 10^{-27}$  kg and the electron mass is  $0.910939 \times 10^{-27}$  g.
- **Solar System:** The average distance of sun-earth is  $1.495985 \times 10^{11}$  m, the solar mass is  $1.989 \times 10^{30}$  kg and the earth mass is  $5.977 \times 10^{27}$  g. The corresponding quantum constant  $H = (aGM_o)^{1/2} = 9.1317 \times 10^{14} \text{ m}^2/\text{sec}$ , here  $a=0.042$  for the terrestrial planets.

Both middle values are 2.8136m, which is about the height of a mankind house; 57.678kg, which is about human weight; and 2.3334g, which is about weight of the small thing around man in a house. Both ratio is about  $2.8270 \times 10^{21}$ , it is

a scale stridden across space.

Further, assume that the extensive quantum theory is suitable for man, cell and macromolecule.

- **Man System:** The quantum constant is:

$$\hbar_1 = H_1 m_1 = (HM_o \hbar)^{1/2} = 4.3764 \times 10^5 \text{ kgm}^2/\text{sec} \quad (6)$$

The mass of man is taken above 57.678kg, so

$$H_1 = 7.5876 \times 10^3 \text{ m}^2/\text{sec} \quad (7)$$

It agrees approximately with various characteristic values of man, and may be called a man quantum.

- **Cell System:** There is nucleus around which cytoplasm and chondriosome, etc., exist in a cell. If the cell quantum constant is  $\hbar_2$ , and  $\hbar_1/\hbar_2 = \hbar_2/\hbar$ ,

$$\hbar_2 = (\hbar_1 \hbar)^{1/2} = 6.7933 \times 10^{-8} \text{ gcm}^2 / \text{sec} \quad (8)$$

Such the space size will be

$$r_2 = (2.8136 \times 5.2918 \times 10^{-7})^{1/2} = 1.2202 \times 10^{-3} \text{ cm} \quad (9)$$

This corresponds to the scale of cell, while the size of usual cell is about. In this theory the masses will be,

$$(m_{man} m_p)^{1/2} = 3.1060 \times 10^{-10} \text{ g}, (m_{small} m_e)^{1/2} = 4.6103 \times 10^{-13} \text{ g} \quad (10)$$

Since cells are varied, the above values seem to correspond to the masses of some cell nucleus or chondriosome, etc. A usual cell nucleus is smaller along with ripening, conversely, they are larger.

- **Macromolecule System:** By a geometric average we derived a space size [7]:

$$r_3 = (1.2202 \times 5.2918 \times 10^{-12})^{1/2} = 2.5411 \times 10^{-6} \text{ cm} \quad (11)$$

Here the masses is  $2.2793 \times 10^{-17} \text{ g}$  and  $2.0493 \times 10^{-20} \text{ g}$ .

While length of myosin molecule is about  $4.9 \times 10^{-6} \text{ cm}$ ,

molecular masses of macromolecule for protein and nucleic acid, etc., are  $10^3 - 10^7$ , i.e.,  $10^{-21} - 10^{-17} \text{ g}$ . For instance, the

molecular masses are about  $10^6$  for rRNA, and are  $2 \times 10^4$  for

tRNA. The quantum constant of a macromolecule is

$$\hbar_3 = (\hbar_2 \hbar)^{1/2} = 8.4539 \times 10^{-18} \text{ gcm}^2 / \text{sec} \quad (12)$$

For cell and Biomacromolecule we may estimate and determine H.

## Some Quantum Equations and Their Spectrum

We propose that cell and biomacromolecule are simplified as the harmonic oscillator based on rotation invariance. Its potential is [10]:

$$V(r) = \frac{1}{2} Kr^2 \quad (13)$$

The quantum spectrum is:

$$E_n = H\nu(n + \frac{1}{2}), n=0,1,2,\dots \quad (14)$$

They can derive the quantization of cells. Cells exist as individual entities, not halves. But it might be that half of the DNA structure for forming new cells, or be RNA. This corresponds to vacuum energy.

In uniform magnetic field B its energy levels are [11]:

$$E_n = H\nu(n + \frac{1}{2}) + \frac{1}{2m} p_z^2 - \frac{\mu}{s} \sigma B \quad (15)$$

Here is magnetic moment of cell.

The model develops to the non-harmonic oscillator [11]:

$$V(r) = \frac{1}{2} Kx^2 + \alpha x^3 + \beta x^4 \quad (16)$$

Its energy levels are more complex.

Caffarel researched the analytic model for the energy spectrum of the anharmonic oscillator, whose potential is [12]:

$$V(r) = \frac{1}{2} \omega^2 x^2 + gx^{2n} \quad (17)$$

The excited state energies are:

$$E_n = E_0 + n\omega_g - P_{n_i} \quad (18)$$

Here the ground state energies are:

$$E_0 = \left[ \frac{\Gamma(5/4)}{\Gamma(3/4)} \right]^2 (1 - \log \sqrt{\frac{[2\Gamma(5/4)]^3}{\pi\Gamma(3/4)}}) g^{1/3} \quad (19)$$

We research a new sine-Schrödinger equation:

$$\psi_{xx} + i\psi_t - k \sin \psi = 0 \quad (20)$$

The Lagrangian density is:

$$L = \frac{i}{2} (\psi \psi^*_t - \psi_t^* \psi) + |\psi_x|^2 + k \cos \psi \quad (21)$$

Its stationary equation is:

$$\frac{d^2 \psi}{dx^2} = k \sin \psi \quad (22)$$

Integration once is:

$$\ln \operatorname{tg} \frac{\psi}{2} d\psi = kx dx + C \quad (23)$$

Integration again is:

$$\psi \ln \frac{\psi}{2} - \psi + \frac{\psi^3}{36} + \dots + \frac{(2^{2n-1} - 1) B_n}{2n(2n+1)!} \psi^{2n+1} + \dots = \frac{1}{2} kx^2 + Cx + c \quad (24)$$

Here  $B_n$  are Bernoulli's numbers. When  $\psi < 1$ , we may

omit the higher order terms, and derive:

$$\psi \ln \frac{\psi}{2} - \psi \approx \frac{1}{2} kx^2 + Cx + c \quad (25)$$

For general (4), let  $\eta = \gamma(x - u)$ , so

$$\psi_{\eta\eta} - i(u/\gamma)\psi_{\eta} - (k/\gamma^2) \sin \psi = 0 \quad (26)$$

Moreover, Eq (20) may become to:

$$\psi_{xx} + i\psi_t - A \operatorname{tg} \psi = 0 \quad (27)$$

We propose an equation:

$$\frac{d^2 \psi}{dx^2} = \pm k' \sin^2 \psi \quad (28)$$

Integration once is:

$$-ctg\psi d\psi = \pm k' x dx + C \quad (29)$$

Integration again is:

$$-\ln \sin \psi = \pm \left(\frac{1}{2} k' x^2 + Cx + c\right) \quad (30)$$

Its solution is:

$$\psi = \arcsin \exp[\mp(k' x^2 / 2 + Cx + c)] \quad (31)$$

This is a multivalued function. When  $C=c=0$ , let  $x = -\infty$ ,

$$\psi = 0 ; x = 0 ; e^0 = 1 ; \psi = \pi/2.$$

In electromagnetic field the extensive Schrödinger equation is:

$$iH \frac{\partial \psi}{\partial t} = \left[ \frac{1}{2m} (-iH\nabla - \frac{q}{c} A)^2 + q\phi \right] \psi \quad (32)$$

Energy levels are still Eq (14). This will predict cell behaviour in electromagnetic and magnetic fields.

In Eq.(4) V may be [10]: 1).  $V(r) = V_0 \left(\frac{a}{r} - \frac{r}{a}\right)^2$ . 2) The

center potential of logarithms  $V(r) = V_0 \ln\left(\frac{r}{r_0}\right)$ , its energy

level is independent of the mass of the particle, and in this case it is independent of the cell type [2,3]. 3) For  $V(r) = \gamma\delta(r)$

, so  $E_n = E_0 n^2$  [10]. 4). Periodicity  $V = A \sin \phi$ , and

corresponds to the sine-Gordon equation. It may describe various biological periods, including cell generation cycle, function cycles and meridian flow, etc.

The nonlinear Schrödinger equation is:

$$iH \frac{\partial \psi}{\partial t} + \frac{1}{2} H^2 \Delta \psi + \frac{2m}{H^2} E\psi + k |\psi|^2 \psi = 0 \quad (33)$$

It is already applied to six aspects. Its soliton solution is [13]:

$$\psi = \psi_0 \sec h[\sqrt{k/2}\psi_0(x - u_e t)] \exp[i(u_e/2)(x - u_e t)] \quad (34)$$

The time-independent equation (5) is similar to the Sine-Gordon equation:

$$\psi_{\eta\eta} = A \sin \psi \quad (35)$$

Its soliton solution is:

$$\psi = 4 \text{Arctg}(e^{\pm\eta}) \quad (36)$$

It is related to the self-induced transparency, etc. But, the time-independent state cannot form wave.

Davydov described the soliton model of the vibrational

energy transported along the biological macromolecules by the nonlinear Schrödinger equation [14]:

$$i\psi_t + J\psi_{xx} + G\psi^3 - A\psi = 0 \quad (37)$$

The known neural conduction may use Davydov soliton and its extension. Neural transmission is a soliton of the nonlinear equations [14]. Lee, et al., researched also the nontopological soliton.

In cells the main elements are hydrogen H, carbon C, nitrogen N, oxygen O (n=1,6,7,8).

**Common Characteristics of Cells:** 1. The most important material is DNA. 2. Metabolism, controlled by enzymes, manifests as a chemical potential V. It is probably free energy in quantum theory.

### Central Dogma Described by Quantum Theory

The molecular biology has the central dogma: DNA→RNA→Protein is the general progression in all life forms. We propose that quantum theory and their equations may describe the simplified central dogma.

DNA is an important basis of molecular biology [15]. The model of DNA is well-known double helical structure. Based on the extensive quantum biology [16], we assumed that A-T and G-C are the basic quantum of DNA, or assume nucleic acid has five types of base quantum: A, T, G, C and U, therefore, we proposed the extensive quantum theory of DNA [17-19]. Let basic quantum elements of DNA are A-T and G-C, such the Schrödinger equation of space component with the linear potential is:

$$\frac{d^2\psi}{dr^2} + 2m(E - Fr)\psi = 0 \quad (38)$$

This potential may be the origin of gravity [20]. Such Eq (38) may become a Bessel equation:

$$\frac{d^2\psi}{dz^2} + \frac{1}{z} \frac{d\psi}{dz} + \left(1 - \frac{v^2}{z^2}\right)\psi = 0 \quad (39)$$

Its solutions are Bessel functions, and may form the double helical structure of DNA in three dimensional spaces. Schrödinger equation at column coordinates and its solution may also derive the double helical structure of DNA [19].

Since purines and pyrimidines are mutually exclusive, and purines and pyrimidines are mutually exclusive, both of which are similar to fermions. The purine and pyrimidine are complementary, and mutual attractive and creates DNA [8]. DNA and RNA seem be two different types of bosons.

For a charged q oscillator under the action of a uniform electric field E, its potential is [10]:

$$V(r) = \frac{1}{2}Kr^2 - qEr \quad (40)$$

Equation may become to Bessel equation with 1/3 order [10]:

$$\frac{d^2\psi}{dz^2} + \frac{1}{z} \frac{d\psi}{dz} + \left(1 - \frac{(1/3)^2}{z^2}\right)\psi = 0 \quad (41)$$

The corresponding levels are:

$$E_n = H\nu\left(n + \frac{1}{2}\right) - \frac{q^2 E^2}{2m\nu^2} \quad (42)$$

DNA is three-dimensional in column coordinates, and splitting into two distinct states that exhibit two distinct cycles. RNA is two-dimensional plan, and merges transcription into one cycle. DNA and RNA have very small molecular difference, but both have very different functions in the cell. DNA is missing an oxygen on the 2' carbon of each sugar than RNA. It corresponds to both transform.

Assume that the quantum equation (4) of time component for RNA is simplified:

$$iH \frac{d\psi}{dt} = 0 \quad (43)$$

Its solution is the simplest linear strand function. This may describe the microfilament of the gene as a polypeptide bond.

From complex DNA described by the Schrödinger equation to simpler RNA is bigger transcription. From RNA to DNA is smaller reverse transcription. RNA is used as an intermediate copy of the DNA to be used for making proteins. RNA forms strands of varying lengths. The bases in RNA are adenine, guanine, cytosine, and uracil, in which uracil replaces thymine in DNA. RNA structure is Figure 1.

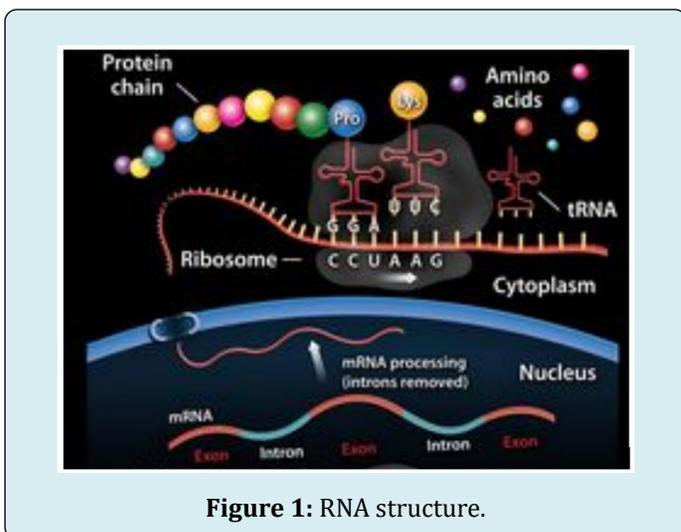


Figure 1: RNA structure.

DNA with stability and RNA correspond to BEC, and RNA may form proteins. Proteins are polymers of small molecules

amino acids. The twenty amino acids are quantum of proteins. Amino acids are joined to each other by combining the amino end of one with the carboxyl end of another. Peptide bond joins two amino acids, and is quite strong and rigid, and does not allow rotation [21]. The ends of a protein have the N-terminus with positive charge and the C-terminus with negative charge. Both attract each other. It corresponds to electric field and its equation.

Proteins are dynamic, and their structures are not frozen in place. Just as it is inaccurate to think of proteins as having a very fixed structure, it is also unrealistic to think of them as having a fixed place [21]. Its place, structure and function can all change. This may correspond to the uncertainty principle, only H is bigger. Its lock-and-key model is the same with my mathematical way [22]. The protein conformations have been investigated [14,15]. Amino acids molecule structure is Figure 2.

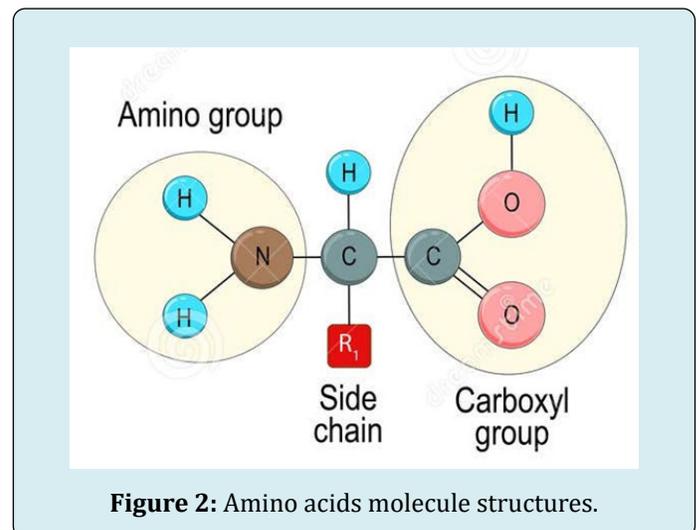


Figure 2: Amino acids molecule structures.

DNA and RNA may be the same Schrödinger equation (4). They are respectively:

- DNA is the spatial component Eq.(38), represented by 3-dimensional column coordinates. DNA has stability as genetic material, and is ease of repair and replication.
- RNA is the one-dimensional time component of Eq.(40). RNA has changeability and variability, and may be evolutions, mutations, recombinations, translation and form proteins.
- From DNA to RNA, i.e., from space to time is namely transcription. Hybrid between DNA and RNA may be the unified space and time. RNA and DNA can form base pairs, U in RNA replaces T in DNA.
- The nonlinear term of self-interactions is introduced into the time equation governing the transition from RNA to proteins. Promoters control the rate of transcription.

The time equation in Eq.(4) may become the logistic equation:

$$\frac{d\psi}{dt} = a\psi - \psi^2 \quad (43)$$

Its solution is:

$$\psi = \frac{a}{1 + c \exp(-at)} \quad (44)$$

When  $t \rightarrow \infty$ ,  $\psi = a$ . It is a soliton of  $\Gamma$ -form. This

corresponds to increasing limit in natural resources, etc. Termination corresponds to the boundary conditions, such as resources. In this case the reproduction of protein will self stop.

The nonlinear Schrödinger equation (33) may become an equation [23]:

$$x' = \sqrt{a} \sin x \quad (45)$$

It has the chaos solution.

The simplest difference equation with the chaos solution is:

$$X_{n+1} = 1 - \mu X_n^2 \quad (46)$$

It is already applied in neurobiology [24]. Here a bifurcation-chaos region  $2 \geq \mu \geq 0, x \in [-1, 1]$  corresponds to

$\infty \geq \mu^{-1/2} \geq 1/\sqrt{2} = 0.7071\dots$  For single stable solution

$0.75 \geq \mu_0 \geq 0$ , i.e.,  $\infty \geq \mu_0^{-1/2} \geq 1.154$ , so the condition on

$|x| < \mu^{-1/2}$  is satisfied necessarily in the region, the soliton

can exist. While for two-branch region,  $1.25 \geq \mu_1 \geq 0.75$ , i.e.,

$1.154 \geq \mu_1^{1/2} \geq 0.894$ ; for a region from four-branches to

chaos,  $1.401152 \geq \mu \geq 1.25$ , i.e.,  $0.894 \geq \mu^{-1/2} \geq 0.845$ . Since

$|x| \leq 1$ , the necessary condition in which the soliton appears

is  $\mu \leq 1$ , it corresponds to the region of single solution and a

part of two-branch region. For the rest  $|x| < \mu^{1/2}$  does not hold

generally. Chaos corresponds to the condition of no boundary, and will form cancer.

In biology quantum may be different genes, twenty amino acids, 64 codons, proteins and the hundreds of different cell types, etc., which are increasing, and the corresponding biological phenomena are becoming more and more complex. DNA and RNA are the same level, and H is

the same. Proteins have different levels, H also varies.

RNA and DNA may hybridize. It corresponds to both equations and potentials may transition. The linear potential may originate from a gravitational field [20] and a uniform electric field. In the extensive quantum theory complex numbers are introduced, with two basis sets, i.e., 1 and  $i$ , correspond to x-y, and DNA-RNA, etc. It is developed to x-y-z...n dimensions. invariance corresponds to the energy conservation.

Pyrimidines are hexagons, and consist of one ring with two nitrogen atoms and four carbon atoms. Purines with two rings are hexagons plus a pentagon (Figure 3).

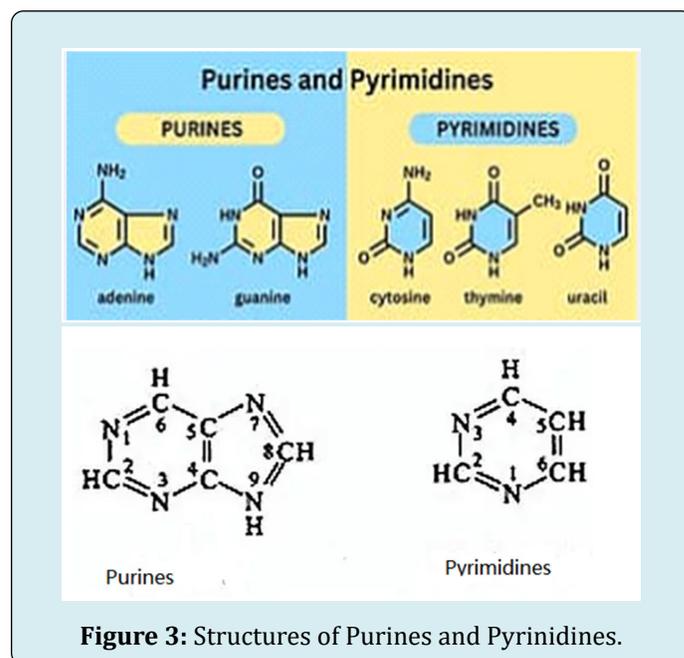


Figure 3: Structures of Purines and Pyrimidines.

We proposed the extensive quantum statistics of DNA and biology, and corresponding quantum equations [8]. Biological macromolecules are mainly divided into two categories: proteins and nucleic acids. DNA is double-stranded, and RNA is single-stranded. The two major biological molecules, purine A-G and pyrimidine C-U-T, are similar to diatomic and monatomic molecules [25].

The two major biological molecules, purines A-G and pyrimidines C-U-T are similar to diatomic and monatomic molecules. The diatomic equation is [10]:

$$\left(-\frac{1}{2M_1} H^2 \nabla^2 - \frac{1}{2M_2} H^2 \nabla^2 + VR\right)\psi = E_i \psi \quad (47)$$

Its energy levels are:

$$E_{nL} = V + \left(n + \frac{1}{2}\right) H\nu + \frac{L(L+1)}{2J} \quad (48)$$

It may be derived from the vibration-rotation model of

biconcavity molecules.

A single atom lies between a potential well  $V(x) = \begin{cases} -V_0, (|x| < a/2) \\ 0, (|x| > a/2) \end{cases}$  and a central force field as Coulomb

$$\text{potential } V = -\frac{eQ}{r}.$$

Both energy levels are respectively:

$$E_n = -V_0 + \frac{H^2 \pi^2}{2ma^2} n^2 \quad (49)$$

$$\text{and } E_n = -\frac{m(eQ)^2}{2H^2 n^2} \quad (50)$$

Here  $a = H^2 / meQ$  is an extensive Bohr radius. The same energy level is obtained for the hydrogen atom. The energy level of single atom should be between both.

The linear potential may originate from a gravitational field [20] and a uniform electric field. The linear center potential  $V(r) = Fr$  may describe quarkonium, which corresponds to two bodies and diatomic molecule. The two major biological molecules are purine A-G and pyrimidine C-U-T, which are similar to diatomic and monatomic molecules [8].

In the molecular interactions of protein folding the most important covalent bonding, hydrogen bonding, ionic bonding and VdW forces are all electromagnetic interactions of different types and levels.

Proteins determine most cellular activity. Life must be stable, and have some capacity for change and be able to be copied [21].

Secondary structures of protein are helix or sheet. We assume that both are respectively quantum spring and loop quantum gravity, and may correspond to two Feynman diagrams in quantum field theory and their extension [26]. Probably, helix and sheet are similar to DNA and RNA, and both quantum equations.

## Cell Aging, Neural Repair and New Connections

Von Neumann clearly outlined two types of wave function evolution: the instantaneous, discontinuous collapse process and the continuous evolution process governed by the Schrödinger equation [27].

Cell aging may be quantum energy dissipation and collapse of wave packet. Cell regeneration involves evolution,

repair, reorganization, and transformation.

We try to describe cell aging and regeneration by the extensive quantum theory [6-8]. In 1929 Heisenberg introduced the collapse of the wave packet into quantum theory. Then it is searched by many Nobel Prize winners, which include Heisenberg (winner 1932), Dirac (1933), Fermi (1938), Pauli (1945) and Wigner (1963).

Nakhmanson [28] studied systematically wave packet and its collapse [28]. Luo researched from quantum cloning to wave-packet collapse [29]. Dick shown that inelastic scattering in a short-range potential leads to a collapse of the wave function within standard evolution through the Schrödinger equation [30].

Alberts B, et al. [2] discussed cell signaling. Cell communication corresponds to quantum entanglement. Endocrine systems can even transmit signals remotely, affecting the entire organism. This microcosm of the human body may enable the study of telepathy.

Neural pulses are electrochemical phenomena that maintain both intensity and waveform integrity during transmission [31]. Solitons exemplify this characteristic.

Assume that cell is a wave packet as harmonic oscillator, so cell aging corresponds to the wave packet collapse [10].

But, after a period of time, the shape of the wave packet may be revival or partial revival, i.e., it is namely cell regeneration. Specially, the ground state wave function of cell as a harmonic oscillator is a Gauss-type wave packet:

$$\psi = \exp(-a^2 x^2 / 2) \quad (51)$$

Its waveform is constantly changing. At the same time, the wave packet of coherent state remains unchanged. We should research the coherent state on harmonic oscillator and cell, which may correspond to the coupled harmonic oscillators and coupled cells. Cell regeneration involves evolution, repair, reorganization, and transformation.

If cell as wave packet is developed to soliton, equation (4) will be nonlinear, such as the nonlinear Schrödinger equation (33). Increasing training is manifested as continuous neural pulse, and forms nonlinear equations and corresponding soliton solutions, which facilitate the formation of new neuronal pathways.

In the summers from 2012 to 2017, we had trained fifty-two blind children in Kunming by combining science and Chinese traditional Qigong adopting the method of guiding blind children to attain a quiet and focused state. Then, it was found these trained blind children could develop some

## Some Applications and Predictions

special functions [32,33]. In this process, we noticed the synchronization which is a combination of telepathy and resonance. A blind child, X.N. Jin was particularly prominent.

He not only accurately recognized dozens of poker points and colors on a Kraft paper envelope, but identified all cards, accurately pointing out single-sided graphics, and even double-sided multi-color graphics. Sometimes, he could even conduct PK successfully. Furthermore, on 6 August 2019, the research team witnessed X. N. Jin see the infrared light using his hidden “eyes” [34,35]. The whole process was conducted using scientific instruments to explicitly confirm that his vision had elevated and was sensitive to the infrared spectrum.

Based on these training results and modern neurobiology, we proposed a testable scientific hypothesis: The neural excitable cell is continuously induced and excited, then grow out new synapse and dendrite, so the feeling system, hearing system, smell system, etc., may joint to visual system, and form a new neural network, and achieve finally a transformation among vision and other sensations. Further, we proposed some possible tests, for example, scientists may train the blinded animals (such as mouse), then dissect their brain, and compare their different functions and different results. And these results may compare with those animals lack some sense organs. If this hypothesis is validated, it will bring benefit to mankind, in particular, disability, and may build a bridge between modern medicine and parapsychology, and between science and religion [36,37].

Further, based on the nonlinear whole biology and Lorenz mode1 of brain, we vividly described the general complementary of left and right brain functions, and researched development of neural networks in the brain, in this process the death of some neurons and cells will lead to the loss of certain functions. Such we may compare the differences between children and adults, and can identify these neurons and corresponding functions. We discussed blind vision and brain plasticity. Cattaneo, et al., study blind vision that is a great work. We searched transformations among vision and other sensations, and possible tests. We researched neural network and quantum neuroscience in interdisciplinary studies. Neurobiology, as a frontier of scientific development, not only has many problems to be solved, but also can greatly improve the conditions for human survival [38].

We should develop neural networks in the brain, in this process the death of some neurons and cells will lead to the loss of certain functions. Such we may compare the differences between children and adults, and can identify these neurons and corresponding functions.

The basic principle of quantum theory is quantization; the biological and cellular basic principle is also one and one element in life system.

The uncertainty principle in biology evolved into Bohr’s biological complementarity [10]. Identical particles correspond to approximately identical biologic quantum and cells. The identical particle replacement group corresponds to the Yin-Yang and Five-Elements replacement group in Traditional Chinese medicine. The statistical associations between nucleotides are short-range, which are some internal interactions in biological systems.

According to the uncertainty principle, a wave packet has the uncertainty:

$$\Delta x \Delta p = H / 2 = \Delta t \Delta E \quad (52)$$

The larger  $\Delta E$  is, the smaller  $\Delta p$  and  $\Delta t$  become. This predicts that at the same H, the larger the cell, the shorter its lifespan and the slower its growth rate. Cancer cells are particularly large. Probably, the value of H may vary depending on the type of cell. According to the Bohr correspondence principle, this seems be the same with everyday knowledge.

For wave packet, the group velocity  $v_g = \frac{d\omega}{dk} < c$ ; the

phase velocity  $v_p = \frac{\omega}{k} > c$ , which may explain the mutual

interactions between cells and cellular nonlocality.

The forces between molecules classify strong or weak in strength, but both are all electromagnetic interactions. These correspond to stable and variable processes respectively and are similar phenomena in nuclear systems.

The basic principles of various medical instruments, such as CT imaging is that X-rays can penetrate the human body for scanning, and then be converted into electrical signals, which are converted into digital signals by analog/digital converters and input into computers for processing.

The basis of nuclear magnetic resonance is the resonance transition between Zeeman energy levels caused by radio frequency electromagnetic field in the nucleus of biological macromolecules under a constant magnetic field. These are specific applications of known quantum effects in electromagnetic fields for cells and biomacromolecules.

### Quantum mechanics has many solutions. If the model holds, we can predict:

- The spatial direction corresponding (40) will be:

$$\frac{d^2\psi}{dr^2} = 0 \quad (53)$$

Its solution is  $\psi = ar^2 + br + c$ .

- Positive and negative regulations, the operon and the repressor correspond to two opposite quantum jumps. We will research the extensive Quantum Electrodynamics (QED) and Quantum Chromodynamics (QCD) in biology and cellular systems. Further, we predict that there may even be biological lasers similar to lasers.
- The energy levels of cells in an electric field. In quantum mechanics there are normal and abnormal Zeeman effects, which split into  $3(n)$  in a strong magnetic field. This basis is that cells are charged and polar. This leads to predictions about cellular behavior in electromagnetic and magnetic fields. More generally, we must investigate the cellular spectroscopy and biophotonics.
- EEG and MEG reflect the synchronous activity of a large number of cortical pyramidal cells. By new bio-instruments MEG, TES, DBS and optogenetics we can even directly identify new pathways that the visual system may form.
- It is known that biomolecule and cell have vibration and rotation. The energy levels (48) should describe approximately both movements.
- Macromolecules have torsional vibrations.

Chemistry has ionic bonds and covalent bonds. We must study how to use them in cells and organisms. There are polar cells and non-polar cells. They may correspond to fermions and bosons.

All natural proteins are composed of left-handed amino acids. The 20 amino acids represent the 20 quantum of biomacromolecules. One consequence of evolution or generalization should be the diversity of biological quanta. Ultimately result is in distinct individuals and celestial bodies.

J.C. Eccles used the quantum uncertainty principle to even get the body-mind duality.

### Summary

Quantum theory is the foundation of the whole physics and the structures of matter, and should and must be the foundation of biology and its structures. Since quantum theory has rich mathematical and physical contents, so it not only may be applied to many biologic regions, and theory may be corrected and developed, for example, the extensive superstring should be able to use the quantum biology [17].

It will certainly be applied in more important and extensive aspects.

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