Article title: Bio-inertia resonates life into evolution

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Introduction

Our planet Earth formed into around 4.54 billions of years ago¹, and life originated on it approximately 3.5–3.8 billion years ago². Physical evidence has been found in biogenic graphite in 3.7 billion-year-old metasedimentary rocks from southwestern Greenland³ and microbial mat fossils found in 3.48 billion-year-old sandstone from Western Australia⁴. Evolutionary processes and adaptations result in immense biodiversity in the geological era. Existing patterns of the biosphere have been fluctuating by both speciation and extinction. More than 99% of all species that ever lived on Earth had been extinct⁵. Estimates of Earth's current species range from 10-14 million, of which only about 1.2 million have been documented and over 86 percent have not yet been described⁶.

For the driving forces of evolution, natural selection theory of *Charles Darwin* is the only conventionally acknowledged “official” cause of adaptation. It was first published in his book *On the Origin of Species* (1859) in mid-19th century⁷. However, this theory is still a "self-evident" theory⁸ since the precise mechanisms of reproductive heritability and the origin of new traits remained a mystery. E.g. some of the papers such as neural theory⁹ have noticed that the strength of inner molecular changes was much more powerful than those of the selection theory required, albeit it still didn't know how to “select” such “inner molecular variations”. Also, modern epigenetics in recent decade increasingly resulted in “acquired traits”¹⁰, despite it is still unknown whether these acquired traits could have degenerated into inheritable sequences. Modern genetics still fails to offer a single piece of experiment or even theoretical clue for an evolution “favorable mutation”. (Suppl.ExpL.1)

On the other hand, experimental studies for the origin of life were also vigorously performed in modern time. Two early experimental milestones of abiogenesis should be Louis Pasteur's swan flask experiments which challenge the “spontaneous generation”¹¹ and Miller's experiment¹² that simulated the primitive atmosphere to generate bio ingredients. Later, synthetic biology continuously attracts attention; however, only occasional reports, obstacles similar to above (acquired) genetic modifications of life functions are still obstinately standing. Meanwhile, the origin of life remains a great mystery, for it is much more challenging than that of the origin of new (inheritable) traits. Here we will modulate these “origins” from the physical aspects of life.

“Le Châtelier's effect” and physical definition of life

Le Châtelier's Principle states:

When any system at equilibrium for a long period of time is subjected to change in concentration, temperature, volume, or pressure, the position of equilibrium moves to counteract the change till a new equilibrium is established.

This principle came for *in vitro* artificially purified few-component individual reaction for more than one century and difficult to be utilized for multi-reaction systems. For a single reaction:

Then $K_c = \frac{[C][D]}{[A][B]^2}$ (K_c: concentration constant, similarly there are K_p, K_T, K_V, etc.) (2)

Here constant K represents the equilibrium (or stationary) state under certain environmental conditions, once the condition shifts constant K will shift. Not just environmental shift, under the same environmental condition, if products and wastes don't remove out promptly, the constant K could also be shifted. If we put one hundred single reactions together and wish each one still keeps their original efficiency, one major jinx need to resolve: there should be available one compromised constant K for all the reactions to assure the efficiencies, also products and wastes need to remove automatically to keep the stability of this constant K. Here "automatic" means all the "removing" processes are driving by synchronized inner physical factors. As in Eq. 2, physical factors such as K_p, K_T, K_V, etc., "automatically" steer the chemical factor K_c to follow the principle and also remove the wastes. We can write:

suppose $C_{qi1}K_{qi1} + C_{qi2}K_{qi2} + \dots + C_{qi(n)}K_{qi(n)} = C_{qj1}K_{qj1} + C_{qj2}K_{qj2} + \dots + C_{qj(m)}K_{qj(m)}$ (3)

then $K_{process} = \frac{K_{qj1}^{C_{qj1}} K_{qj2}^{C_{qj2}} \dots K_{qj(n)}^{C_{qj(n)}}}{K_{qi1}^{C_{qi1}} K_{qi2}^{C_{qi2}} \dots K_{qi(m)}^{C_{qi(m)}}}$ (*ik, jk*:subscript; C^{qik} , C^{qjk} :copy number) (4)

Eq. 3 represents the bundles of single reactions we put together. "qi, qj" is the subscript of K_{process}, K_{qik} and K_{qjk} represent constant K_(s) for certain reactions which could express as Eq.2. Human chemical engineering nowadays still can't integrate reactions into such a higher level; therefore, for a human interfered process, we can just roughly use a "→" to describes Eq. 3. Only for bio-systems "→" become "=" and we can also get Eq.4. Due to constant K is the integration of certain environmental conditions, it needs unifying reaction condition for functioning; such a unifying condition is *in vivo* condition. It is why in a real-world biological *in vivo* processes are all multi-reactions with complex matrix ingredients and a lot of compartments, reticulum, membranes, tissues, etc., are come into reactions. And also synthesis and removing of products and wastes are

synchronized quite well. All these are evolved to resolve the above jinx. In an ideal condition, no intermediate wastes accumulated. Eq. 4 represents an effective equation for an ideal bio-system. (Here the ideal condition means organisms are at a young state. In that state Eq. 4 works well, it only retrograde due to senility or disease and never from species. For some of the cross-species conditions such as symbiosis, it is still effective.) This conclusion is not only effective for chemical parameters but also effective for all relevant governing physical parameters. (All K_P , K_T , K_V in Eq.2 are physical parameters. Actually, from the very beginning until today, chemical engineering includes physical parameters: reaction surface, speed, extract products, etc. Possibly due to the reactions in bio-systems were much more complex to consider physical factors, biologists began to “habitually” forget physics. In a real condition, these two disciplines are inseparable even for non-living beings.) Empirically frog sciatic nerve experiment and Human patellar reflexes demonstrate Le Châtelier’s physical effect. These snapshot experiments show Le Châtelier’s reaction units of bio-process. For accumulated or growth Le Châtelier’s effects, (**Suppl.Movie.1.0**) and its explanations (**Suppl.ExpL.2**) gives historical evidence. For those who are not accessible to such ancient systems, (**Suppl. Exp. 1-5**) offered equivalent modern scientific empirical evidence.

From these verifications, we can define that life is a “Le Châtelier’s system”, the potential of a living system to issue “Le Châtelier’s effect” to its discernable environmental signals is bio-inertia. (The statement “at equilibrium for a long period” mean by the major part of the system has attained to an environmental signal–maximum–entanglement-state, any change will induce the system to maintain the *status quo* and counteract the change, this state can also call “stationary state”).

Peoples in (**Suppl. Movie 1.0**) got “level one” ancient physical training, thus could resist much stronger strike than that of untrained people. However, such resistance still can’t change the constant K. (A constant K for a certain process or the entire body is bound with a lot of parameters. As in (**Fig.1a**), such training can only make a curve B of untrained people becomes curve A, increases uptrend length of the curve and also make retrograde (downtrend) more symmetry with uptrend part.) The uptrend length of the curve is the constant K effective binding or stability. That means under similar k range; trained people can resist outside strikes more powerful than those of untrained people. (Resist means not damage the recovering capacity of the place gets hitting and not induces bruise or any other kind of hurt on the surface or deep tissues, after beating these tissues could still be recovered. Or in other words, no chemical, physical or biological wastes are accumulated, or even

help remove the old wastes.) More effective binding means the physical strike momentum can be distributed well; therefore, the strikes to a single distributor minimized, the people can resist more powerful strikes.

Le Châtelier's effect equals to the Principle of Least Action. The latter remains the center of modern physics; being applied in diverse divisions includes the Theory of Relativity, quantum mechanics and the string theory. Hamilton's principle is one of its versions; it defines action $\mathcal{S}$ as:

$$\mathcal{S} = \int_{t_1}^{t_2} L(\mathbf{q}, \dot{\mathbf{q}}, t) dt \quad \text{then } \delta\mathcal{S} = 0, (L(\mathbf{q}, \dot{\mathbf{q}}, t): \text{Lagrangian, } \mathbf{q}: \text{generalized coordinates}) \quad (5)$$

From Eq. 5 that “action” should be least, combined with Eq.4 we then can get:

$$\delta K = 0 \text{ (or infinitesimal, oscillate nearby 0 with narrow range is defined as “infinitesimal”) } \quad (6)$$

$$\text{or } \Delta\left(\frac{K_{pj1}^{C_{pj1}}}{K_{pi1}^{C_{pi1}}}\right) \Delta\left(\frac{K_{pj2}^{C_{pj2}}}{K_{pi2}^{C_{pi2}}}\right) \dots \dots \Delta\left(\frac{K_{pj(n)}^{C_{pj(n)}}}{K_{pi(m)}^{C_{pi(m)}}}\right) \geq \Delta K, \left(\text{any item: } \Delta\left(\frac{K_{pj(n)}^{C_{pj(n)}}}{K_{pi(m)}^{C_{pi(m)}}}\right) \geq \Delta K; 1 \text{ to } m, n\right) \quad (7)$$

Eq. 6 or 7 is the biological version of the Principle of Least Action (can also be written as “least squares” version). It means that the younger or higher bio-inertia state of the bio-system, the smaller of the difference between left and right hand part of this equation. As in (**Fig.1a**) for a time point or a short period of time, the constant K still keeps the same (or changes in an infinitesimal value) while certain internal parameter(s) are changed greatly. (We can roughly estimate the probability of δK shifting, in the binding if only 1 of n parameters is changed for a certain amount, the chance of δK change is $P_{\delta K} = 1/(n!-1)$, if n is large such probability is quite small. Even if all n parameters have changed, $P_{\delta K} = n/[(n-1)!-n] = 1/[(n-1)!-1]$, still quite small if copy numbers of each parameter are quite lower than the “n”. From here, constant K is a good measurement to follow the Principle of Least Action.) Only in a relatively long period or even whole lifespan, we can then observe the curve of (**Fig.1a**). The tolerant range of δK change is quite narrow, at the start point and the highest point of (**Fig.1a**), δK only differ an infinitesimal amount. And break such an infinitesimal amount is enough to make K turning to retrograde or system malfunction. (Due to binding this curve is a “smooth discrete curve” and not a continuous curve. From this curve, not only physical strikes but also other interferences such as deliveries of certain genes, stem cells, RNA, etc., are all following the equation. All the parameters are equivalently binding by constant K. Don't misunderstand to think that a gene or any other modern deliveries will be more powerful than those of ancient physical deliveries. All of them are equivalently regulated by the Principle of Least Action,

and physical parameters govern chemical or biological parameters. (Technologically, delivered genes on site are still continuously modified by physical forces. Immunological vaccines can only modify “adaptive immunity” and can never change “innate immunity” or constant K . Even “adaptive immunity” needs a tight δK difference for functioning. Immunogenicity does need substantial binding to function even within the discipline of immunology. Senility is a process to divert the δK difference at old ages, which means K stability decreased.) Evolution is a similar process that binds constant K or accumulates binding for Eq.4; just period extended to the geological era. (**Fig.1b**) refers to holistic constant K for a series of species. An evolution from one species to another means the initial slope of the curve is improved. (Only “infinitesimal” slope lifting can happen between two closely related species. Estimates of Earth's species range from 10-14 million⁶, that means if they all fall between 0 to 90 degree in the I Quadrant of the figure, then average one degree roughly needs to occupy by 0.1 million species (include extant and those extinct). So we only draw a few curves to represent such 10-14 million species. For how one species can lift constant K slope and evolve to another species we still can back to (**Fig.1a**). Suppose some factors extend the uptrend curve such as curve B becomes curve A in (**Fig.1a**). The difference can show as the “training improvement” segment in the figure. This segment not necessarily meant by physical training, any input factors are equally following the same principle. It just means new factor(s) have been binding into curve A and get Le Châtelier’s regulation to extend the curve. If this difference is small, then the new binding can’t be written into an inheritable carrier. However, while “training improvement” reaches a certain threshold, then the offspring will have a lifted slope of the curve. Such lifted slope is just a short peak, as in the figure’ miniature at the up left corner of (**Fig.1a**). A’ is extended from B’, and in the start region of A’ there is a small “short slope upgrade” peak. (In the figure’ all the connections should be smooth curves and the above peak should be very slight; we just exaggerated the peak for viewing.) Only when such “short slope upgrade” reaches population level and also be extended to the whole curve B’ (means the highest point of “short slop upgrade” is near or over the highest point of B’), then a new species will exist. The whole process is still following the Principle of Least Action. Every species on Earth is definitely complying with this principle. Generally, new binding needs a geological time to degenerate into inheritable structures.

We can get these curves are still because that evolutionary process follows the Principle of Least Action. (In physics, a lot of famous equations are derived from the Principle of Least Action. It has

been regarded as an axiom for centuries which can't be inferred from other physical laws. However, in bio-systems, it is very different. We can take Le Châtelier's Principle as an axiom and derive the Principle of Least Action: Due to the whole system counteracts to certain change then this change has to fall into the "least" effect on the system. It is unsure whether Le Châtelier's Principle is more general than that of the Principle of Least Action in our universe since it is not limited to bio-systems. However, it is much sure that within bio-systems it is "father axiom" and the profound causes of the Principle of Least Action.) For holistic constant $K_{(s)}$ of a species such as in (**Fig.1a**), it can bind a lot of parameters such as physical, chemical, biological and even social factors. Conventional gene(s) only contribute a small fraction to K due to the binding. Different types of parameters still must follow the same principle. Generally, most of the interferences such as physical strikes, DNA transfer, RNA injections or cell therapy, etc., can't change K ($\delta K = 0$ or infinitesimal) in short terms. However, once one of the combinations can lift K "observable value" in the long term by increasing copy numbers or bio quantum path entanglement, all the bindings will be then changed to follow the Principle of Least Action pattern. E.g. the physical training in (**Fig.1a**) which makes curve B becomes curve A; will then equally make all other bindings such as DNA, RNA, epigenetic modifications, cells, etc., follow such changes under certain environmental conditions. This time substantial environmental signals have joined the binding to assure previous constant K . And "symmetrical shift" is vital in preventing senility problems such as cancer. (Modern medical sciences try to find the molecular mechanisms of cancer. However, cancer is generally not an inheritable disease and most of the molecular reports about cancer are unrepeatable. We still can't get an animal tumor model directly from knocking in or knocking out certain oncogene(s). Embryonic stage interference will induce a lot of malformations which are still not cancer since they can't metastasis. Go back to Eq. 3 we could know what happened. At the embryonic stage, bio-inertia is relatively higher. Following Le Châtelier's regulation, artificially forced knock-in or Knock-out will make the whole system counteract such change(s). Part or all of the bindings will be peeled off functions to maintain the constant K . Such out of tolerating range deprive of functions for diverse bindings will then result in malformations. They are just physical malformations originated from system higher bio-inertia compromise to intolerable man-made interferences and not tumors. In contrast, cancers of distinct subtypes within an organ are usually found to be derived from quite different cells of origin far outside the organ. These prove that cancers are of physical origin and molecular factors only

contribute to a small fraction of the reasons. The real cause of cancer is that bio-systems can't afford two different sets of constant $K_{(s)}$ working at the same time (forked curve in the figure, the real cause of metastasis). Now we can understand that embryonic stage interference induced malformations, no matter how horrifying, are still under the regulation of one set of constant k , therefore are not cancers. Thus in (**Fig.1a**) we state that cancer is induced by the asymmetric detaching of constant k binding at old age. As in the figure, constant K detachment at old age is an unavoidable process and "asymmetric detaching" will easily induce two or more different constant $K_{(s)}$ work simultaneously at downtrend curve. The only way to deal with cancer is to make constant K detaching process becomes more symmetric. (Such symmetry at least means the parameter detaching sequence equals the parameter binding sequence.) For symmetric retrograde of constant K , a proper ancient physical strike system is veritably the simplest and the most effective way in the human history of all time.

From the physical definition of life, here we need to emphasize that life is never endowed by the things we usually see, such as DNA, RNA, and cells, etc. It comes from the recovering capacity or the constant K bindings of abovementioned structures instead of the structures themselves. (E.g. While an outside DNA sequence inserted into a genome, the whole genome or at least the active region correlated with this sequence will then counteract its change. After counteraction the change made by this sequence to the whole genome to a minimum or equivalently its distribution to the whole genome attains the maximum, then it is activating. It is such a responsive recovering capacity or Le Châtelier's effect of it that indeed endows life instead of any sequence. Once such responsive recovering capacity is diminished to some degree by senility or other reasons, life will end no matter what kind of sequences are residing on the genome. It is recovering capacity governs gene functions and not in a reverse way, such as gene sequences can fully decide functions, etc. Not only DNA, all other known biostructures & bio units such as cells, tissues, etc., are governed by this law. We can call it recovering law of bio-systems. "Recover" means under the same constant K binding take inner parameters as the axis to acquire environmental parameters to partially compensate for K stability.)

Binding of gravity

Newtonian law of universal gravitation under nonrelativistic conditions is:

$$F = G \frac{mM}{r^2} \quad (\text{Gravitational constant } G = 6.674 \times 10^{-11} \cdot \text{m}^3 \cdot \text{kg}^{-1} \cdot \text{s}^{-2}) \quad (8)$$

Einstein's modifications can be understood by calculation of the curvatures of a photon (light quantum), an apple (100g, diameter = 10 cm) and the moon ($M=7.3477 \times 10^{22}$ kg, $r=1,737.10$ km):

$$\text{Curvature}_{\text{photon}} = \frac{E}{r^2 c^2} = \frac{h \nu}{r^2 c^2} \quad (9)$$

(Planck constant $h=6.626 \times 10^{-34}$ J·s; ν , c , are frequency and speed of light)

$$\text{Curvature}_{\text{apple}} = G \frac{M_{\text{earth}} m_{\text{apple}}}{r^2} = \text{constant} \cdot \frac{m_{\text{apple}}}{r^2} \quad (10)$$

For Eq.9 we roughly take $r = \text{wavelength } \lambda$, (the wavelength of visible light is 400-760nm), the result is around 10^{-22} , this value is so small to impact nearby space-time, we can then get the first principle for theory of relative: The speed of light in a vacuum was independent of the motion of all observers. For Eq.10, G and M_{earth} are fixed number, we can simplify as $K = G \cdot M_{\text{earth}}$, then:

$$\text{Curvature}_{\text{apple}} = K \cdot m_{\text{apple}} / r^2 = K \cdot 10 \text{ kg} \cdot \text{m}^{-2}, \text{ similarly, } \text{Curvature}_{\text{moon}} = K \cdot 2.4 \times 10^{12} \text{ kg} \cdot \text{m}^{-2}$$

The curvature induced by an apple and even by the moon is not enough to change the results of the application of the Newtonian system on Earth due to the lower mass distribution density. Therefore, the denotation of (8) is Newtonian mechanics; denotation of (9) and (10) is Einstein's Theory of Relativity. However, (**Suppl.Exp.6-8**) demonstrate that the gravity of living organisms are quite different from the value when it is dead, the range is 0.14% - 3.8%, which is challenging to be explained by the above two systems. (In Cavendish or later modified methods for non-living being G measurement, the affinity forces on the device are only 10^{-11} of the weight of the attracting balls. Therefore, it can only perform by world-famous experimental physicists with highly sensitive Cavendish torsion balance. However, once such differences increased from 10^{-11} to 0.14% - 3.8% of the measuring weight in bio-systems, that means gravity enlarged to 10^9 (median calculation). Then just a common people with a cheap balance and lower level experimental skills can perform quite well, no need to consider some error factors such as air buoyancy and air disturbance, etc.) In Eq. 8, M , m , and r remain almost the same, therefore such "gravitational loss" should come from the shifting of G . Einstein has developed his field equation to modulate the G to: $\kappa = \frac{8\pi}{c^4} G$, however, this way still far beyond so large discrepancy on same existence with same space curvature and lower speed conditions can include. If G of nonliving things are correctly described by the Newtonian and Einstein's theories on the different empirical conditions, the G shifting in bio-system should come from the constant K binding of gravity, Eq. 8 can then be modified as:

$$F = K^N \cdot G \frac{mM}{r^2} = G_{bio} \frac{mM}{r^2} = K_{bio}^N \cdot mg \quad (\text{N: copy number}) \quad (11)$$

Eq. 11 can only be used for estimating the gravity shifting between a living being and Earth, it can't be used for measuring the affinity between two living beings since the inertia mass is quite different from the gravitational mass and has fallen into complex non-linear relationships. For nonliving beings, inertia mass equals to gravitational mass is the foundation of modern physics. It has been “validated” by Eötvös and other experiments, and till today at 10^{-12} precision, these two masses are identical. However, the Eötvös experiment and free-fall verification have a hidden premise to get conventional results. Once the hidden premise is broken, even for non-living beings the result will tend to the bio-system conclusion (**Suppl.ExpL 3**). The most convenient way to verify inertia mass VS gravitational mass relationships is still the derivative designs of (**Suppl.Exp.6-7**). The significance of Eq. 11 is not just for such validation; we possibly can monitor *in vivo* gravitational waves for real biological applications. From Eq. 11, whether a transferred gene inside an animal is inheritable will be decided by the gravitational loss of the whole body it induced. (While previously referring to “training improvement” in (**Fig.1a**), we roughly say when that extended curve reaches a certain level, it could be inheritable. Now we can say that “gravitational loss induced by it to the whole system reaches a certain threshold” then it can be inheritable.)

Another concept “time dilation” (a difference in the elapsed time measured by two observers) is also from Einstein's Theory of Special Relativity: $T = T_0 / (1 - V^2/C^2)^{1/2}$ (C, speed of light; V, speed of an object). Some people are always misunderstanding to regard this equation as proof that the highest speed in our universe is from light; nothing can exceed this speed. Logically no theory with human knowledge can be qualified for such kind of “proof”. It only says that “the speed of light in the vacuum is independent of observers”, therefore it can utilize such “independent speed” to establish a reference system. (In the future, if there is a speed higher than that of light could be presented, just some modifications following the Principle of Relative are enough since the speed of light is yet the most reliable reference at the present technological level.) However, light speed reference is only effective for a system which Le Châtelier's effect not present or can neglect. (Michelson-Morley Experiment and the way modern physics deals with this experiment can be interpreted as there is no Le Châtelier's effect to be taken into account while a beam of light passes a space. Any changes made by this beam of light pass through space can be independently measured

by all the parameters induced by it, and all of them are absolutely “measurable”. However, in bio-systems due to Le Châtelier’s constant K binding or Eq.4, the speed of light can’t simultaneously act as references for all commuting parameters. Once it can refer well for some parameters induced by it, then it will definitely refer with system enlarged errors for other commuting parameters. This means that “observation” or “observers” are no longer absolutely “available”. Theory of Relative tries to create an unbiased reference for all observers. It can work well for an observable system and will become reluctance once all “observers” are not equally available.) However, in the latter condition we still can estimate time dilation in bio-systems as:

$$T = \frac{T_0}{\sqrt{1 - \frac{R^2}{R_0^2}}} = \frac{T_0}{\sqrt{1 - \frac{A^2}{A_0^2}}} \quad (12)$$

R and R_0 are “recovering radii” for which Le Châtelier’s effect can be presented in certain degrees. A and A_0 are “oscillation amplitudes” which we’ll refer to later. Beyond a series of Le Châtelier’s radii or oscillation amplitude, the system will be retrograded into nonliving systems and follow their empirical rules.

Binding of nonliving “conservative forces” on bio quantum path and the sustaining of bio curved space

Time and space in a Newtonian system “never concern with anything inside space”. In Einstein’s system, time and space began to concern with each other and with mass density distribution and energy. Is there any bio curved space presented? What is the fundamental origin of the “recovering capacity” we mentioned before? Let’s start with a case:

In the geometric diagram of (**Fig.1c**), path A is the circumference of a circle, path B is a wave-shaped curve along the same circumference (bottom left is a real device; here not show the side rail or concave for holding a ball running inside it). One ball with same energy run through path A and path B, which way could be faster and save time? Common sense believes that path B need to go through many crests and troughs or includes much longer running distance than that of path A, with same energy path A should save time. However, we can watch (**Suppl. Movie 3**), path B does save time than path A. (This design actually comes from a mathematical problem in Newton’s times known as “brachistochrone curve” which put forward by Johann Bernoulli. At that time, many famous people included Newton and Leibniz had joined the challenge and got the results. Bernoulli

himself took the Fermat Principle which was the earliest version of the Principle of Least Action for a solution. Now we connect many brachistochrone curves to get a wave-shaped curve as path B. It is actually not limited to brachistochrone curves, any kind of smooth curve will work to save time for this physical experiment. Just those composed of brachistochrone curve segments can save a little bit more time than other shapes.) (**Fig.1d**) is the analysis of the difference between path A and path B by Newtonian mechanics, if we offer a same horizontal slight F_0 (F_0 can't be large enough to make ball jump on path B) to the balls on path A and path B. The ball on the path A has to depend on this ephemeral promotion F_0 to move forward. However, for the ball on path B, besides this same promotion F_0 , it still gets a force $mg \cdot \sin\theta$ comes from gravity to drive the ball moves forward: $dF_{forward} = F_0 + mg \cdot \sin\theta$. (In the figure, θ is the angle between the perpendicular line from the ball to its contact surface and vertical gravity. This angle starts from 0° at the highest point X_0 and gradually increase to the maximum and then gradually back to 0° at the lowest point Y_0 .) While the ball falls down to Y_0 it has stored gravitational potential energy $mg \cdot h$ and can go back to the next highest point X_1 if there is no energy loss such as frictions. This process continuously recovers and then drives the ball on the path B. If we consider friction, the region which friction slowing down the movement of the ball can be defined as “friction counteracting region”. In the (**Fig.1d**) for one period, suppose the corresponding points of path A X'_0 and X'_1 equivalent to path B's high points: X_0 and X_1 . Then the entire distance from X'_0 to X'_1 on path A are “friction counteracting region” represented by red color. However, the “friction regions” on path B are the only small red color region in front of the X_0 , X_1 . Therefore for path A the promotion force F_0 (or primary momentum) need to overcome the frictions in the whole path A. F_0 (or primary momentum) on path B only need to overcome the frictions in the small red color region due to the help of gravity. This is why we can directly watch a ball on path B is running faster and saving time than the one on path A in the movie. (In physics, gravity is a “conservative force” while friction is a non-conservative force. A conservative force can be defined as $W \equiv \oint_C \vec{F} \cdot d\vec{r} = 0$, which the total work done in moving a particle between two points is independent of the taken path. Life function or evolution can depend on path B or its derivatives to strengthen and collect conservative forces and weakening non-conservative forces and then maintaining the system; we call this process “splicing”.

For the shape of curve B, it can be diverse wave-like shapes just symmetrical can then assure

the above process. In physics, a simple harmonic motion is a type of periodic motion or oscillation motion where the restoring force is directly proportional to the displacement and acts in the direction opposite to that of displacement. This path can be then projecting on coordinates and get a simple harmonic motion on each dimension of x, y, z under ideal conditions. (Left of **(Fig.1e)** demonstrates how a uniform circular motion vector $\vec{A}$ projecting on x, y-plane to get simple harmonic motion $A_x(t)$ and $A_y(t)$. If an orthogonal z-dimensional simple harmonic motion $S_z(t)$ is resonating into then can get path B. Right of **(Fig.1e)** demonstrates how this happens in a 3D sphere. Resonating here means the projections of two rotation vectors on the same axis become equal: $A_x(t) = S_x(t)$.) The environmental signal which keeps the same vector independent of system movement and is also discernible by the system is defined as a sustaining signal. (Like the gravity $m\vec{g}$ in the above case, keeps the same vector no matter how the ball is moving in the system scale. Here “discern” means Le Châtelier’s effect can be happening, path A can’t discern this signal and path B can.) In **(Fig.1e)** Z dimension is the sustaining signal direction. (We use the terminology “signal” to replace “force”, just due to constant K binding in non-isolated systems.) Then path B can be defined as “bio quantum path”. (The primary sustaining signal on Earth is only gravity. Series of “bio quantum paths” share same sustaining signal then evolved into earlier life. Later sunlight, water pressure, and organic materials etc., join in and then create many derivative sustaining signals. With the progressing of evolution, all the *in vivo* movements refer to a certain part or the whole system which independent of the movement of this part or the whole system is sustaining signals. Like a blood flow or a bone structure in the bottom of **(Fig.1c)**, every such region of a blood vessel can be modulating by it. The quiddity of bio quantum path is a kind of very general strengthening & weakening effect. As we see in the figure, flat path A can’t splice out friction, path B splice out friction by strengthening & weakening effect sustaining by gravity.) Bio quantum path can write from projections as:

$$\begin{cases} x = A_x \cos(\omega t + \varphi_x) \\ y = A_y \cos(\omega t + \varphi_y) \\ z = S_z \cos(\omega_z t + \varphi_z) \end{cases} \quad (13)$$

Mathematically Eq. 13 is an ellipsoid which every section is an ellipse or circle if $\omega = \omega_z$, no matter how A, S, and φ are changing. (This is possibly the reason why eggs are ellipsoid in shape since bio-inertia are maxima.) **(Suppl.Exp.9-12)** are some general experiments for this model.

We define “bio quantum path” instead of “bio force” for the above model for a few reasons.

First is that not only physical forces but also any other signals (memory is a kind of signal transferring, it follows the same Eq. 13 with the forces we move our hands & legs just with different “splicing” number.) fall into above “path” (partially or totally) will get an equivalent effect: “recovering capability”. (A Newtonian force which has been described by his three laws of motion can be written as a vector $\vec{F}$. The “recovering capability” of such a vector $\vec{F}$ is quite lower. If it is superimposed with any other vector force $\vec{F}'$, it will easily be changed either on direction or quantity or both direction and quantity by parallelogram law. However, for a resonating force on a bio quantum path, the superposition result of it with a vector force is still a bio quantum path (refer to **Fig.1d**). Sometimes there is even no detectable shift in A, ω in Eq. 12 since the vector forces are not just superposed with bio quantum path we see, it actually needs to superpose with large resonating structures which issuing the bio quantum paths. If a resonating force meets with another resonated force or a wave series, the result still keeps a bio quantum path pattern even if something such as interference or diffraction is happening. “Keeps the similar pattern” means the “recovering capability” of the resonating force or signal is issuing.) Now we can understand that for offspring, they not only need biomaterials from parents but also need these inherited materials to possess enough bio-inertia or oscillation frequencies. Swimming of spermatozoa in the biological kingdom is due to the physical oscillation requirement of reproduction processes. The second reason we can see some properties of forces or signals which have been integrated on bio quantum paths. Newtonian vector forces are usually separated from inertia. $\vec{F} = m \cdot d\vec{v}/dt$, m decide inertia and $\vec{F}$ can’t influence on inertia without acting on a mass. (For something like a photon which is massless, vector force generally can’t influence inertia.) However, in bio-systems all the mass are normalized, a big cell or a small cell, or even a tissue possesses the same normalized mass; therefore, *in vivo* momentum can be issuing by force without the involvement of a mass. (The Newtonian mass concept has been replaced by a “structural concept” (bio quantum path) in bio-systems. Like Newtonian forces can’t be separated from mass to issue works, “bio forces” still can’t be separated from the structure or bio quantum path to issue functions.) As the case we mentioned before, the momentum of a wooden rod hit on the certain part of the human body can be written as $p = mv$, once this momentum enters into deep tissues, it is then distributed by $p_i = n \frac{h}{\lambda}$ for the *in vivo* part. (The latter equation is

generally only applied for atoms and subatomic particles (0.3 - 3 Å) scale; bio-systems are quite special, can apply it on a macrocosmic *in vivo* scale.) Third, we also note that the “conservative forces” or signals in bio-systems are slightly different from that in physics. In physics, conservative forces only refer to the path VS work done and seems never involved with mass or can be separated from the mass. In bio-systems, conservative forces become sustaining signals, bio quantum paths (structures) and can no longer be separated. This is why bio-systems can fix so much gravity. We should also understand that no matter Newtonian or Einstein’s theory, gravity is quite difficult to make a bundle of research targets to demonstrate Le Châtelier’s correlation, even if they can follow the Principle of Least Action, still can’t show Le Châtelier’s effect to respond to outside signals. However, once gravity is bound into bio quantum paths *in vivo*, each structure is then unexceptionally endowed with Le Châtelier’s effect. Therefore, in physics gravity is a conservative force without any Le Châtelier’s effect. In bio-systems it is the origin of conservative forces (bio quantum paths) and Le Châtelier’s effects. Primary sustaining signal or “conservative force” gravity on Earth always takes roughly the same vertical direction; however, “secondary” sustaining signal or “conservative forces” in bio-systems can shift to diverse other courses. Also, biomaterials running on it will not unlimitedly “independent of the path taken” and always leaves some infinitesimal amount; with senility the “splicing out resistance capability” or tolerance for “infinitesimal leftover” from bio quantum paths will gradually decrease; however, still follow the principle of least action to get a lower δk even while losing binding. Life in generation can’t be eternal just due to this reason since “splicing” can only splice out resistance to the infinitesimal amount instead of “0”.

However, on the other hand, bio quantum still path can be called “bio perpetual motion path”. “Perpetual motion machine of the second kind” seeks to continuously acquire energy from certain sources. Since this path is conceptually and realistically most close to the motivation of “perpetual motion machine of the second kind” and life does depend on it for collecting and transforming sustaining signal, we can call it “bio perpetual motion path”. (In thermodynamics, Clausius Inequality is written as $\oint \frac{\delta Q}{T} \leq 0$, only for a reversible condition $\oint \frac{\delta Q}{T} = 0$. Some people then take this inequality to deny the possibility of perpetual motion since among all the designs the irreversible processes are unavoidable. However, this inequality is acquired from an isolated system. Bio-systems are actually open systems. All the living beings we see are real natural “perpetual motion systems”.

Generation to generation, biosphere can be regarded as “eternal”; therefore, eternal life concept not necessarily depend on “ $\oint \frac{\delta Q}{T} = 0$ ”, alternative “ $\oint \frac{\delta Q}{T} = \text{infinitesimal}$ ” still works well.)

In the (**Suppl. Movie 3**) experiment, due to the procuring of a sustaining signal, the ball runs on a curved path B will save time and runs faster than that runs on a Euclidean geometric shortest path A. This is actually the concept of curved space. However, such bio “curved space” is different from that of mass distribution curvature and energy space. It depends on “sustaining signal” for “curved” and “splicing” characteristics. (Einstein ring or Einstein lensing effect is an astronomical phenomenon while light pass through a large celestial body will be bent. The angle of the bent is: $\theta = \frac{4GM}{rc^2} = 2 \frac{r_s}{r}$, G, M, c, and r_s are Newtonian gravitational constant, mass, the speed of light and Schwarzschild radius. It is published by 1936 and till 1980 get first verification. Now if we take the light pass through the edge of an animal body or observe the cells under a microscope, we still can visualize a similar effect by adjusting the angle and strength of light. However, such effect in bio-systems is less likely to be induced by mass distribution, albeit life has bound 10^9 levels of gravity. The z dimensional signals from diverse bio quantum paths contribute substantially. This is why bio curved space which upholds by sustaining signals is different from Einstein’s curved space that upholds by mass distribution and energy. In Einstein’s curved space, gravity can be neutralized. In a bio curved space, all biological functions are based on 10^9 levels of gravitational binding, quite difficult to be neutralized unless the whole system is damaged.)

In physics and other disciplines, the law of conservation of energy is generally accepted for an isolated system or “isolable research targets”. However, bio-systems are absolutely non-isolated systems, this law becomes different. Back to (**Fig. 1d**) we can see, path A is a conventional energy conservation model which agreed by all systems, running a ball on a plane, the primary momentum mv_0 is gradually damping down by friction over time t. Diverse physical equations can be written down for such conservation. However, for path B things become complicated. If the system is regarded as an isolated system such as using a black box to cover path A or path B, energy is no longer conservative due to the participation of gravity which outside the system. It is easier to engineer a ball running on path B attains as 50 times of distance as that of a ball running on path A with the same conditions. If we want to take “isolable research target” method to compromise the case into the conventional law of conservation of energy, it is still not easy since the forces and bio

quantum path are functionary inseparable. Here the case just one bio quantum path, in bio-systems all the forces and signals can only be transferred by diverse bio quantum paths. Energy conservative discrepancy will be much larger than in the figure. We can define that resonate energy which can be adapted into or transferred by Eq. 13 is called “conservative energy”, no matter which mechanism is involved. The indiscriminate energy we usually see is actually non-conservative energy which can’t be utilized by bio-systems. (This is why we can’t feed animal electricity or petroleum to produce meat for us. Estimated for advanced species like human beings, the “splicing” number has been over 1 million; that means from every 1 million units of energy we can only utilize 1 unit of “conservative energy”, the efficiency is quite lower. In bio-systems, “conservative energy” is still relatively conservative in the short term; just the indiscriminate energy we usually see is not conservative.) To further understand energy conservative in bio curved space and the role of gravity in evolution, we can go to Einstein’s field equations of general relativity^{14,15}: $R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu}$, Newtonian G is the term with $\kappa = \frac{8\pi G}{c^4}$, to simplify into Nonrelativistic Newtonian G need to write stress-energy tensor in a field of matter with low proper density ρ and low velocity v as¹⁶:

$$T_{\mu\nu} = \rho \begin{pmatrix} 1 & \frac{v_x}{c} & \frac{v_y}{c} & \frac{v_z}{c} \\ \frac{v_x^2}{c^2} & \frac{v_x^2}{c^2} & \frac{v_x v_y}{c^2} & \frac{v_x v_z}{c^2} \\ \frac{v_y}{c} & \frac{v_y v_x}{c^2} & \frac{v_y^2}{c^2} & \frac{v_y v_z}{c^2} \\ \frac{v_z}{c} & \frac{v_z v_x}{c^2} & \frac{v_z v_y}{c^2} & \frac{v_z^2}{c^2} \end{pmatrix} \quad (14)$$

For bio-systems based on board facts and the gravity binding quiddity, bio-evolution is actually the normalization of the time dimension. We add oscillation at time dimension into (13) then get a general equation for all bio-systems:

$$\begin{cases} x = A_x \cos(\omega t + \varphi_x) \\ y = A_y \cos(\omega t + \varphi_y) \\ z = S_z \cos(\omega t + \varphi_z) \\ t = A_t \cos(\omega t + \varphi_t) \end{cases} \quad (15)$$

For the evidence of the existing of Eq. 15, developmental inversion¹³ is quite stronger. (Actually, just from (**Fig.1d**) we could know that there are commutation relations inside bio quantum path model. Z dimension has persisted priority over that of x, y, and x, y have conditional commutations with each other. Commutations come from the whole resonance space which far outside the

morphological boundary of bio quantum path, means the entanglement of the environment on each dimension is dynamically different.) Such kind of commutations will be inverted by Le Châtelier's effect to make t exchanges with x, y, z dimensions, that is an inversion. (Sexual behavior is a special type of inversion, just z dimension inversed with that of x, y to lose part of time-dimensional binding or bio-inertia. Refer to **(Suppl.Exp.13)** for empirical evidence. Later we'll see other versions of the inversion process.) All dimensions of Eq. 15 can be mathematically combined into one locus equation (with roughly the same phase angle ω), with coefficient matrix and constant term D as:

$$(x, y, z, t) \begin{pmatrix} \frac{x^2}{(A_x)^2} & -\frac{2xy}{3A_xA_y} \cos \varphi_{xy} & -\frac{2xz}{3A_xS_z} \cos \varphi_{xz} & -\frac{2xt}{3A_xA_t} \cos \varphi_{xt} \\ 0 & \frac{y^2}{(A_y)^2} & -\frac{2yz}{3A_yS_z} \cos \varphi_{yz} & -\frac{2yt}{3A_yA_t} \cos \varphi_{yt} \\ 0 & 0 & \frac{z^2}{(S_z)^2} & -\frac{2zt}{3A_zA_t} \cos \varphi_{zt} \\ 0 & 0 & 0 & \frac{t^2}{(A_t)^2} \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ t \end{pmatrix} = D \quad (16)$$

$$D = \frac{1}{3} (\sin^2 \varphi_{xy} + \sin^2 \varphi_{xz} + \sin^2 \varphi_{xt} + \sin^2 \varphi_{yz} + \sin^2 \varphi_{yt} + \sin^2 \varphi_{zt}),$$

For the Eq. all $\varphi_{ij} = \varphi_i - \varphi_j$, such as $\varphi_{xy} = \varphi_x - \varphi_y$

Following Eq. 14, Einstein's stress-energy tensor which deals with non-living systems is symmetric, according to Noether's theorem its energy is conservative; however, in bio-systems the coefficient matrix in Eq. 16 is not symmetric, according to the theorem, energy is not conservative. This means that bio-systems need continuous input for maintenance, such input are conservative energies mainly compensate for z dimensional oscillation. If we don't consider the time dimension and only take bio quantum path from Eq. 13, we still can combine dimensions to get the coefficient matrix and constant term D as follow:

$$(x, y, z) \begin{pmatrix} \frac{x^2}{(A_x)^2} & -\frac{xy}{A_xA_y} \cos \varphi_{xy} & -\frac{xz}{A_xS_z} \cos \varphi_{xz} \\ 0 & \frac{y^2}{(A_y)^2} & -\frac{yz}{A_yS_z} \cos \varphi_{yz} \\ 0 & 0 & \frac{z^2}{(S_z)^2} \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = D$$

$$D = \frac{1}{2} (\sin^2 \varphi_{xy} + \sin^2 \varphi_{xz} + \sin^2 \varphi_{yz}), \quad (\varphi_{xy} = \varphi_x - \varphi_y)$$

Following Noether's theorem, the energy conservative conclusion keeps the same. (If we make a

device with three spring vibrators which can be similarly written into Eq.13 in an isolated system without gravity, energy for such an isolated system is conservative since there is no commutation relation in the device. However, this device is put on Earth “commutation” will always present between different dimensions; therefore, even for non-living beings, energy is not conservative due to differentiating oscillations. As in a bio quantum path, if z dimensional input is enough and can be resonating to other dimensions well, the system is in an active state and can splicing out diverse resistance quite well. However, once the input in this dimension is decaying to a certain degree, the system has to resonate part of x, y dimension to z for maintaining, such “stress condition” can’t last long since the splicing capability is greatly reduced.)

The trace of the coefficient matrix in Eq. 14 or Eq.16, which is the sum of the diagonal elements from top left to bottom right, is equal to zero for potential fields (Laplace's Equation), or following the Principle of Least Action they both should tend to “least action” therefore equivalent in a fixed time period. Compare the trace of $T_{\mu\nu}$ and the coefficient matrix of Eq. 16, we can get:

$$A_t = t = A_x = A_y = S_z = c \quad (17)$$

Eq. 17 can be called as “time evolution equation in bio-systems”; it just means in bio-systems, we can’t use c as a reference, the reference significance of c becomes oscillation amplitude. It is not difficult to understand that bio-systems take oscillation amplitude as reference for gravitational effect and nonliving beings in astronomical scales take c as reference for gravitational effect. As mentioned before, bio-systems fully follow with the Principle of Least Action at an early age. We also mentioned that the first version of the Principle of Least Action is light pass through space (Fermat's principle). Follow the same Principle of Least Action, just one is referred to in a large astronomical range which Le Châtelier’s effect is zero or neglect-able, and another is referred to in small *in vivo* range which Le Châtelier’s effect is the main driving forces; therefore, the equation is rational. The time dilation concept has been modified into commutation time $t = A_t \cos(\omega t + \varphi_t)$.

There are many examples for bio quantum paths, a palindromic arc could be regarded as a bio quantum path. The percentage of which is increasing with evolution. Over 98% of the human genome is noncoding¹⁷ while only 20% of a typical prokaryote genome is noncoding. From here we could know that palindromes are “conservative sequences” and coded genes are mainly “non-conservative sequences” based on their fitness with bio quantum paths. While issuing function, it must superimpose non-conservative oscillations into conservative oscillations by splicing. This

also means that coded genes are evolving from palindromes, coded genes issue higher oscillation levels of functions and palindromes supply recovering capability for these levels. Without palindromes, coded gene functions will be quite ephemeral. Gene regulations are also following such a pattern. Restriction enzymes or restriction endonucleases are examples. These enzymes are found in bacteria and archaea to provide a defensive mechanism against invading viruses. Type II restriction enzymes (homodimers) are functioning on palindromic sequences¹⁸. This means cutting on such sequences will be much more effective than on other sites. Conventional evolution theory describes LUCA as common ancestry and never regards the virus as a life. However, much evidence demonstrated that palindromic sequences are essential to viral life cycle¹⁹⁻²³. In the gut, they even make use of palindromic sequences from the secondary host: human being, along with their utilizing of the palindromes in primary hosts: gut microbes²⁴. Without palindromes, they possibly even can't invade hosts. The driving bio quantum paths are therefore evidently come from more than one organism. These prove that palindromes are physically modified. In cross-species case, the modification is still similar to those of *in vivo* superposition of palindromes with genes.

For above palindromic sequences, we only get indirect shreds of evidence since conventional genetics didn't care about and even regarded them as junk genes. However, for this example of gene copy number variation (CNV), we have many conditions which can only be explained by bio quantum path model. CNV is a phenomenon in which sections of the genome are repeated and the number of repeats in the genome varies between individuals in the human population²⁵. It also happens in board species include E.coli²⁶. Approximately two-thirds of the entire human genome is composed of repeats²⁷ and 4.8–9.5% of the human genome can be classified as CNV²⁸. It is a type of structural variation with duplication or deletion event that affects a considerable number of base pairs and is generally categorized into short repeats and long repeats. Short repeats include mainly bi-nucleotide repeats (two repeating nucleotides e.g. A-C-A-C-A-C...) and tri-nucleotide repeats. Long repeats include repeats of entire genes. Genome-wide studies have concluded that there is a minimal spatial bias of the genomic location of CNV²⁹. One example of short CNV is the tri-nucleotide repeat of the CAG base pairs in the Huntingtin gene that is responsible for the neurological disorder Huntington's disease³⁰. Once the CAG tri-nucleotide repeats more than 36 times, Huntington's disease will likely develop in the individual and it will likely be inherited by his or her offspring³⁰. The number of repeats of the CAG tri-nucleotide is correlated with the age of

onset of Huntington's disease. One example of a whole gene repeat is the alpha-amylase 1 gene (AMY1) that encodes alpha-amylase which has a significant copy number variation between different populations with different diets³¹. It is also one of the few genes that had been displayed convincing evidence which correlates protein function to its copy number³¹. It was found that the high starch diet populations had a significantly higher (2 times higher) average AMY1 copy number than the low starch diet populations³¹. The recent origin of the multi-copy AMY1 gene implies that depending on the environment, the AMY1 gene copy number can increase and decrease very rapidly relative to genes that do not interact as directly with the environment³². However, for the causes, mechanisms, and correlation with certain diseases, etc., there are a substantial amount of reports but no consensus theory. Back to Eq. 4 CNV will be easily explained. We can write Eq. 4 into:

$$K_{process} = \frac{gene_{j_1}^{j_1} gene_{j_2}^{j_2} gene_{j(n)}^{j(n)}}{gene_{i_1}^{i_1} gene_{i_2}^{i_2} gene_{i(m)}^{i(m)}}$$

Clusters of functionally related genes, from $gene_{in}$ change to $gene_{jm}$ for certain process can be given a $K_{process}$, each copy number was on the power of each gene. (If introns or exons or even short repeats join the process, we just write involved genes into intron or exon or even bi-nucleotide, tri-nucleotide repeats format then CNV roles keep the same.) The shifting of CNV is due to Le Châtelier's effect to keep constant K. What drive the CNV shifting are physical bio quantum paths. Following Eq. 4 even "DNA damage" is a quite ambiguous concept. We should also note that among the neurons in the human brain, somatically derived CNV are frequent³³. CNV show wide variability (9 to 100% of brain neurons in different studies). Most alterations are between 2 and 10 Mb in size with deletions far outnumbering amplifications³³. CNV appears to be higher in brain cells than in other cell types³³. This is not epigenetic shift but real sequence shifting³³. Brain mosaicism strongly proves bio quantum path model and splicing process which we'll refer to later.

Upgrade Newtonian "motion" & "rest" into stationary quantum superposition structure

The term "Metastasis" has been recorded for near three centuries (1727-1850, "metastasis of milk" presented in publications, albeit at that time it was not concerned with cancer.). Till today people normally know that metastasis is migration and proliferation of cancerous cells (epithelial origin) to different *in vivo* sites. However, whether metastasis is only specified in cancerous cells? If so, which kind of factors can offer cancerous cells that "super mobility and implantation capability"

which normal stem cells lack? Such factors have never been revealed; we then have to believe that cancerous cells and normal stem cells are in the same capability levels for mobility and implantation. Top of (**Fig.1f**) is from a study for the distinctive role of Wnt 5a/Wnt 5b in mouse embryonic development³⁴. The Wnt signaling pathways are a group of signal transduction pathways from cell surface receptors till genomic regulation level that should belong to genetic physical regulations. We can see the blue staining is never restricted to a certain locality but also not attain full region, establish some regulation “spectrum”. At the bottom left is a breast cancer metastasis to lung region. We could see both normal cells and cancerous cells have far reach mobility; establish a proliferation “spectrum”. (If we choose other stem cell indicators we still can get a similar “spectrum”. Even physical strike on one site will be distributed in such a board “spectrum” on diverse sites if the strength is within the tolerant range. While the strike is over the tolerant range, it will create bruise or hurt on the strike part and later recover still follow such “spectrum”.) Evidence also from other sources, metastasis is reported as the result of inflammatory processes by abnormal immune cells³⁵. The existence of metastatic cancers without primary tumors also suggests that metastasis is not specified in malignant cells³⁶. (This confirms what we mentioned before, cancer is originated from constant K asymmetric retrograde, or arise from normal cells. It is impossible for system gives normal stem cells and tumor cells with different “splicing” capability, and the “splicing” is a kind of “mobility”.) To model this we need first discuss “motion” and “rest” concept.

Early in the Newtonian system, motion is defined as the change in position of an object with respect to its reference frame in a given interval of time. If the position of a body is not changing with respect to a given frame of reference, the body is said to be at rest state. A choice of the reference frame is free for “inertial frame of reference”. The concept of energy conservative is naturally come from here; while some parameters such as mass, force, displacement, etc., can describe state from t_1 to t_2 we then habitually write these descriptions into energy. The conservative of energy is a justification for human’s knowledge which attached to the above “human” descriptions. E.g. we can write, $E = \int_{t_1}^{t_2} (\frac{1}{2}mv^2 + mgh) dt + \int_{t_1}^{t_2} (Self - motion) \cdot dt$, the hidden premise of which is, while the inertia state of an object in t_1 (either at rest or continues to move at a constant velocity) changes to state in t_2 , such change only can be performed by human’s known laws; if not then the object must remain in t_1 state, that means the second term $\int_{t_1}^{t_2} (Self - motion) \cdot dt = 0$ or at least

neglect-able.(Here all the third party actions on the object which beyond human's known laws such as evolutionary signals which came from billions ago can all be added to "self-motion" item.) Einstein introduced "non-inertial reference system", still only touched the first item and not the problem of the second item $\int_{t_1}^{t_2} (Self - motion) \cdot dt = 0$. Obviously, in bio-systems such a classical concept is not feasible, for a living being from t_1 to t_2 ; it can self-motion, even without observable self-motion it still could become older or dead. Quantum mechanics transfers to the more general energy state of a system and still not touched such a fundamental problem. (Quantum mechanics has already very close to transcending thermodynamics, just due to neglecting to the fundamental problem; no one really realized such exceed, in contrast, even leave some pending issues for this discipline. Right bottom of (**Fig. 1f**) is a metal bar; following the Second Law of Thermodynamics, it is impossible to get one end of it in higher temperature and another end in a lower temperature at equilibrium. This is a kind of "fluctuation equilibrium" bio-systems depend on for functioning & evolution. Quantum mechanics failed to modulate that.) Back to (**Fig.1d**), bio quantum paths depend on a general strengthening & weakening effect for splicing out resistance. (The terminology of "strengthening & weakening effect" is come from music which fits for board scenarios and covers all parameters. The term "constructive & constructive interference" is come from physics which only refers to oscillation superposition amplitude shifting. They are actually the same thing in bio quantum path.) The structure of a bio quantum path at least composes of two parts, a "motion" part, and a "rest" part. Now the "motion" concept is no longer diverse types of Newtonian motions, the only motion is a strengthening & weakening or "fluctuation" motion. The "rest" part is inseparable sustaining part while "fluctuation" is running; it keeps the same vector or contributes constantly to the system, which is the sustaining signal. While a lot of bio quantum paths composited into a bio-system, a holistic "stationary" part which sustains all levels of fluctuations still exists, and it is the highest binding part where biomaterials are superposing on in evolution, inseparable with conservative energy.

(**Fig.1g①**) is a string oscillation figure possibly even present earlier than the history of human written languages (**Suppl.ExpL.4**). (**Fig.1g②**) shows series bio quantum paths with corresponding "splicing number" equal to the "wave number" of the oscillation strings (only draw the $n=3$ and $n=6$ bio quantum paths). Splicing number is the number of periods in Z dimension while x, y dimension

finish one cycle. Now that stationary structure can't be separated with conservative energy, we have to first go back to earlier quantum mechanics; it had experienced four stages: Planck's law, Einstein's photoelectric effect, Bohr model of the atom and Schrödinger's model. The major success of the Bohr model was in explaining the hydrogen spectrum. It believed that electron jumping among "orbits" can emit or absorption energy. Such "orbits" could be regarded as a series of strings in **(Fig.1g①)** or bio quantum paths in **(Fig.1g②)**, for non-living beings energy possibly can be jumped in this way, however, for living beings we can see their splicing number is different, in normal conditions energy need first transfer with same "splicing number" or frequency, that is horizontal transfer to the attaching structures and the feedback energy goes to corresponding splicing number. Vertical "jumping" similar to Bohr's model can only happen in very stressful conditions which bio-systems will subsequently loss substantial amount of bio-inertia. Schrödinger himself disliked energy vertical "jumping"; therefore, wave function replaced "orbits" and allowed the electrons to occupy three-dimensional space. Three quantum numbers (coordinates) were needed to describe the distribution of electrons. (Principal quantum number (n), azimuthal quantum number (ℓ) and magnetic quantum number (m), later spin quantum number (s) is also added into.) However, the problem of the fragileness of the quantum states to enter in a macrocosmic world still remains. From linear transformation $E\Psi = \hat{H}\Psi$, energy becomes $|E_n\rangle$, and certain E_k is presented by probability which measurement will induce to collapse into certainty.

Possibly due to still not satisfied with Copenhagen interpretation, Schrödinger released his legendary "cat". After that release, quantum mechanics failed to convincingly deny the legend that before opening the box the cat is in a "dead-and-alive superposition state". Quantum mechanics itself has then to become a "dead-and-alive superposed discipline" till today. Now we can slightly modify this thought experiment to find some hidden premises. We put two cats, one male and one female both with good fertilities into a box with two chambers separated by a gate, the device which controls the gate is still Schrödinger's radioactive device, just in one hour decaying time there is 50% chance of opening the door. Then we'll see while opening the box how many cats will get. One possibility is just a male and a female cat, one possibility is beyond the couple we get a few extra baby cats. However, this case is a little bit different from that of conventional Schrödinger's cat. Generally, a cat from mate till delivery babies takes around 70 days, the male and female cat still need time to "fall in love" and get pregnant. We just suppose 70 days for the whole process. So after

one hour of the decaying of a radioactive element, then within 70 days no matter how hard and how many times we open the box and whether the Schrödinger device is triggered or not, the result will definitely no more than two cats. Therefore there is no such story as “superposition of states collapse to a concrete state”. After 70 days could possibly get extra baby cats, however, the chance still quite lower than 50% (which previously set to radioactive decaying) since diverse causes will significantly impact on the probabilities. Both cases are opening the box for observation, why one is legendary probability story and another is certainty in a long period of time? We could easily understand the only difference is the time. If the legendary claim that “observation can affect a quantum wave function”, then it definitely can only impact on the events which happen in a time frame quite shorter than that of the observation time. Suppose open the Schrödinger’s box for observation needs 3 seconds, this observation can only possibly affects events which happening time is far less than that of 3s. As in the baby cats’ case, it takes 70 days for delivery and if we still want arbitrarily “probability condition”, the only way is to continuously increase the observation time to $\gg 70$ days. In the Bohr–Einstein debates, there is a topic about whether Moon is presented if we don’t observe it. Actually, at that topic Einstein is correct, no matter we observe or not, Moon exists there. Since a glimpse observation time is only second and the Moon’s existence is quite long. Suppose one glimpse is 1s, then this glimpse only possibly affects events which happen in *millisecond* or *microsecond*; it is definitely impossible to affect the Moon which had existed there for 4.4–4.6 billion years. If someone really wants to make the existence of the Moon becomes a probability event in his eyes or even want “probability can be collapsed by his glimpses”, he possibly needs to become a “superman” which a glimpse takes at least 100 billion years, then his lifespan will attain 3×10^9 billion years. However, right now the known age of our universe since the Big Bang is only 13.8 billion years. From here we could easily understand that superposition of quantum state is conditional with time, and the collapse of quantum state must also observe above time frame. Back to the case, we could regard a pregnant female cat as a quantum state superposition and delivering babies as “collapse to non-superposition state” by the number of cats as a physical parameter, then not in the right time no matter how hard and how many times we open the box for observation, can never make the “collapse” (delivery babies) happen earlier. (At a time close to 70 days repetitively open the box for hundreds of times possibly makes the collapse ahead a few hours. However, that is due to edge effects and not due to observation collapse the superposition.) This means that quantum

superposition collapse absolutely follows above time frame. The prerequisite condition for any observation or event can induce wave function collapse is their happening time must quite longer than that of collapse time. And this is only a necessary condition instead of an NSC. (From here we can understand, quantum mechanics will never take superposition state as a stationary structure since it is the most fragile part which will “collapse” due to the probability. Bio-systems want take superposition structure as a stationary structure needs first solve the problem of “fragility”. Also the major problem for quantum mechanics to be applied in bio-systems is the unitary time evolution. (It is a restriction on the allowed evolution of quantum systems to ensure the sum of probabilities of all possible outcomes of any event equals to one, $\int_{-\infty}^{+\infty} \Psi^*(x)\Psi(x)dx = \int_{-\infty}^{+\infty} |\Psi(x)|^2 dx = 1$.) This means the stability of an event is decided by the unitary of event probability. However, bio-systems take a totally contrary way for stability, due to constant K binding some biomaterials’ stability depends on other biomaterials’ speed of disappearing, or anti-unitary processing. Like foods become excrements leave the body, the speed of excrements leave the body strengthens the system stability. Examples also include a bone; it not only needs to physically support the body weight but also needs to sustain the body recovering capacity. Such recovering capacity must depend on anti-unitary processes or the turnover rate of stem cells migration in and out of bone from the whole body. If we change the bone to a metal bone, albeit it seems can support more weight than that of a biological bone; the turnover rate or the recovering capacity becomes zero. This way will greatly hurt the body health.)

Beside the unitary problem, gravity is another critical issue. Some people like to claim that quantum mechanics has solved all types of physical interactions except gravity, and still can’t explain why it fails to resolve that. As we know, the position and momentum compose of fundamental commutation relations in it, this relation is actually just an approximation since inside the momentum $\hat{p}_j$ there is still some further inner commutations if consider earth’s gravity. While on Earth the p_j dimension which closes to gravitation vector will prior than the other two dimensions. Albeit the impact of gravity on momentum is not as large as that of bio quantum path, such impact is never zero. In **(Suppl.Exp.7)**, cutting the spinal column of an animal can quickly release the gravitational binding; this proves that quantum superposition itself is a process of binding gravity. (This means in double-slit or similar experiments, while two beams of light or electrons get an interference pattern on the screen, extra gravity will be possibly binding to the interference pattern. Both quantum

mechanics and the Theory of Relative haven't realized such shifting. Albeit it is possible that in most of the conditions, neglect of gravity in quantum mechanics is acceptable. It is not always.) Albert Einstein has questioned the completeness of quantum mechanics by EPR paradox³⁷. Till today most of the people believed that Einstein was wrong since various experiments of quantum entanglement gave them specious support. However, if we carefully check all the experiments we can easily find, every one of these experiments just partially proved that quantum entanglement did present at a certain distance. None of them have shown that the “spooky action” can be presented without the help of gravity. Following our model, if inside three dimensions of momentum there are really existed commutation relations which origin from gravity, then quantum entanglement is therefore just a natural result of Earth's gravity (Z dimensional oscillation). Based on all nowadays available experiments, it is really too early to say that Einstein is wrong albeit his paper about EPR paradox was not fully accurate. Unless some experiments can prove that “quantum entanglement” can stably penetrate through the gravitational field of another planet which not initiating the quantum state, such as entangle to device put on moon or Mars, this process can then be qualified with the word “spooky” which granted by Einstein. (In quantum entanglement experiments, there is one performed on a satellite. Generally, on a satellite there is still 95% of gravity presented, thus this case can't prove that “quantum entanglement independent of gravity”.) If finally, quantum entanglement can't penetrate through the gravitational field of another planet which not initiates the quantum state, then it means Einstein's intention for seeking “hidden variable” becomes a success, the hidden variable of quantum state superposition falls on “gravity” and its derivatives. Even if there is no EPR paradox, quantum mechanics possibly still needs to face the range of neglecting gravity due to (**Suppl.Exp.7**).

The third problem of quantum mechanics, which is the most important for all, “whether a quantum state can present independently in a non-isolated environment”? Actually, there are seven correlated questions inside this question that can't be separated; we have to discuss them together:

- ① definition of motion and rest in a bio-system
- ② where the time-independent Schrödinger equation comes from
- ③ “integer” or “integer variable function” quantization of a quantum system
- ④ the recovering capacity of a quantum state
- ⑤ the stability of the superposed quantum states (unitary or “turnover rate” superposition)

⑥ time evolution or time commutation

⑦ “regenerative” wave-particle duality and the range of quantum state (macro- or microcosmic)

We discuss all these relevant questions just to modulate the concept of metastasis at the beginning of this section. For ①, we have discussed before that in bio-systems, the motion (fluctuation) and rest (stationary) are inseparable to sustain the functioning. For ② following such modified concepts of “fluctuation” and “stationary”, if we wish to apply the quantum mechanics in bio-systems, the quantum state can’t be present independently; Schrödinger equation should have certain accompanying structures. It is those attaching structures make the stationary state present in certain environmental conditions. The fragileness of quantum state, such as wave function collapse comes from the shortage of attaching structures. Now we discuss ③, earlier quantum mechanics in Planck’s and Einstein’s studies are from the macrocosmic world. After Bohr and Schrödinger, it began to deal with the microcosmic world. Copenhagen’s interpretation eventually makes people totally puzzling about how to apply such “upgraded” mathematics back to a macrocosmic world. Planck’s Law published in 1900 can be written as:

$$I_\nu(\nu, T) = \frac{2h\nu^3}{c^2} \frac{1}{e^{\frac{h\nu}{kT}} - 1}$$

(I_ν, ν, T, h, c, k , are radiance, frequency, Planck’s constant, speed of light, Boltzmann constant, resp.)

This formula, in the limit of low frequencies, tends to the Rayleigh-Jeans law and in the limit of high frequencies, tends to the Wien approximation; means it is based on enough empirical evidence. (Rayleigh-Jeans law was presented later than Planck’s law for about one decade.) The prerequisite condition of this formula becomes the foundation of quantum mechanics, $E = nh\nu$, (5 years later Einstein successfully use it to explain the photoelectric effect, the energy of the emitted electrons depends on the frequency of the individual photons instead of the intensity of the incoming light.). Planck’s model is derived from the classical simple harmonic oscillator model, $E\Psi = \hat{H}\Psi$. The presence of quantum states is conditional, $E = nh\nu$, is an “integer function”. For bio-systems, we then need another formula $f_n = f_1 \times \sqrt[n]{2^{n-1}}$ for frequency energy which we explained in (Suppl. Expl. 4). It has been applied in western music harmonic for centuries. (If consider ancient China it has been applied for millennia.) Beside such historical evidence, both Planck’s and Einstein’s model depend on frequencies for transferring, $f_n = f_1 \times \sqrt[n]{2^{n-1}}$ can be adapted into Planck’s law and becomes, $E = \sqrt[n]{2^{n-1}} h\nu$, $n=1,2,\dots,n$; for integer it recovers back to original equation $E = nh\nu$, just some

non-linearity values presented. Einstein's photoelectric effect thoroughly reveals that frequency decides the pathway of energy transferring. It can also be explained by $E = \sqrt[n]{2^{n-1}} h\nu$ replaces $E = nh\nu$ for the whole process. (Work function $W = hf_0 = \sqrt[n]{2^{n-1}} h$ where f_0 is the threshold frequency of the metal. The kinetic energy of an ejected electron is then $k = h(f_k - f_0) = h(\sqrt[n]{2^{k-1}} - \sqrt[n]{2^{0-1}}) f_{ground}$. (Einstein's photoelectric effect theory is a model which most close to a bio-system model inside conventional physics. Electrons bound to metal are activated by certain frequencies from incident photons and then jump out of the surface of the metal. Cells bound to tissues will still jump out of the surface and migration if activated by certain kinds of stuff such as RNA, cytokines, etc. to a certain frequency. And when their frequencies decreased to a certain threshold, they will back to certain sites with the same frequencies. Since the only restriction factor for energy transferring is frequency, then cells will reside on a certain site which offering them "favorable" frequency energy. The membrane on the surface of tissue or organs just increases the escaping threshold values. In both cases, the decisive factors are frequencies. Actually, in the field of quantum mechanics, Einstein had transcended his predecessor Planck in the discipline; just his successor didn't reach his intuition level. In Bohr-Einstein debates he still didn't find the solution for defending, just from his intuition he believed that something was incomplete. Today if we back to history, we have to admit that almost everything from his intuition in the debates is correct.) Music harmonics directly based on simple harmonic motion, similar to that of quantum mechanics take simple harmonic motion as an approximation. Such "integer to integer variable function" modification is not only very convenient for harmonic analysis (**Suppl. Expl. 5**) but also agrees with our definition of "motion" and "stationary" in bio-systems; no matter at which levels, while $n = 12k+1 (k=0,1, \dots, K)$ or the integer is present in the formula, it is stationary structure, and while "n" equals to other integers, they become the fluctuation structure which resides on the integer "stationary" state. From such fluctuation & stationary model, we can easily understand why only one set of constant K is allowed in a bio-system. For bio-systems $|N_{\sqrt[n]{2^{n-1}}}\rangle$ as a quantum state, non-integer part is the origin of the recovering capacity or Le Châtelier's effect we mentioned before, therefore relatively robust. A lifespan of 100 years means the highest level of the quantum superposition (spinal cord) can maintain 100 years on proper environmental conditions. For the non-living $|n\rangle$ quantum state, the fragileness comes from lacking non-integer part. This is what ④ refers to. Now we can discuss ⑤, the stability of the

superposed quantum states. The superposition principle states that any two (or more) quantum states can be superposed together and the result remains quantum state. Wave functions can be superposed like waves in classical physics. The critical problem is here. If we require every superposition must present constructive & destructive interference pattern or the strengthening & weakening effect as prerequisite condition, then in a non-isolated system with the increase of quantum number “n”, substantial numbers of quantum state superposition will become “ineffective superposition” which constructive & destructive interference patterns are gradually decaying. If there is no such requirement, we can unlimitedly write $\Psi = \sum C_i \Psi_i$ as in quantum mechanics.) This is also why this discipline has never clarified the conditions for the time-dependent or time-independent state. Bio-systems follow the frequency formula $E_n = \sqrt[n]{2^{n-1}} h\nu$ ($n=0, 1, \dots, n$), while $\sqrt[n]{2^{n-1}}$ is an integer then E_n is the superposed state; while $\sqrt[n]{2^{n-1}}$ is a non-integer then the state is an attaching state which strengthens the E_n to sustain the system stability; composed of “fluctuation” & “stationary” interactions to splicing out resistance and stable the system. We could also understand from an identical particle model from quantum mechanics, the superposition of two particles is:

$$|n_1, n_2; S\rangle = \text{constant} \times (|n_1\rangle |n_2\rangle + |n_2\rangle |n_1\rangle) = 1/(\sqrt{2}) \times (|n_1\rangle |n_2\rangle + |n_2\rangle |n_1\rangle)$$

$$|n_1, n_2; A\rangle = \text{constant} \times (|n_1\rangle |n_2\rangle - |n_2\rangle |n_1\rangle) = 1/(\sqrt{2}) \times (|n_1\rangle |n_2\rangle - |n_2\rangle |n_1\rangle)$$

Bosons, occupy symmetric states and fermions occupy antisymmetric states, for “n” particles:

$$|n_1, n_2, \dots, n_N; S\rangle = \sqrt{\frac{\prod_j N_j!}{N!}} \sum_p |n_{p(1)}\rangle |n_{p(2)}\rangle \dots (n_{p(N)}) \quad (18)$$

$$\text{or } |n_1, n_2, \dots, n_N; A\rangle = \frac{1}{\sqrt{N!}} \sum_p \text{sign}(p) |n_{p(1)}\rangle |n_{p(2)}\rangle \dots (n_{p(N)})$$

All these particles are “indistinguishable” and establish a quantum state follow Eq. 18, could be symmetric, antisymmetric or even exchange symmetric. However, in bio-systems, all these particles (all biomaterials such as DNA, RNA or cells, etc. can be physically expressed into bio quantum paths, here we just regard one bio quantum path as one identical particle.) will be automatically grouped by the strength of “Le Châtelier’s effect” (As the double-slit experiment in the right bottom of **Fig.1f**, the interference patterns on the screen have already failed to evenly distribute. Such uneven of superposition pattern will definitely decay the interference effect with the increasing of “n” number.). As a result, particles with higher “Le Châtelier’s effect” will be pushed in one group, the other particles are then offered “turnover rate” for them. (Definitely, with the evolution of time, these

particles with higher “Le Châtelier’s effect” could possibly become “turnover rate” particles for other particles. Therefore the system only leaves “turnover” structures and no longer the particles which establishing the quantum state.) This is the “anti-unitary” or “turnover” superposition in bio-systems.

For ⑥, time evolution in quantum mechanics is unitary and in living systems is non-unitary; such a difference is coming from the above state unitary superposition and anti-unitary superposition. A unitary superposition requires that the probability of events equal to one, this is possibly the reason for the claim that “observation can induce collapse”. However, in bio-systems, the shifting of unitary probability is not meant the collapse of superposed states. In contrast, it meant the initiating of “Le Châtelier’s effect”. We observe the system induce the probability of one site get change, then the whole system will counteract this change, therefore horizontal or vertical energy will be transferring and the system stability is strengthened. Anti-unitary processes make bio-superposition much stable.

For ⑦ we should understand that wave-particle duality is a “regenerative” property, slightly different from that the routine explanations. Given a bundle of particles A and a series of wave B, even in the macrocosmic world, we can’t simply say A presents particle characteristics and B presents wave properties. The A or B we see just based on our previous experience, not the performance of group characteristics of either A or B’s on a system. Without an interacting system, both A and B are neither particles nor wave. A lot of the quantum mechanics textbooks world-widely usually claimed that wave-particle duality only happens in a microcosmic world by an example. In a macrocosmic world, suppose a 50-gram object moving in a speed of a bullet, the De Broglie wavelength $\lambda = h/p = h/mv$ is so small therefore it is undoubtedly a particle. (Also some people use something like Planck length, Compton wavelength or even Schwarzschild radius to claim similar “boundary” stories.) However, if a 50-gram egg is cooked and eaten by a person, the digestive process is totally governing by simple harmonic motions, thus it becomes a series of waves. At this condition, De Broglie’s equation is no longer effective. Back to the right bottom of (**Fig. 1f**), under the “fluctuation” metal bar there is a volcano and an iceberg which reveals a kind of fluctuation on a large scale; an animal gets partial oscillations from such kind of fluctuation, this is a macrocosmic wave resonance, therefore, no longer a particle. Even the equilibriums in thermodynamics are still composing of fluctuations in small scales. (Energy transfer only follows fluctuation regulations and never follows the isolated system we observe them.) Beside the volcano and iceberg in the figure, there is a Gaussian curve; all the macrocosmic events will fall into it with enough repetitive numbers.

This is a quite general fluctuation, if such a fluctuation from certain events can be resonated with a large system, it will demonstrate wave characteristics. And under an integrated wave environment of certain events, the superposition of waves will demonstrate particle properties (the number of wave peaks becomes the number of particles) in certain conditions. This is the wave-particle duality in bio-systems, never concerned with micro- or macro-scales, only concerned with the existing of resonating system. (The quiddity of such wave-particle duality is actually the conditions which constructive & destructive interference or a more general strengthening & weakening effective could happen, definitely not concerning with the raw materials we observed are particles or waves; both previous observed “particles” and “waves” can issue constructive & destructive interference under certain conditions if a resonating system is presented. They are actually “regenerative” waves or particles and not the previous observed “waves” or “particles”; therefore, we can use “integer variable function” $|N_{12\sqrt{2^n-1}}\rangle$ for expression, integer part potentiates particle characteristics and non-integer part potentiates wave properties; if get strengthened will show out. Such new interpretations of “duality” can even explain double-slit quite well than before.) Now with all the above discussions from conventional quantum mechanics, we can then finalize the definition of motion and rest (stationary) state structure in a bio-system: start from lowest level all the recovering capacities come from the interactions between motion (fluctuation) and rest (stationary) structures; from different levels such as DNA, RNA, protein, cells, tissue, organs, etc., finally superposed into the spinal cord; all the above active biomaterials inside a human body take the spinal cord as the only stationary structure. And this is the strongest part of human beings which keeps the body to follow δK into the Principle of Least Action. (It’s not the “motion”& “rest” concept for running with human’s known law; it’s bio-systems’ binding prerequisite condition. We have to rely on it to modulate bio-system since we have no other choice. It composes of strengthening & weakening superposition from diverse anti-unitary processes. It is never so fragile such as “observation collapse” if enough binding established under certain environmental conditions.) In quantum mechanics, the principal quantum number is the number of electronic shells in an atom to describe the electrons’ state. In bio-systems it becomes the number of vertebrae. (The principal quantum numbers in quantum mechanics are only validated by single elementary substance via spectroscopy. In compound states how such numbers are shifted is unclear. In bio-systems, while all biomaterials

superposed into stationary structures, we can reasonably believe that some elements such as Fe, Zn, etc., in the protein compound states at the spinal cord region or even in the whole body will possibly degenerate their principal quantum numbers into multiple of vertebral number. We also need to understand that vertebral quantum number must be a “regenerative” number and not the number of vertebrae we see on the spinal cord. For an alive or dead animal, the vertebral number is the same but the “regenerative” quantum number is totally different. Lifespan totally depends on the decoherence of the superposition on the strengthening & weakening effect on this structure. At old age, the strength of the strengthening or weakening effect inside the spinal cord totally decides the dead or alive state of the living being. However, in quantum mechanics, the strength of the constructive & destructive interference effect never decides the “dead or alive” of the quantum state. So it is again a “dead-and-alive superposed discipline”.) The spinal cord in nature has been evolved for billions of years from the first evidence of life² till the first vertebrate *Haikouichthys* presented in 525 million years ago³⁸. For the applications correlate with the spinal cord in human society has also experienced thousands of years for progress. (From the unfledged I Ching, the origin of Chu’s constant till the finalization of the Wudang physical training system 590 years ago, ancient Chinese culture had advanced in practices. Theoretical progressing from western culture started from earlier Newtonian mechanics, Einstein’s theory, and quantum mechanics till biosciences. This ungraded Newtonian motion & rest definition comes from the superposition of multi-culture & multi-discipline for thousands of years, can’t be worked out by a single discipline or even a single culture independently. We’ll gradually supply historical and modern evidence later.)

Now back to the metastasis we discuss at the beginning of this section, we could easily understand that both normal stem cells and cancerous metastasis cells have stronger mobility and implantation capability, just normal stem cells based on spinal cord for such “capability” and cancerous metastasis based on a “deformed spinal cord” for that. (We should also note that the mobility of cells or other biomaterials is not driving by blood flow, for earlier living systems without blood flow the mobility still equivalently present; the only driving factor is strengthening & weakening effect which comes from the whole system; blood flow is just a representation which still controlled by above forces.) Some people suggested using stem cells to medically repair spinal cord injuries. This is a routine manner in conventional medical research just unfeasible. There are substantial technological problems in stem cells applications (**Suppl.ExpL.7**), even if we can

overcome all these technological challenging, major challenging still remains. Spinal cord binding a lot of attaching structures in the body; its injury means all the attaching structures have also impacted. Even if we can overcome the all the problems of stem cells and “repair” the spinal cord biologically, we still can’t “repair” all the injuries inside attaching structures since there are much commutation relations inside the spinal cord binding.

While Planck wrote down his black body radiation formula and also in later quantum mechanics, people just believe that “Planck’s constant h is the smallest scale of energy transferring”, seems never refer to the “fluctuations” inside it albeit simple harmonic motion model is extensively utilized. Planck’s constant can be empirically measured by black body radiation or Einstein’s photoelectric model. Now based on the new interpretation of wave-particle duality in bio-systems, we could understand that “ h ” is the “least fluctuation which can regenerate with the whole system”. Following such definition, we can find Planck’s constant in bio-systems; the minimum discernable fluctuation is likely to be a palindrome or an intron in scale. CRISPR repeats typically range from 28 to 37 bps³⁹ and the shortest intron is 30bps⁴⁰. Thus the least “fluctuation” in a bio-system could be the horizontal projection of 30 bps. 30bp in a straight line is around $30 \times 3.4 \text{ \AA} \approx 100 \text{ \AA}$, 10^{-8} m , suppose this 30bp roughly composed of the two sides of an equilateral triangle then the h_{bio} should be 15 bp, around $50 \text{ \AA} = 5 \times 10^{-9} \text{ m}$, with oscillation range. This scale equals to 7.5×10^{24} Planck quantum or 50 water molecules in a line. We can then write “conservative energy” or “frequency energy” in as:

$$E_{conservative}^{bio} = \sqrt[n]{2^{n-1}} h_{bio} \omega, \quad (n = 1, 2, 3, \text{ to } n, h_{bio} = h_{planck} \times 7.5 \times 10^{24} = 5 \times 10^{-9}) \quad (19)$$

Eq. 19 means in bio-systems least fluctuation scale which can resonate with the whole system becomes a modified Planck constant h_{bio} . (Such constant h_{bio} is possibly only fit for all eukaryotes and most prokaryotes with enough percentage of palindromes. For the most primitive types of life, the h_{bio} is possibly only three nucleotides; however, three-nucleotide is not in a straight line. We just take 1/10 of 5×10^{-9} from the previous estimation of 30bp, that is $5 \times 10^{-10} \text{ m}$. Mitochondrial and chloroplast sequences should take this scale due to their prokaryotic properties, so we can write $h_{mt} = h_{chloro} = 5 \times 10^{-10}$. This conclusion is also supported from the fact that triplet code as a three-nucleotide codon binds a single amino acid with some exceptions which allow insertion⁴¹ and short CNV repeats we mentioned before are bi-nucleotide or tri-nucleotide repeats²⁸. Genes superposed on palindromes for recovering capacity and triplet code can take insertion for its

recovering capacity. We should note that both h_{bio} and h_{mt} are only for the ideal or young stage. Senility is a process of decaying of the percentage of *in vivo* compromised oscillation “wavelengths” which can fall into h_{bio} or h_{mt} in a bio-system.) The physical significance of h_{mt} just proves again that energy in bio-systems is frequency controlled “fluctuation” energy. h_{mt} equal to around 5 water molecules in a line, that means no matter which kind of energy, either from water molecule oscillation or from any chemical bonds or even compound reactions in water, they must possess a least “fluctuation” scale for the energy exchange. In the most ideal conditions, if the “fluctuation” scale is lower than 5 water molecules in size then no energy can be transferred under all conditions. Planck or Einstein’s systems can exchange energy with “ h_{Planck} ” scale due to there are much less constant K binding and lower recovery requirements for their system. Bio-systems with above two requirements have to utilize frequency energy with at least $7.5 \times 10^{23} h_{Planck}$ scales. (This number is a little bit close to the Avogadro constant 6.02×10^{23} , possibly in the future, it needs to consider this constant and enough empirical data for modifications. That implies life depend on a scale which equivalent to 1mol Planck’s constant in a queue as a least frequency energy fluctuation scale. We’ll also note that this is just a theoretical ideal condition; in a real condition due to age or various factors, the minimum fluctuation scale should be shifting in a range and finally enlarged by senility.)

Upgrade Einstein's frequency energy into network binding copy number stability, horizontal & vertical transferring of diverse critical bioprocess

Einstein’s frequency energy comes from his photoelectric effect model, which is the only relative conservative type of energy in bio-systems, not the indiscriminate energy conservative model we usually see. Start from the genomic level, the basis of gene functions is how the system identifies them. The *in vivo* identifications of the gene in bio-systems are based on “oscillation or quantum spectrum match” similar to our physical choice of a musical instrument (**Suppl.ExpL.5**), and never follow the linear sequence on a DNA. Let’s see the CRISP/Cas9³⁹ (Clustered Regularly Interspaced Short Palindromic Repeats) system in (**Fig.1g③**) for details. The CRISPR array comprises an AT-rich leader sequence followed by short repeats that are separated by unique spacers. CRISPR repeats typically range in size from 28 to 37 bp, though there can be as few as 23 bp and as many as 55 bp³⁹. The size of spacers in different CRISPR arrays is typically 32 to 38 bp (range 21 to 72 bp)³⁹, a little bit wider than that of the palindromic regions. There are usually fewer than 50 units of the

repeat-spacer sequence in a CRISPR array³⁹. An RNA guided Cas9 protein can detect the invading DNA or own default segments on spacers (CRISP array) and then cut and subsequently promoted system repairing of these alien regions. However, people have never clarified the mechanisms of critical “detecting” and “repairing” steps, albeit the gene-editing based on Cas9 or similar such as Cpf1 has overly prospected and applied. As in the figure (**Fig.1g**③), we get a blue and a red-colored DNA segment in the spacers that will be splicing into a series of segments represented by discrete same color segments from $n=1$ to K . (Splicing occurs in all the kingdoms or domains of life; therefore, a DNA segment in the spacer will be unexceptionally subjected with. Such splicing is possibly just from the middle of the segments which allow some deviations, slightly different from the intron & exon splicing in eukaryotes. We use colored segments instead of particular sequences since almost all the DNA sequences can follow into this pattern.) We called this vertical splicing and marked with an arrow in the figure. The “splicing number” k which refers to how many levels of splicing will happen depends on the *in vivo* site situation. The “theoretical frequencies” or the “frequencies which follow the Principle of Least Action” are shown in the formula of (**Fig.1g**①). The actual frequencies of each segment will finally compete out a proper RNA template with proper length, frequency and copy number amount on site. With this template, Cas9 will make DNA segments to more spacers. Note, this new sequence is no longer the same sequence which originates it, at least on oscillation frequencies; we call it “eigensequence” (This is not the eigenvalue in quantum mechanics; in that discipline, the linear eigenvector or ground state can’t be regenerated after mathematical calculation. In bio-systems it must be continuously regenerated by the real *in vivo* splicing processes and the driving forces are from the whole *in vivo* system thus no longer linear. Here we just partially borrow the terminology.). From the original segment produces new eigensequence into spacers, we call this process “horizontal splicing”. As in the figure, suppose blue colored segment can get new eigensequences to be put into more spacers, even a new eigen-eigensequence (can be written down as $|eigensequence_n\rangle$) could possibly be produced from this eigensequence under certain conditions. The red-colored sequence can’t get eigensequence, the system will damage it and also remember the pattern for future defense. (We can’t simply say that red-colored segment is invading and blue is belonging to the species. Both blue or red could be invading, just the sequence can produce more eigensequence will be in a higher chance from their own species. The sequence rests on the spacer is a bio quantum path needs z dimensional oscillation

to support the vertical splicing, even later transfer to horizontal splicing still need z dimensional input; therefore life always needs sustaining signals. And in bio-systems only x, y dimensional structures can be inherited, most parts of z dimensional structures generally need postnatal growth recovery.) From here we could see, CRISP/Cas9 or similar is not just an immune system, it is actually a real self-evolution-cycling system. Gene(s) are evolved from palindromes; from vertical splicing to horizontal splicing and get eigensequence based on certain *in vivo* conditions; superposition of the eigensequences is then getting genes. This is a gravity binding process; while the binding of gravity of certain gene reaches a certain threshold, then it becomes inheritable. (As in the model, without enough gravity binding the splicing processes will be fragile and such a gene will definitely be difficult to be inheritable.) We could also understand that bio-systems never use the linear sequence like in our sequencing results to judge a gene; they take the frequency energy (or quantum) spectrum of a gene running inside *in vivo* environment for judgment and issuing functions. Vertical and horizontal splicing from sequence to eigensequence and cycle again if possible is the way a gene *in vivo* activation and cross-generation evolution, and this process deeply concerning with the upgraded Newtonian “motion & rest” concept. Eigensequence will be the rest (stationary) state of the sequence which issue under certain *in vivo* genomic environment, so does $|eigensequence_n\rangle$. We say that CRISP/Cas9 is also an evolutionary system since eigensequences with higher splicing number could possibly establish a system which more complex than the original system which issuing them under the same condition. Such potential if enter into next-generation could accumulate evolution trend if favorable postnatal conditions are acquired. (Take the classic thermodynamics concept, eigensequence will be in a lower entropy state than the sequence which issuing it even if their linear nucleotide sequences are possibly the same. Living beings possess such dynamic eigensequence or ground state regenerating and non-living beings don't. However, we should note that the energy is Einstein's frequency energy, totally different from the indiscriminate energy model in thermodynamics. We should also note that eigensequence can't be separated from the *in vivo* environment which produces it. The eigensequence in one cell goes into another cell, will possibly no longer be an eigensequence due to gravity binding, the new cell needs to take its own system to get a new eigensequence based on the input sequence for functioning. This is why bacteria directly uptake of exogenous genetic materials from their surroundings through the cell membrane transformation or plasmid transfer from other bacteria by sex pili are still need the eigensequence

cycle to adjust binding before finally be incorporated. From bacteria plasmid transfer till the most advanced species such as human sexual behavior always accompanied by gravity loss as in (Suppl.Exp13); that is for reducing the numbers of eigensequence cycle of biomaterials for the receivers. We also can understand “eigen-” from Principle of Least Action, bio-systems need “splicing” for all the process, therefore, “eigen-” means “the least splicing state based on the function”. For any required functions, “splicing” can’t be too much or too less, therefore, the “least splicing action” which just enough for functioning based on *in vivo* conditions on site composes of the “eigen-”. Eigensequence is just “most efficient splicing” at the genomic level based on available *in vivo* conditions. Offspring get better eigensequence not means they could be evolutionarily more advanced than their parents unless the relative lower entropy eigensequences and derivatives can finally narrow δK to the “training improvement” level as in (Fig.1a). From here we could also understand the quiddity of bio quantum path; this path is just the eigenpath or eigenforce in bio-curved space which bio-systems can continuously approach via sustaining signal binding processes. The Principle of Least Action regulates next binding.) From the above facts we could know that people actually have over-prospected for the CRISP/Cas9 based gene editing, besides the widely reported off-targets problems, what put on sequence will continuously subject to certain modifications on site due to the discrepancy between our input sequence and the real “eigensequence”, and also little we can do for it. (Even if we could know the exact RNA splicing sequence of a certain step, while we directly inject RNA with same theoretical RNA linear sequence to the site, the injected RNA will no longer be eigensequence due to Le Châtelier’s effect and diverse other reasons. Dolly sheep is a good example, it is claimed to possess the same genome with the donor. However, due to eigensequence modifications, it is impossible to keep the same genome. It finally only got half of the normal lifespan.) *In vivo* gene regulation is really a physical process instead of a chemical operation, without any physical consideration and just take chemical nucleotide editing is actually quite problematic.

CRISP/Cas9 is the ever known primitive form of immune system. With evolution advancing, the model of horizontal & vertical splicing to superimpose eigensequence model is still not changed. The major histocompatibility complex (MHC) is a set of genes that code for cell surface proteins essential for the acquired immunity in vertebrates. The human leukocyte antigen (HLA) complex is a gene complex encoding the MHC proteins in humans, which resides on a 3 Mbp stretch within

chromosome 6p21, as in (**Fig.1g**④). Antigen presentation is a vital immune process for T cell immune response triggering since T cells recognize only fragmented antigens displayed on cell surfaces. (T lymphocytes can detect a peptide displayed at only 0.1%-1% of the MHC molecules.) And such antigen presentation or cross-presentation (splicing between MHC I and MHC II) process is actually a process based on eigensequences. (Start from earlier bacteria, enzymes always like to attack palindromes, therefore a high chance of leaving asymmetry characteristic segments (palindromic crest part). To advanced species, lysosomes or even animal digestion still keep such pattern, damage the periodical structures in priority and leave the periodical crest part. No matter gene, protein or even cell segments, exogenous non-periodical structure superposed on internal periodical structures will then get the characteristic presentations, especially with more cycles.) In a cell, protein molecules of the host's own phenotype or of other biologic entities are continually synthesized and degraded. Each cycle is actually an evolved process of CRISP/Cas9 eigensequence splicing model we mentioned before. And same with before, this system is an immune as well as an evolutionary system. Just the horizontal splicing processes with enough vertical splicing support have been extended from among- palindromes to among-chromosomes, based on the facts that MHC on human chromosome 6 need horizontally splicing to other chromosomes for producing the complex. (We even can regard the cell with antigen presentation markers as “eigencells”.) The evidence for splicing in immunity can also come from antigenic peptide splicing from different proteins⁴². For the evolutionary trend, the correlation between HMC & sexual selection has been observed in mice⁴³ and the human male-specific region of the Y chromosome is a result of splicing⁴⁴. (It states “a mosaic of discrete sequence classes” is indeed a process of “splicing”, and massive palindromes contain testis genes are quite stronger evidence of the eigensequence model.)

Prokaryotic genes lack exon/intron; in eukaryotes, genes need “RNA splicing” which spliceosomes cyclically spins off introns (3'AG-----GU-5') from pre-mRNA and then matured into spliced mRNA as in top of (**Fig.1h**). In human genomes, the ratio of exons to introns inside genes is average 7.8 to 8.8⁴⁵. And the intron to intergenic sequence is also near 1:1 across animal species⁴⁶. This means splicing processes are just amplified CRISP/Cas9 model with exon/intron occupy around the spacer/palindrome size. A large gene will then covers a lot of palindromes in scale. Alternative splicing⁴⁷ which claimed to potentially result in large numbers of protein isomers is shown in left bottom of (**Fig.1h**). In human 95% of multi-exonic genes are alternatively spliced⁴⁸. *Drosophila*

Dscam is claimed to potentially produce 38,000 isomers⁴⁹ (possibly the highest number in literature) and the purpose of alternative splicing is to “increase isomer number for adaptation”. Now we can see how eigensequences superposing in right bottom of (**Fig.1h**), suppose a DNA splicing into “K” number of exons after removing of introns, then all these exons could be regarded as pro-eigen units with quantum number $n=k$; two of them combined together get a few $n=k-2$ eigensequences; similarly, three of them combined together to get a few $n=k-2$ eigensequences, and so on; as the blue colored segments in the figure. In a gene splicing, which eigensequence is finally activated depends on *in vivo* conditions. If a few genes work together, the eigensequence of each gene can further splice together. (From here we can further understand that eigensequence is different from the issuing sequence on *in vivo* splicing cycle information. Even with the same linear nucleotide sequence, other parameters such as gravity binding, oscillation frequency, distance or amplitude of each nucleotide, spatial conformations, etc., are totally different. For cells or other biomaterials, the concepts “eigen-” are similar, just based on *in vivo* regenerative information. The problem of Car-T technology is in here. The splicing information of cells cultured *in vitro* has already differed with cells *in vivo*, therefore while they are transfused back to the same person will fail to catch the previous cycle and become ineffective. Immunity is directly related to oscillation frequencies or splicing number.) We could then know that among these 38000 potential isomers of *Drosophila* Dscam, only very small numbers of isomers are bioactive. The remaining mRNAs are actually sacrificing for the eigensequences or oscillation frequencies of those few real isomers. (And the few isomer mRNA templates will possibly still experience horizontal splicing, that is going reside on nearby palindromes and then start the new cycles if conditions are met. The reasons why advanced species need more palindromes just because coded genes really need palindromes as “stationary” structures to functioning under certain conditions.) The purpose of alternative splicing is producing eigensequences for next steps instead of “increasing isomer number for adaptation”. Recursive splicing^{50,51} is another type of alternative splicing, for large intron need to be spun off by multi-steps and needs days to finish. Self-splicing occurs for rare introns that form a ribozyme, performing the functions of the spliceosome by RNA alone. tRNA (also tRNA-like) splicing is another rare form of splicing that usually occurs in tRNA. They should be ancient since they are presented in prokaryotes and spliceosomal introns only present in Eukaryotes. Studies from a wide range of organisms show that the intron-exon structure of homologous genes in different organisms can vary widely⁵². More

recent studies of entire eukaryotic genomes have now shown that the lengths and density (introns/gene) of introns varies considerably between related species⁵³. Intron loss is demonstrated to correlate with gene expression^{54,55}. All these evidence have strongly validated our physical splicing model. As mentioned before that quantum superposition needs strengthening and weakening effect to be really effective in bio-systems. Exon/intron splicing is such a superposition, as the wave-shaped dotted line in the upper part of (**Fig.1h**); the exon is in the strengthening part and the intron is in the weakening part. (In conventional molecular biology, cut down introns will become useless things, however, from the model this possibly need reconstructed, cut down introns still influence the future spectrum by Le Châtelier's effect. From here we could understand that without activated by a very general strengthening & weakening effect no genes or eigensequences can be used. Eigensequence is just one of the superpositions of strengthening & weakening part which fit for use in that *in vivo* conditions. Shifting among eigensequences is for recovering capacity. Diverse epigenetic modifications such as methylation should also follow such pattern. Exon/intron strengthening & weakening follows Le Châtelier's effect, we can use Le Châtelier's constant K model for one or clusters of correlated genes (the closer of constant K then the more correlation of the functions):

$$K_{\text{gene(s)}} = \frac{K_{\text{exon1}}^{CN_{\text{exon1}}} K_{\text{exon2}}^{CN_{\text{exon2}}} \dots K_{\text{exon}(n)}^{CN_{\text{exon}(n)}}}{K_{\text{intron1}}^{CN_{\text{intron1}}} K_{\text{intron2}}^{CN_{\text{intron2}}} \dots K_{\text{intron}(m)}^{CN_{\text{intron}(m)}}}, \quad (\text{CN: copy number}) \quad (20)$$

From Eq. 20 we can easily understand the clinical significance of eigensequence, as we see there are copy numbers present. Eigensequence can assure the function of copy number. Tumor cells are due to incorrect eigensequence(s) amplified by copy number, if not cleaned by the immune system will then accumulate into cancer. Caner just tumor cells superposed on a “wrong spinal cord”.

From genomic to proteomic level, beside the immunological splicing mentioned before⁴²⁻⁴⁴, Protein splicing has been observed in a wide range of organisms including humans⁵⁶. This means that the quality of protein structure still depends on a series of quantum or frequency spectrums. We still have to find the strengthening & weakening effect of proteins since it is the origin of Le Châtelier's effect and such effect of proteins should be generally higher than that of genomic sequences. Protein structures range in size from tens to several thousand amino acids. By convention, a chain under 30 amino acids is often identified as a peptide. By physical size, proteins are classified as nanoparticles, between 1–100 nm. (We should note that such nanoparticles are different with non-living artificial nanoparticles. Protein particles contain very higher Le Châtelier's effect which originates from

diverse splicing processes. Non-living nanoparticles lack such characteristics since they don't get any splicing. Some people study the drug delivery by non-living nanoparticles, that's actually quite challenging. Those nanoparticles can pass through the *in vivo* environment freely means they are non-discernable signals to bio-systems. Therefore, even if they can deliver drugs to a certain locality of the body, these drugs still can't be used. Bio-systems can only utilize Le Châtelier's signals, anything beyond that will be no effect. This is why all the biomaterials need splicing processes.)

For proteins, large aggregates can be formed from subunits. All the repeatable units (such as monomer, dimer, trimer, tetramer, etc.), are functional fluctuation structures and definitely need relevant stationary structures either from self or other proteins for functioning. (Following our interpretations of wave-particle duality, any repeatable units need splicing processes to become effective repeats or any repeatable units in bio-systems have already included enough splicing parameters. Peptides folding is a process which makes repeatable units effective. Eigensequences in genomic levels is also due to such reason. Vertical splicing reach certain levels will expand to horizontal splicing, this is a kind of horizontal repeatable units. And while such repeatable units attain a certain level they will accumulate vertical splicing again. The whole process is then to make "repeatable units" become effective.) Structural biology employs techniques such as X-ray crystallography, NMR spectroscopy, and cryo-EM to determine the three-dimensional structure of proteins. Top of (Fig.1i①) is a GPCR structure, bottom shows the quantum mechanics "orbits" and the fundamental crystallography "map" which gets such a structure. With the "map" we can write:

$F(hkl) = \sum_{j=1}^N f_j e^{2\pi i(hx_j + ky_j + lz_j)}$ (The structure factor F_{hkl} is a mathematical function describing the amplitude and phase of a wave diffracted from crystal lattice planes characterized by Miller indices h,k,l. The sum is over all atoms in the unit cell, x_j, y_j, z_j are the positional coordinates of the jth atom, f_j is the scattering factor of the jth atom, as in the figure.) Inverse Fourier transform get:

$$\rho(xyz) = \frac{1}{V} \sum_h |F(hkl)_{obs}| \cos[2\pi(hx + ky + lz) - \alpha_{hkl}] \quad [\text{ref. } f(x) = A \cos(2\pi x - \alpha)]$$

$$\text{or} \quad \rho(xyz) = \frac{1}{V} \sum_h \sum_k \sum_l |F(hkl)_{obs}| e^{-2\pi i(hx + ky + lz) + i\alpha_{hkl}} \quad (\rho, \text{electronic density})$$

$$R = \frac{\sum_{hkl} |F_{hkl}^{obs} - F_{hkl}^{cal}|}{\sum_{hkl} F_{hkl}^{obs}} \quad (\text{obs: observation, cal: calculation}) \quad (21)$$

As mentioned before the problem of classical quantum mechanics is no consideration of gravity. For non-living beings to do so is possibly acceptable in certain ranges, in living systems with 10^9

level of gravity binding, esp. for protein structures that will definitely mean large errors. (Gravity is the sustaining signal of fluctuation, z dimensional will be either gravity or other secondary sustaining signal. Whether the structural biology methods such as crystallization or liquid nitrogen can fix and snapshot the z dimensional oscillation structure is still unclear. NMR or cryo-EM can resolute protein structures in a close to natural conditions without crystallization; however, still fail to consider gravity. Also, for the published structures, it still difficult to know the motion & rest part and where is the sustaining signal or oscillation frequency located, therefore, it is quite challenging to know functions from these “structures”.) This discipline possibly needs quite substantial modifications. The suggested methods could be from the computational stage, such as add gravity binding dimension (the range of the destructive and constructive diffraction should be controlled by gravity and upgraded Newtonian motion & rest concept is needed); setup R of Eq.21 in a range for recovering shifting; or study from the *in vivo* conditions of the protein or from a series of functional correlated proteins, the latter should be fundamental. GPCR is known as seven-(pass)-transmembrane domain receptors(7TM receptors), constitute a large protein family of receptors that detect molecules outside the cell and activate internal signal transduction pathways and cellular responses, as in (**Fig.1i**②). On cell membrane, for a single 7TM the splicing number is 6 (if there are many GPCR on the membrane, the splicing number is 7), then the vertical splicing direction should start from membrane to nuclei successively reduced from n=6, n=5 till n=1, frequency energy transfer from n=6 to n-1 will experience different protein complex, and while this transferring attains a certain threshold, GPCR will extend to other sites on the membrane, this is transfer from the vertical splicing to horizontal splicing(**Suppl.Exp.14**). This is a physical model which chemical or biological processes must comply with. And possibly there is some shifting of structures for GPCR while relocation on the membrane and such shifting will be reflected on the R range of Eq. 21. This is why resolute protein structures need a series of R values or other similar parameters, we yet can’t sampling or engineering a series of sample eigenstates; therefore, have to take a series of R spectrum to understand the eigencycles of proteins. (**Fig.1i**③) show a report about GPCR signal transfer from NMR. Non-linear relationships have been reported, that possibly should fit the “integer function” $^{12}\sqrt{2^{n-1}}$. This can supply side evidence for vertical & horizontal splicing.

As mentioned before, proteins not only have their own stationary structures for local

strengthening & weakening effect but also will finally superpose on spinal cord, that is via homeobox. A homeobox is a conservative DNA sequence 180 base pairs long, found within genes that are involved in the regulation of patterns of morphogenesis in animals, fungi and plants⁵⁸. These genes encode homeodomain protein products that are transcription factors sharing a characteristic protein fold structure that binds DNA. As in (**Fig.1i**④), three alpha helices binding on a DNA chain and the peptide sequence of which is shown in (**Fig.1i**⑤) with a blue frame. (Homeosis describes the outright replacement of a discrete body part with another body part, e.g. antennapedia—replacement of the “antenna” on the head of a fruit fly with legs. The "homeo-" prefix stems from this mutational phenotype, which is frequently observed when these genes are mutated in animals.) Helix 2 and helix 3 form an HTH (helix-turn-helix) structure, where the two alpha helices are connected by a short loop region. The N-terminal two helices of the homeodomain are antiparallel and the longer C-terminal helix is roughly perpendicular to the axes established by the first two. It is this third helix that interacts directly with DNA via a number of hydrogen bonds and hydrophobic interactions, as well as indirect interactions via water molecules, which occur between specific side chains and the exposed bases within the major groove of the DNA⁵⁹. Homeodomain proteins are found in eukaryotes. Through the HTH motif, they share limited sequence similarity and structural similarity to prokaryotic transcription factors. The HTH motif shows some sequence similarity but a similar structure in a wide range of DNA-binding proteins. (One of the principal differences between HTH motifs in these different proteins arises from the stereo-chemical requirement for glycine in the turn which is needed to avoid steric interference of the beta-carbon with the main chain: for cro and repressor proteins the glycine appears to be mandatory, whereas for many of the homeotic and other DNA-binding proteins the requirement is relaxed.)

The homeodomain protein motif is highly conserved across vast evolutionary distances. In addition, homeodomains of individual Hox proteins usually exhibit greater similarity to homeodomains in other species than to proteins encoded by adjacent genes within their own Hox clusters. (This means the horizontal splicing among species has been conservative well than the vertical splicing which refers to the spinal cord evolution, confirmed that x, y dimensions from inheritance and z dimension mainly from postnatal acquirement.) In organisms especially vertebrates, the order of the genes on the chromosome (close to one another in clusters) is the same as the expression of the genes in the developing embryo, with the first gene being expressed in the anterior

end of the developing organism. For all the species always the genes located on 3'-end for head and 5'-end for the end of the body. This is called the collinearity. Homeodomain transcription factors typically switch on cascades of other genes. The homeodomain binds DNA in a sequence-specific manner or in the promoter region of their target genes compose as complexes with other transcription factors. Such complexes have higher target specificity than that of a single homeodomain protein. Homeodomains are encoded both by genes of the Hox gene clusters and by other genes throughout the genome. Humans have over 200 homeobox genes of which 39 are Hox genes⁵⁸. From our physical model, collinearity should come from copy number which originated from the homeodomain binding on a gene network as in (Fig.1i(5)). (Homeodomain can decide the morphology of embryo development; therefore, the gene network they can bind should be thousands of genes. For human beings with 20K coded genes, if 1/3 gets expression in embryonic development, then all should be binding by homeodomain. The conservative characteristics of certain genes in evolution are originated from their constant K binding network size. Homeobox genes are so conservative in evolution, therefore they should at least bind full spectrum of developmental genes, possibly full genomic spectrum. Here we only draw a very small network as a representation.) Such kind of binding will adjust the harmonic condition of the network, as mentioned before (Suppl.ExpL.5) the frequencies of the same level should be equal, in the figure (Fig.1i(5)) for frequency energy we can easily get $gene2_1 = gene2_2$, $gene3_{11}=gene3_{12}$, etc. The protein binding strengthens these harmonic conditions. Also, we could see how CN (copy number) is initiated in a binding gene network. As in the figure, there present four frequency energy flows such as $gene1 \rightarrow gene2_1 \rightarrow gene3_{11}$, $gene1 \rightarrow gene2_2 \rightarrow gene3_{21}$, etc., all could be written down into constant K:

$$K = \frac{\text{gene frequency energy flow finished state}}{\text{genefrequency energy flow starting state}} = \frac{gene2_1 gene3_{11}}{gene1} \frac{gene2_1 gene3_{12}}{gene1} \frac{gene2_2 gene3_{21}}{gene1} \frac{gene2_2 gene3_{22}}{gene1}$$

$$= \frac{gene3_{11} gene3_{12} gene3_{21} gene3_{22} gene2_1^2 gene2_2^2}{gene1^4} \quad (\text{CN of gene 1 is 4})$$

Now we can clearly see where the CN of gene1 and gene2 are come from, just from the normal binding of homeodomains of the gene network. In a large gene network, Hox genes work in the same way. Within the animal kingdom, Hox genes are present across the bilateria⁶⁰ and have also been found in Cnidaria such as sea anemones⁶¹. Following our previous definition of motion & rest, vertebrates should take higher CN of homeobox to express into the spinal cord and control the collinearity of the whole body; lower evolved invertebrates take lower (or no CN) of homeobox to

assure the collinearity. (For fruit fly, mutation of Hox gene can get a leg present on antenna position. However, for advanced species like a mouse, it is difficult to do so. Embryonic stage mutation can only get diverse malformations such as dysmelia, etc., instead of a leg present on the head. That is due to the CN on Hox gene binding. And such evolved CN definitely includes profound strengthening & weakening effect for the whole network. Housekeeping genes should be the major binding albeit inside housekeeping gene sets, there are still further binding.) The increasing of CN of homeodomain bindings regulated by *in vivo* condition can't be unlimited. E.g. 1/3 of 20K coded gene is 6K; suppose there are 6k genes in the human embryonic stage which binding by Hox genes, the helixes' complex can't hold so large a CN of 6k, therefore, degenerate of the CN into binding factors and finally to the spinal cord will be necessary. The spinal cord is the cache for CN, the maximum outward representing CN is 12. (There are 24 vertebrae in human spinal cord plus some fused vertebrae; 7C, 12T, 5L, sacrum and coccyx. In development, there are actually come from two sets of 12 units with 12T insert into another 12 units and separate them into two sets with 7C and 5L. So the maximum number which vertebrae can stably hold is 12 instead of 24. After the CN over 12, it can be further bound by other binding factors. E.g. $12^1, 12^2, \dots, 12^k$, etc., K as parameters bound by different factors. We've already known a lot of transcription factors & coactivators or epigenetic modifications; just need further know how they replace the relevant gene network CN into binding. We should realize that the CNV in bio-systems is different from pure number change; it generally needs enough binding to produce Le Châtelier's effect and pure number shift only happens in a higher superposition region. And Einstein's frequency energy governs all the CNV binding stabilities, no matter they are dominant or recessive. Einstein has written down two types of energies: in the mass-energy equation and in the photoelectric effect equation. The former is just a conventional energy concept and the latter is a conservative energy concept in bio-systems. For bio-systems and the future of mankind, the latter is actually more vital than the former since the energy we use for muscles and the energy we use for brain thinking are the same types of frequency energy just with different frequency. Brain mosaicism mentioned before which refers to the higher CNV comes from the spinal cord. And no matter in which kind of tissues or cells, CNV generally relates to binding network binding stability shifting, no matter such CNV is dominant CN shift which means observable CN shifting or recessive CNV which means only binding factors shifting to "replace" a real CN shifting.) Here is the spinal cord stationary structural binding at the genomic & proteomic

level. (**Fig.1i⑥**) demonstrates the overlap of Hox genes' expression on embryonic stage spinal cord. For stem cell level superposition, the hematopoietic stem cell figure in (**Suppl.ExpL.5**) demonstrates the CN of MPP from that map should be 7 if that network map is empirically correct. The CN of 7 definitely includes much "recessive binding". All other stem cell CNV still follows the same way.

In bio-systems by size, genomic & proteomic levels belong to the microcosmic scope, tissues & organs are in macrocosmic scope, cells are intermediate; they all follow the strengthening & weakening superposition principle and rest on the spinal cord. The fundamental function of the spinal cord is to physically reduce the inner resistance and extend effective superposition. We need to understand what are wastes based on superposition. Conventional chemistry and biology have listed a lot of wastes; those are just chemical or biological significant wastes, physical significant wastes in bio-systems just mean their oscillation frequencies or fluctuation range have decreased to a certain threshold thus can't be utilized by the systems. (Like the eigensequence case, the issuing sequence of it becomes a waste based on this cycle, thus the DNA itself becomes a waste due to oscillation frequency outside the certain range.) Such a concept is different from those in conventional theories. At cell levels, eigencells are those at least with better cytoskeletons (**Suppl. Movie 6.1**) than other cells. A cytoskeleton is present in the cytoplasm of all cells, including bacteria, and archaea. It is a dynamic network of interlinking protein filaments that extends from the cell nucleus to the membrane. The cytoskeletal systems of different organisms are composed of similar proteins. In eukaryotes, the cytoskeletal matrix is a dynamic structure composed of three main proteins, which are capable of rapid growth or disassembly dependent on the cell's requirements. The structure, function and dynamic behavior of the cytoskeleton can be very different, depending on the organism and cell type⁶². Even within one cell, the cytoskeleton can change through association with other proteins and the previous history of the network⁶³. Cytoskeletons compose of the main part of cell bio quantum paths and the major recovering structures of a cell. People unanimously agree that cytoskeletons definitely work in a cluster to issue functions instead of individually. However, lack of a detailed model for such superposition at the cell level; we then have to rely on the macrocosmic ancient physical ligaments & joints training superposition to modulate the cytoskeleton superposition. They are functional counterparts just in different scale; therefore the results are transferrable.

A ligament is the fibrous connective tissue that connects bones to other bones. Beside such true ligament, other ligaments in the body include the: Peritoneal ligament: a fold of peritoneum or other

membranes. Fetal remnant ligament: the remnants of a fetal tubular structure. Periodontal ligament: a group of fibers that attach the cementum of teeth to the surrounding alveolar bone. Ligaments are similar to tendons and fasciae as they are all made of connective tissue. The differences in them are in the connections that they make: ligaments connect one bone to another bone, tendons connect muscle to bone, and fasciae connect muscles to other muscles, also among or inside organs. All of them should evolve from the cytoskeleton, for simple, we just call all of them ligaments based their common properties. There are three important common characteristics of such ligaments; first, they are notoriously difficult to medically repair. Conventional repairs, including grafting tissue from the patient's body, or placing artificial prostheses to replace ligaments, were quite unsuccessful. Surgical suture which routinely applied for muscles, other tissues or even large nervous fibers is ineffective for ligaments. (For any ligament torn, what the doctors can do is only remove the torn part under an arthroscopy and hope for the body self-repairing, impossible to make any stitching or grafting, etc.) Due to their higher constant K binding, any repairing will be theoretically difficult; certain claimed technologies such as artificial ligaments or stem cell repairing of ligaments are only stories on publications. (Ligaments bind tissues or bones; that means their repair need come from all the binding parts instead of just ligaments themselves. A genomic sequence can get eigensequence quickly, a ligament to get its eigenligament for repairing have to take a very longer Le Châtelier's time which impossible for the system, this is the cause of the "impossible" in repairing. Ancient people quite precaution with the protection of ligaments in physical training since they knew from their experience that recovery of a torn ligament is almost impossible. Modern medical sciences have advanced so much nowadays; however, such "impossible" is still not changed. The unrepairable characteristics of ligaments should be applied to the cytoskeleton level. That means cytoskeletons still physically unrepairable, once they damaged or oscillation lower, the only way is immune-clean of the cell.) Second, ligaments are the only anatomical structures in the human body which never get cancer. (CSF is also a structure that will not get cancer; however, CSF is not an anatomical structure, once life is ended CSF will decaying quickly, difficult to exist as an anatomical structure.) Every human tissue includes advanced structures such as brain, eyes, and blood could get cancer under certain conditions, ligaments are the only exception. This means they have the highest recovering capacity among all human tissues. Cancer needs recovering capability for curing. If this common property applies to the cellular level, we could then understand that the greatest difference between a

normal cell and a cancerous cell should be their cytoskeletons. A cell becomes a cancerous cell is first and foremost because of its deformed cytoskeletons or even short of cytoskeletons. Deformed cytoskeleton means their horizontal & vertical oscillation splicing ratio is “divergent” by diverse reasons; refer to (**Suppl. Exp.14**). (From cytoskeleton to fasciae, tendon, ligament and finally superpose on spinal joints to establish a large physical network to shapes the growth, tumor cells just escape the control from the cytoskeleton level. It is the spinal cord shapes their horizontal & vertical splicing ratio. There are a lot of publications to describe the “genomic mutation” of tumor cells. This means without the control of cytoskeleton, the genome of a cell will induce board mutations. Medical sciences shouldn’t try to decipher so-called oncogenes from genomic regulation. It should first find how cytoskeleton regulates claimed oncogenes. Physical processes really govern all chemical or biological processes in a cell.) Third, ligaments or joints at the different part of the body possess profound correlations and they finally superpose on the spinal cord with constant K copy number. Ordinary people can’t voluntarily oscillate their spinal cord; however, ancient ligaments & joints training system can make a person doing so. The method of which is actually strengthening above CN binding. As in (**Fig.1j**①), setup of human hip joints (pointed by green arrows), should joints (blue colored), elbow joints (green and the grey colored), sternum-rib-joint (blue colored), and spinal column joints for opening training as in (**Suppl. Movie 7.1-7.7**). Such training need step by step and follow the sequence, at least three-month-interval between different steps. Every day one thousand repeats for each step then in 3-5 years then the people can finally oscillate spinal column as in (**Suppl. Movie 7.6**). Such training is different from modern gymnastics training. Gymnastics stretch the ligaments to perform various movements and the purpose is not for opening the spinal cord joints. The stretch lengths of the training ligaments not corresponding to the whole body recovering capacity increase. In contrast, the opening of the spinal cord is not fully depended on the stretch and elastic of subordinate ligaments. It also needs transferring oscillations to muscles or bones bound by ligaments to activate diverse cytoskeletons. Without oscillation transferring and only stretch the ligaments can’t finally activate spinal joints. From here we could understand that (**Fig.1g**①②) is really fundamental in bio-systems even for ligaments training. For people who finally successfully open the spinal joints in a good oscillation state have all performed at least one million times of movements of each previous step training as in (**Suppl. Movie 7.1-7.4**), this fact profoundly reveals the oscillation and constant K copy number quiddity of spinal ligaments to other

subordinate ligaments in the body. (Ligaments as the same sort of tissues composed of joints; at different locations of the body, they possess one million training repeats difference, it can only be bound by CN relationships which show as splicing number while active oscillations. As in (**Fig.1h**) bottom right, every gene needs splicing to issue functions; the same gene if get activated will demonstrate a higher splicing level in spinal ligaments than in subordinate ligaments. This also means the eigensequence needs more cycles to fulfill. In classical Le Châtelier's Principle, subscribes only mean molecular number. However, molecules are not rigid and they take "identical particle" models, we then need transfer molecular number into macrocosmic binding copy number.) It could be regarded as the macrocosmic representation of CN of Hox genes' binding, and also a typical model of gene dominant and recessive. If this common property applies to the cellular level we could know that cancerous cells should with deformed cytoskeletons and will no longer follow the constant K binding network. (Note: the number of training movement repeats is not the gene network CN since each movement has already activated a wide spectrum of genes. Just these two numbers have some correlations. Therefore, an estimated 6K copy number on a gene network binding actually need one million macrocosmic ligament training repeats from each of the different steps for activation. This is just a typical condition for people from 18-35 years old normally join the training, for those who get the physical strike training start from born as in (**Suppl. Movie 1.2,1.3**), only takes around 1/4 – 1/5 of training repeats, however, this degenerative training repetitive number is still quite larger than 6K. And it is truly difficult for those over a certain age or involves too much sex behavior to finally succeed. From here we could understand most of the people only activate a small portion of their genes, in a modern society almost no people include those work physically or athletes could run one million times of out-spinal joints to active their spinal joints. Gene dominant or recessive is really a physical process.) The conventional theory just explains gene recessive into chemical allele gene shielding; that theory neglect CN bindings which need to be activated by physical activities. Also, we should note that semiconservative replication is still a non-physical model. The activation of gene functions and eigensequences from the father or the mother side generally shift in a wide range due to CN which difficult to assure equal CN for genes from the father or mother side. The genomic imprinting⁶⁴ percentage should be larger than that reported and belongs to some sort of network binding. Even asexual reproduction and parthenogenesis should be regarded as the simplification of the above range since eigensequences with enough oscillations

should enter into the next generations. Otherwise, offspring even with the same nucleotide sequence with that of the previous generation will lose functional genes in large scale, due to the insufficiency of physical oscillations.) (Fig.1j②③④) are some maps of Hox gene functions, just habitually not realize and write down CN by the authors, possibly need some modifications in the future. (Fig.1j⑤) shows a human spermatozoon; it can reflect spinal binding profoundly. A spermatozoon generally consists of a flat, disc-shaped head $3.1 \times 5.1 \mu\text{m}$ and a tail $50 \mu\text{m}$ long⁶⁵; the tail flagellates the sperm cell (at about 1–3 mm/minute in humans) by whipping in an elliptical cone; the mtDNA present in the mid-piece (10–14 spirals of mitochondria surrounding the axial filament in the cytoplasm) which far away from the nuDNA. We can also easily see from the figure, the oscillation frequency of the nuDNA is different from that of mtDNA while swimming. This is possibly the origin of different of h_{mt} and h_{bio} in frequency energy scales. We refer to spermatozoa here since mitochondria have been used to modulate the spinal functions. (This is possibly the only discussion in conventional biology which refers to the physical functions of the human spinal cord and could offer some clues for h_{mt} modulations.) Let's see some empirical reports, the connection between mitochondria and aging has been verified⁶⁶. Mitochondria concerned with brain & spinal aging and contributed to ALS (Amyotrophic Lateral Sclerosis) which is a disorder finalized in physical strength^{67,68}. Mitochondria concerned with skeleton muscle aging⁶⁹ and motor neuron degeneration⁷⁰ have been confirmed. Mitochondria regulate cell apoptosis⁷¹. All these prove that mitochondria deeply correlate with aging, means they definitely participate in functional gene network binding. As mentioned before, $h_{mt} = \frac{1}{10} h_{bio}$, their participation of binding should at least via frequency energy or even splicing. Also, mitochondria network with neurogenesis in the spinal cord has been validated⁷²; this correlates them with thinking and brain functions. CSF involved with multiple sclerosis^{73,74}. Mitochondria relate with intestinal development⁷⁵. Mitochondrial DNA modulates telomere length⁷⁶. Vigorous phosphotransfer between mitochondria and nucleus has been observed⁷⁷. Mitochondria direct impact on brain function and cognition⁷⁸ by dynamically undergoes shape changing. All these could be evidence for splicing, and strong evidence of deep splicing can be found on mitochondria structures. In humans, a cell contains around 10^3 - 10^4 mitochondria each with 2-10 copies of mtDNA composed of 16,569 base pairs of mitochondrial DNA encode for only 37 genes⁷⁹ which just produce 13 proteins, 22 tRNAs and two rRNAs. In the cells of extant organisms, the proteins present in the

mitochondria (around 1500 different types in mammals) are coded from nuclear DNA (most of them are of prokaryotic origin)⁸⁰. The majority parts of mt-proteins are splicing from nuclear is indisputable evidence of stronger splicing among mtDNA and nuDNA, even shielded by the fact that the coding system of mtDNA is different from that of nuDNA. The strength of splicing which induces a higher percentage of mt-proteins to come from nuDNA is powerful enough to impact on reproduction. Paternally inherited mitochondria have been reported in some insects such as fruit flies⁸¹, honeybees⁸², and periodical cicadas⁸³. And also have been found in sheep⁸⁴, cloned cattle⁸⁵, included a single case in a human male⁸⁶. These reports mean that albeit there is distance between mtDNA and nuDNA in spermatozoa, after instilling genomic DNA to the ovum, mtDNA in the midpiece region will still enter into the gamete later by certain mechanisms. The detection of parental mtDNA⁸⁶ is claimed as an abnormal condition, however, even in human being it can be claimed as an accident, we actually can't neglect the fact that paternal mtDNA inheritance has been presented in the animal kingdom for quite a long time. There are also reports claimed that paternal mtDNA can be detected in the 4 to 8-cell stage⁸⁷ of some abnormal embryos but never sustained till infants after born⁸⁸. If human beings have really evolved some "clearance mechanisms" for the "accidentally" infused mtDNA, then the mechanisms should be engensequence model due to high splicing between mtDNA and nuDNA. And such a clearance manner possibly can't assure 100% clearance under any conditions. If such a "clearance mechanism" is not as general as claimed; then the mtDNA "accidentally" entered into the gamete will very likely to present into the spinal cord. And in the spinal cord, this paternal mtDNA will bind maternal mtDNA or even nuDNA if some conditions could be met. Like in the ancient training, other joints need one million repeats to activate spinal joints; we actually don't know whether the "abnormal" report of the human paternal mtDNA case⁸⁶ is due to lack of proper physical stimuli. (In a binding gene network, if upstream genes can't get downstream genes' signals for a certain period, it will then retrograde or inverse. Like the ancient training, spinal joints need one million repetitive signals from other joints for stimuli. The person in the case probably just needs physical activation to be "normal". Alpha system has been widely presented in animal societies. Alpha male should correlate with paternal mtDNA transferring profoundly, or mtDNA can tighten δk under certain postnatal conditions. Even only consider the evolutionary trend, mtDNA will either function for both parents or retrograde to cease to function for any single-sided parent, less likely to work only from one parent in the long term. Such a pattern is

an evolutionarily unstable model which quite difficult to survival.)

Upgrade Schrödinger wave function into “repeatability fluctuation” harmonic superposition, highest horizontal & vertical transferring structure in bio-systems-----spinal cord

Water clocks are one of the oldest time-measuring instruments in which time is measured by the cascade regulated flow of liquid where the amount calibrated as time. They are the most accurate and commonly used timekeeping devices for millennia until replaced by more precise pendulum clocks. The principle of which is not complicated. As in the top of (Fig. 1k), we put water in a container then drop it. The time of drop out one container of water could be calibration as time. If we add an overflow on the container, the time becomes more accurate since the overflow drops stable the level of water surface under certain environmental conditions. If we cascade a few of such container units, then the time becomes more and more accurate. (The cascade number is not unlimited. Ancient artifacts generally composed of 4-7 cascades, at final container took a floating device for time calibration since it is the most accurate one among a series of containers.) Not only liquid, but electronic circuits are also following similar rules. Nearby the water clock is a simple LC circuit with simple harmonic oscillation ω and f wrote below. (Add R (resistance) into LC just makes the simple harmonic motion into a damped oscillation, will not change the cascade effect too much.) If we cascade a series of such (R)LC circuit units together, we can get more and more accuracy and robust oscillation at the terminal unit. Water clock principle is a natural unbiased phenomenon happened in an open system which can converge periods or oscillation frequency by overflowing. Not just for periods, other parameters such as concentration or even physical force can converge. (One or more chemicals into the first container without stir, then concentration accuracy or mixture uniformity will converge in the final container. And such converge is not due to human stir in the container to make solvent evenly distributed, it is due to entangled environmental conditions combined together via “anti-unitary” processes gradually converge the simple harmonic motions of the system.) This is why under a general multi-parameter-entangled environment, the numbers of effective parameters will not impact on the converge tendency, just possibly influence the converged ratio or required cascade number. (Albeit the water clock is not as accurate as of a pendulum clock, it actually shows commutation time to some degree. That means for a person lives in the same environment with a water clock, if he wants a time with least divergent from his physiological parameters, a water clock

will be better than a pendulum clock.) Water clock clearly demonstrates the “anti-unitary” process we mentioned before. As in the figure, the stability or converge of each level of container or the whole system relies on the overflow leaves the container. There are physical Le Châtelier’s effects among water molecules and water drops; therefore while overflow leaves the container, the system will counteract such change; such general “counteractions” will then converge the whole system. This is the model of an “anti-unitary” or “turnover” stationary process.

Le Châtelier’s effects of living beings will quite stronger than that of a simple water clock; however, the mechanisms are the same. Top right of (**Fig. 1k**) shows some levels of human somatic water clock system. From gut to CSF (cerebrospinal fluid) composed cascade of “anti-unitary” converging oscillations. The central oscillation of each level is closer to ideal simple harmonic motion than that from its nearby lower level. (For human spinal column the central oscillation is located in L4 (4th Lumbar Vertebra) which directly opposite with navel button. In the developmental process, umbilical blood comes from navel to transfer oscillations to somite directly start from here. A lumbar puncture is around here since at far away vertebral locations the CSF release amount will be less. We can see from an experiment to understand the “inseparable” upgraded Newtonian motion & rest structure. (**Suppl. Movie 8.0**) is a chicken after releasing of CSF and not fixed it for a long time; then it will uncontrollably struggle to the death. (I have sampled 7 chickens by an insulin syringe for releasing and intentionally not fixed them, 5 of them inevitably dead. This is not due to hurt the nervous system since that only can make a chicken lame or crippled and not death. For a human the daily CSF production is 500ml and a spinal tap can get only 1-10ml CSF, around 1% of the total amount. This means for a chicken only release 1% of the CSF is enough to kill it if not handling properly. In contrast, to kill a chicken need release at least 80% of the blood. This is due to the higher physical binding of CSF than that of the blood.) The motion and rest structure of a bio-system is inseparable. We release the CSF which composes the most stationary structure of a vertebrate and not allow enough time for the system to recover a new set of CSF & motion conjugation to compensate for the previous damaged set, then the system will inevitably be ruined. For human beings after sampling of CSF, the patient needs to strictly maintain a supine posture for at least two hours and not turn the body. However, even under such medical precautions, implications such as post spinal headache with nausea, etc., are quite usual. (Right after CSF sampling if a human still takes stronger physical activities like the chicken, then the fate will be definitely the same with

that in the movie.) This means that CSF sampling is a physical bio-inertia, gravity binding or lifespan decaying process, without absolute necessity we really need to avoid it. It's not just a blood sampling which not seriously impact on lifespan. The condition for other vertebrates is the same; releasing of CSF means the stationary structure of the animal gets retrograded. Actually not just for CSF, for any binding hierarchy network, the repairing of the damaged upstream structure need compensation from all the downstream structures. (The bacterium is a simple life; plasmid genes are those can bind a larger network from the genome while activated; therefore, removing of a plasmid is difficult to be repaired by the binding network, similar to removing the CSF from an animal. If a bacterium wants to fix a plasmid gene into a genomic gene, it needs a long term evolution which the whole binding gene network gets the opportunity for a stable inversion. The reason we can apply plasmid for editing is also the bacteria themselves need a quite long Le Châtelier's time to repair the upstream genes on a binding network; therefore, difficult to regulate human-edited genes into the principle of least action in a short term, however, diverse endosomes will produce for compensating the system regulation failure. Inclusion bodies in prokaryotes could be regarded as primitive "tumors".) From the CSF experiment, we can understand that "rest" or "stationary" is an inseparable superposed concept instead of an absolute concept. One animal is more "stationary" than another animal; just mean it has more potential to keep tighten δk under same environmental stress conditions than another animal, or the "strengthening & weakening" superposition on its spinal cord possess a larger potential than another animal. For any vertebrates at an early stage, the amplitudes of superposition from every part of their bodies on the spinal cords are quite larger, and such amplitudes decrease with age, while such amplitudes decay to certain thresholds or ineffective superposition attains certain percentage, death will happen. For a young man and a dying old man, their spinal cords are only different on superposition strength from a physical point of view; definitely, such decaying could be accompanied by certain clinical symptoms such as syringomyelia, spinal disc herniation, etc. (Cancer is not just such a senility problem of decaying superposition strength but also established a "deformed spinal superposition".) Senility means the same "strength of superposition on the highest *in vivo* stationary structure decaying" for all bio-systems. Species as simple as bacteria or even viruses still follow the same definition. (**Suppl. Movie 6.0**) shows such a "growing old" model.

Now back to CSF clinical discussion, the human CSF flow inside the spinal cavity is a very clear, colorless body fluid circulates in the subarachnoid space around the brain and spinal cord to

the sacrum, occupies the subarachnoid space and the ventricular system inside the brain and spinal cord. There is about 125mL of CSF at any one time, and about 500mL is generated every day with an exchange rate of 4-5 times a day, quite higher than that of the blood system. CSF contains approximately 0.3% plasma proteins, or approximately 15 to 40 mg/dL, depending on sampling site⁸⁹. In general, globular proteins and albumin are in lower concentration in ventricular CSF compared to lumbar or cisternal fluid⁹⁰. This continuous flow into the venous system dilutes the concentration of larger, lipid-insoluble molecules penetrating the brain and CSF⁹¹. These are stronger evidence of non-homogeneous of CSF fluid or the inner oscillation spectrum with it. The reason that CSF is a very clear liquid is due to higher splicing number or three-dimensional oscillations for all of its ingredients, close to a liquid crystal. The transparency will gradually be opacification due to senility. (Possibly conventional structural biology should study the bio crystals inside the CSF. CSF bio quantum paths bind all the oscillations of somatic and cell membrane proteins to establish a binding network. Without such a high CN binding network model, we really can't understand the concept of "structure".) CSF pressure is a dynamic pressure system different in range with a blood pressure of 80/120mmHG, around 10–18 cmH₂O (8–15 mmHg) with the patient lying on the side and 20–30 cmH₂O with the patient sitting up. CSF pressure determines intracranial pressure with physiological values ranging between 3 and 4 mmHg before the age of one year. CSF moves in a single outward direction from the ventricles, but multi-directionally in the subarachnoid space, physically oscillating with the pressure waves of blood vessels⁹². Some authors dispute this, posing that there is no unidirectional CSF circulation, but cardiac cycle-dependent bi-directional systolic-diastolic to-and-fro cranio-spinal CSF movements⁹³. (**Suppl. Movie 8.1**) is MRI image of blood pulse superpose on brain and CSF region. (**Suppl. Movie 8.2**) demonstrates one period of CSF movement; we could possibly notice the moving Rabi oscillations along the CSF flowing path. (**Suppl. Movie 8.3**) shows the CSF ventricle system deep inside the brain. Bottom of (**Fig.1k**) is an animal comparable developmental map; the embryonic stages of most animals generally morphologically show some characteristics of the previous evolutionary species. E.g. Like a human embryo will still present gill slit stage, like a fish; or a long tail like a reptile, etc. However, we should understand the difference between the human embryonic fishlike stage and a real non-evolved fish. The rest or superposition structures of fishes are their own spinal cords and the superposition structures of fishlike human embryos are their mother's spinal cords. Different in rest (stationary) structures make

these two similar shaped organisms totally different even only consider the morphological parameters and neglect the evolutionary factors, this is possibly one of the significances of the definition of motion & rest concept in bio-systems.

We have discussed some limits of quantum mechanics in bio-systems before. However, still not refer to the definition of “wave function”. In quantum physics, a wave function Ψ is a mathematical description of the quantum state of an isolated quantum system. The wave function is also claimed as a function of the degrees of freedom corresponding to some maximal set of commutation observables. Once such a representation is chosen, the wave function can be derived from the quantum state. Due to this discipline mainly deals with electron superposition, the scale of the “wave function” is still restricted within the subatomic range. Bottom of (**Fig. 1i(1)**) is the dynamic shape of some of the electronic wave functions. If we can modify some conventional concept for it, subatomic “wave function” can then be adapted to macrocosmic scales in bio-systems. In bio-systems, “wave function” is no longer the probability amplitude or the degrees of freedom for certain biomaterials. It is first and foremost refer to a regenerative wave-particle duality which assure all of the *in vivo* bio-materials can mutual transfer frequency energy by means of strengthening & weakening effect superposed on a stationary structure under certain environmental conditions. However, what does “regenerative” exactly mean? We have mentioned to “fluctuation” before, as in the right bottom of (**Fig.1f**) any existence or event happens with enough repeats will fall into a very general Gaussian curve, the more repeats the more close to the curve. This tendency is not only fit for the macrocosmic world, in a microcosmic world it is equally working well. The Gaussian curve is not a flat curve and then it does contain fluctuation(s). So we called it “repeatability fluctuation”, means a fluctuation induced by repeatability under a non-isolated environment. This repeatability is slightly different with what we used in statistics, it is a “regenerative repeatability” based on a system and not the observable “repetitive events” in statistics, a series of waves or particles can both regenerate such a fluctuation with enough repetitive numbers. So we have mentioned before that wave-particle duality must be a “regenerative” property which not concerned with issuing source and also need “interacting system”. In bio-systems, the regenerative processes only happen within the system’s Le Châtelier’s radii and can’t fully occupy the whole *in vivo* range. “Repeatability fluctuation superposed on certain system” is therefore the wave function definition. It is a very general definition which even can also be applied into conventional non-living quantum mechanics: suppose an

electron presents in an atom with the positions: $X_1, X_2, \dots, X_n$, these positions will interact on the system and get certain effects, and the “fluctuations” of these effects will be superposed into wave function, if these effects lack “fluctuations” due to interference or any other reasons then there will be no wave function. Like a human being, at young age body structures superposed on the spinal cord get powerful strengthening & weakening effects and have a stronger wave function, due to senility the strengthening & weakening effects are decaying at old age, then the wave function is also decaying even if the biomaterials are almost the same. What decaying is not biomaterials, it’s exactly the “superposition fluctuation” of biomaterials on the spinal cord. About the decaying of “Repeatability fluctuation”, we even can go back to (**Fig.1d**) for understanding, the friction is spliced out by a repetitive strengthening & weakening path under gravity. While a lot of wave-particle duality superposed together by Le Châtelier’s effect, the system still can be compromised into a strengthening & weakening path to deal with outside resistance. The decaying of the capability for the system to splice outside resistance just means the “strengthening & weakening repeatability” is decaying. In an open system, such “repeatability” is not only come from the system but also partially come from the environment, so it will present “fluctuation” to sustain better in the environment. (Ancient Chinese people based on (**Suppl. Movie 7.1-7.7**) for ligaments physical training is to develop such strengthening & weakening effects on the spinal cord.) From here, the wave function is not just a mathematical description but a real dynamic stationary interacting process. Conventional Newtonian motion & rest concept base on the unitary reference frame, in bio-systems it must base on an anti-unitary or “turnover” stationary structure (compose of series of turnover rates); then it is the wave function. The significance of the ungraded definition of the wave function is that it is also the system “comply with the principle of least action” structure”. Now we can modulate spinal cord.

As in (**Fig.2a**), each vertebra follows an infinite potential well model which CSF running inside it. For quantum mechanics inside the well $V(x) = 0$ or C and outside $V(x)=\infty$, all the CSF “particles” take a “normalized μ ” we just regard it as a constant and inside the well $V(x)$ should be gravitational binding of CSF. (The ingredients of CSF has demonstrated position effect³⁹ which release at different vertebrae get different results. The gravitational binding should also be different at each vertebra which we can measure by the time-elapse of CSF released out at different locations.) Each vertebral barrier is not a theoretical “infinite potential well barrier”, it comes from relevant body structure gravitational bindings outside CSF, therefore with selective permeability. (**Suppl. Movie 8.4**)

simulates the oscillations pass through a vertebral barrier; it is also the quantum tunneling effect in conventional quantum mechanics. It binds all the recovery processes.) The length of each vertebral barrier is written down as $L_{vertebra}$, the bio quantum path period is λ_{bio} . We then can modulate with conventional quantum mechanics (Chu's constant $\sqrt[12]{2^{n-1}}$ can replace n as “integer variable part”):

$$L_{verteba} = n \frac{\lambda_{bio}}{2} \quad (n=1, 2, \dots, n), \quad p = \frac{h_{bio}}{\lambda_{bio}} = n \frac{h_{bio}}{2 \times L_{vertebra}} \quad (p: \text{momentum}, n: \text{integer})$$

$$\text{Then} \quad E_n^{bio} = \frac{p^2}{2\mu} = \frac{n^2 h_{bio}^2}{8\mu L_{vertebra}^2} = n^2 E_1 \quad (22)$$

For 5 lumbar vertebra, $n=1_{1-5}$ (subscript 1-5 means 5 lumbar vertebrae are also 5 sub bio quantum path frequency energy level just bind here to $n=1$); similarly, for thoracic vertebrae, $n=2_{1-12}$ and for cervical vertebrae, $n=3_{1-7}$. (These are “integer” relations, for “integer variable” relations which sustain the former we need $\sqrt[12]{2^{n-1}}$ to take to replace n. On top of (**Fig.2a**), we use equations in blue color for “n” and equations in red color for “ $\sqrt[12]{2^{n-1}}$ ”, they actually in one integrated part. $L_{verteba}$ is just the initial scale, in oscillations every L could be as short as half of the h_{mt} and as long as the whole spinal cord and even to the ventricles under certain conditions.) For human beings, the tail has been fused into the sacrum, so the frequency of sacrum could be regarded as relative zero. The fusing of the tail into sacrum and coccyx reveals the disappearing of spinal joints in this region resulted in the disappearing of baculum for evolutionary trend. Human spinal center locates in the L4 which opposites to navel where the umbilical blood infusing in the embryonic stage, compared with the symmetric pattern of the double-slit in the right bottom corner of (**Fig.1f**), human spinal cord superposition is quite asymmetric, even much more asymmetric than that of an animal with a tail. (For all the bio quantum path set, we just draw them into one splicing number due to lack of software; actually, that should be a dynamically shifting splicing number for every bio quantum path. For the frequency energy curve on the right, we also omit many subordinate “n” since they are in the same pattern. As mentioned before, the spinal cord of a young and an old individual only differs on the superposition strength. On top of the frequency energy curve, we use a rotating coin to demonstrate this. Toss a coin can get one of the two sides; if the coin is rotation means the superposition of these two sides. The more rotation the more superposition energy stored. Collapse just means the coin is fallen down, so a young and an old individual only differs on the rotation frequency energy stored. And such stored energy comes from the whole body in the long term instead of just certain biomaterials.) For all the equations in (**Fig.2a**), if they refer to CSF then use h_{mt} , if refer to the spinal

cord then take h_{bio} . (Inside spinal cord there still mobile phase which should be modulated by h_{bio} with same equations. There is a section of the spinal cord in (**Fig.2a**) on top of the rectangle panel. There are averages 13.5 million neurons inside a human spinal cord, besides neurons are almost mobile phase which follows the same oscillation superposition. Now the wave function of human includes at least 24 bio quantum paths, C_{1-7} , T_{1-12} , L_{1-5} ; these 24 bio quantum paths are only “integer” parts which follow Eq. 22, $E_n^{\text{bio}} = n^2 E_1$; for each “n” there still at least 12 “integer variable” equations, $E_n^{\text{bio}} = \left| \sqrt[6]{2^{n-1}} \right\rangle E_1$, that means totally at least $24 \times 12 = 288$ Eq.15 or Eq.16 to describe the frequency energy of all the “bio identical particles” in CSF since the shifting of phase angle ω of each equation is different. (in CSF, all the protein particles, RNA, hormone, etc., can approximately follow the quantum mechanics “identical particle” model, therefore call this way). Generally, these 288 equations could be simplified into frequencies; therefore, each “bio-identical particle” has 288 different oscillation frequencies to issue different functions. Their combinations can compose of much more binding functions for outside spinal cord networks. (In (**Fig.2a**) the splicing numbers for bio quantum paths should be shifted from 1 to 24, only one type of bio quantum path is shown due to lack of drawing software.) Schrödinger equation is challenging to be applied into bio-systems, once constant k binding over two parameters the equation will lose its linearity (Heisenberg's uncertainty principle could be regarded as the simplest format of constant K binding); phase angle ω shifting will also make the Schrödinger equation quite complicated with many Hamiltonians in one equation. So here for CSF we only roughly modulate the highest CN part. However, the concept of Schrödinger wave function is a great idea for bio-systems even without any Schrödinger equation. (In Bohr–Einstein debates, Schrödinger was standing with Einstein. Possibly still dissatisfied with the Copenhagen interpretation, he studied life in his later year possibly hoped to upgrade this concept. Now we just slightly modify this concept then it will become vital in bio-systems.) The oscillations of all the biomaterials we see can be modulated by bio quantum path locally and holistically. The composition of one or more bio quantum paths will be a new bio quantum path which composes the wave function of them. The CSF we modulate in the figure is the eigenwavefunction for the whole body. For non-living beings, the wave function ψ must be continuous and all its partial derivatives ($\partial\psi/\partial x$, $\partial\psi/\partial y$, etc.) must also be continuous. And since $\int \Psi^* \Psi d\tau$ is the probability density, it must be single-valued. Here single-valued just means we only

have one wave function and there is no eigenwavefunction. (Mathematically, single-valued is for the real part. The imaginary part possesses the conjugation wave. Eigenwavefunction just refers to the real part.) In bio-systems due to constant K binding and non-unitary time evolution, we have to use a bundle of equations as in (**Fig. 2a**) to modulate the eigen wave functions of human beings. Eigenwavefunction means among the wave function shifting spectrum it can get more close to “least action” wave function by certain cycles under certain environmental conditions. Even for a lower evolved single-celled species which the wave function can be simplified into just one bio quantum path, it is still not single-valued and will fall into a spectrum. We must deeply understand that multi-valued wave function is the basis of bio-system recovery capability. The wave function of classical quantum mechanics is one-valued; therefore, it has to claim that once this only wave function is touched then it will collapse into one state as claimed. In bio-systems, if anything only touches the wave function and not the eigenwavefunction, the system can recover this touched wave function based on eigenwavefunction and its cycle. (Touching the eigenwavefunction means simultaneously touch all the structural wave functions, otherwise, if the touch is not full spectrum then the system can recover after the local contact is removed. CSF releasing is a kind of full-spectrum wave function “touching” thus will threaten to lifespan.) In bio-systems the more values of the spectrum between wave function and eigenwavefunction, then the more recovery capability can issue. (**Suppl. Movie 6.0**) is a cell migration model which simplified from (**Fig.2a**), it composes of one eigenwavefunction to govern all the signals into migration. (In this simplified model, the splicing number of the eigen bio quantum path is still shifting, just difficult to demonstrate in the video). We can see outside signal effect can be three types: strengthening, weakening, and fluctuating signal. System approaches to fluctuating signal is still a type of cycle process which establishing eigenwavefunction. Due to the cell migration approaches to “fluctuation” signals, in a certain period it will establish an eigenwavefunction more adapt to that environment, in next period it will establish another eigenwavefunction, and this new eigenwavefunction will generally close to the previous eigenwavefunction (base on splicing number and amplitude of strengthening & weakening effect). Therefore, a series of eigenwavefunctions will close to each other by the nearest “neighbor”. This reveals that this model is not only a cell migration model but also the “memory” model due to such “closeness” characteristics. Eigenwavefunction of a single-celled species will issue “memory” function which memorized the previous states via

strengthening & weakening effect; advanced species evolve to memorize far away states, both are in similar models just differs in the number of phase angles. The memory of human beings is not like that of a computer, each signal occupies a memory unit and the contents of which are not shifting without operation. And also these signals only have logical relations with each other and no splicing relation involved, then no phase angle concerned. As in (**Fig.2a**), any signal once discerned by the system falls on one of the 288 bio quantum paths, it will be transferred upward and downward to all the other bio quantum paths, therefore, any signal no matter how slight will occupy the full spectrum of memory units with different phase angles and splicing number. (Even if not do any operations, the signals on memory units will issue their own eigen-cycles. People recall certain music in a long time after the concert is due to such self-eigen-cycles of memory units, not because of the music still there.) What memorized is not the signal itself; it's this signal's "splicing" relationships with other signal based on the eigenwavefunction, or this signal's oscillation pattern with other signals based on the spinal cord. The structure which functioning for "memory" is definitely the spinal cord and not brain, thinking could be inside the brain, however, memory for all the vertebrates include human being is definitely happening in their spinal cord. Memory is just an advanced physical recovery capability for system superposition states; even a lower evolved single-celled species can "memorize". (In the (**Suppl. movie. 6**) we have stated that "language" just a bundle of oscillation patterns which can be recovered in another individual via the media, both the donor issuing and the receiver recovering are based on the Principle of Least Action. "Memory" is the same sort of thing just both the state in t_1 and the state in t_2 follow the Principle of Least Action for recovering. Memory is part of the self δk binding and language is part of the partner δk binding. ((**Fig.2a**) can be displayed into a video of the human spinal cord eigenwavefunction or "memory" model with 288 or at least 24 layers of stereo wave functions entangled together *in CSF*, and each layer is (**Suppl. Movie 6.0**) with different binding.)

A wave function is not complete bio-inertia. As mentioned before there are "fluctuation" & "stationary" part for bio-inertia, the wave function is actually just the stationary part. This model doesn't mean that an atomic quantum superposition has "memory". Anything that satisfies $|\Psi\rangle = c_1|a_1\rangle + c_2|a_2\rangle$ is quantum superposition. Bio-systems take "harmonic" superposition instead of just a quantum superposition. The term "harmonic" means that any superposition must demonstrate enough "strengthening & weakening" effect for all superposition, time evolution is

anti-unitary, beside $|n\rangle$ part there is still “integer variable” part $|\sqrt[n]{2^{n-1}}\rangle$, etc. Only with these conditions and the new definition of the wave function then it means memory. Without such condition, the wave function is just an oscillation rest or stationary structure. We also need to note that albeit wave function in quantum mechanics is by convention for an isolated system, with the new definition of “variable repeatability fluctuation” it must be present in the non-isolated system. Only entangled with the environment, fluctuation can then be present. In a real “isolated system”, the Gaussian curve will become a flat curve. Only in a non-isolated system, it can be a curve; no matter with a higher or a lower variance δ , it’s a curve instead of a flat line. The right figure of (**Suppl. ExpL. 5**) shows how “repeatability fluctuation” superposes diverse wave functions; electrons pass through the slit(s) then get diffraction patterns on the screen, no matter electron is passing one by one in certain intervals, or pass by any combinations of certain numbers of electrons, once any combinations passing by with enough repeatability, then the diffraction will happen. The slit is a controlled “repeatability unit”, and all these are in the non-isolated environment thus “repeatability” can fluctuate. It is obvious that any events which can reduce the “repeatability” will decay the diffraction and which can enhance the “repeatability” will then strengthen the diffraction. This is the reason why we mentioned before that “duality is regenerative”. Some people took the double-slit to try to show Copenhagen interpretation that “observation or human consciousness causes collapse of the wave function”; we should deeply understand, the factor decay the pattern is absolutely not the “observation” or “consciousness”, it is whether such things or any event else can damage the “repeatability”, if damage then the diffraction pattern disappear, if not, no matter how we observe and how our “consciousness” works, the pattern is there. The quiddity of the Schrödinger wave function is “regenerative repeatability fluctuation superposition” instead of other claims. We also need to clear, even if any wave function can be “collapsed”, the new wave function will then produce from new “repeatability fluctuation”, what eternal in our universe is fluctuation instead of non-fluctuation. Empirically, eigenwavefunction is also the *in vivo* highest gravity binding structure or the *in vivo* gravitational wave which composes the highest recovering capacity in bio-systems. (Gravity can’t be evenly distributed *in vivo*. For non-living beings, the gravitational waves which Einstein described are just the emission part and not the binding part. Now we can clearly understand that the binding gravitational wave in bio-systems is eigenwavefunction. Compare with the Einstein

emission gravitational waves, it is very lower speed. Also, the definition of Einstein gravitational waves, “are ripples in the curvature of spacetime that propagate as waves, generated in certain gravitational interactions and traveling outward from their source.”, still can be modified into upgraded wave function for the binding part, binding gravitational waves just “repeatability fluctuation superposition” based on upgraded Newtonian turnover stationary structures or the whole *in vivo* environment. We also could understand both Schrödinger wave function and Einstein gravitational waves binding part take the same definition, means they are all “regenerative anti-unitary waves” in bio-systems, the *in vivo* transferring manners are still frequency energy.)

The above model is the application of quantum mechanics in biological sciences for the first time. (Structural biology only takes quantum mechanics for electron diffraction patterns and not refers to bio-mechanisms, thus not a real application. All the protein structures issued by this discipline lack the wave functions to understand their oscillations; without any wave function for the protein structures it produced, this discipline is still a “dead-and-alive superposed discipline”). Historically, our wave function highest gravitational binding stationary model has experienced thousands of years of evolution in Ancient culture before finally superposes with modern science.

Eigenwavefunction Le Châtelier’s converging superposition and frequency notation

Following ancient Chinese people’s belief and experiences, any physical training must compose of two parts: stationary training and fluctuation training to mutual interaction and attain a higher level. Almost all of the modern sports are lacking stationary training. (Gymnastics which evolved from exercises from the ancient Greeks that included skills for mounting and dismounting a horse includes a little bit stationary training.) Stationary training increases the stability of the anti-unitary or turnover structures and the ever known highest stationary structure is CSF, ancient Chinese people’s belief includes sets of technologies to add CSF training into ordinary physical training(Wushu), or to strengthen the CSF-ligament conjugations. Anatomically, synovia directly comes from CSF; serous fluids permeated on the surface or inside of diverse fasciae and tendons are CSF derivatives; there are also a lot of CSF derivatives. (Fig.2b⑩) shows the contents of an egg; on the edge of the egg albumin we can see some thin albumin, all the CSF derivatives are developed from here. We could understand, for cytoskeletons there should be similar structures and functions. Even trackback to bacteria, CSF should be evolved from palindromes. Previously we mentioned that

the physical training in **(Fig.1j①)** need one million repeats to open the spinal joints, that is actually for developing such CSF to palindromic correlations. Such kind of correlations is very weak for untrained or old people; for correctly trained people such kind of correlations is very stronger, and such kind of stronger correlations is based on the tightening of δK to comply with the Principle of Least Action. Therefore, we can simply call the training concerning the CSF-ligament conjugations as the “(constant K) converging” training. For older people, their ligaments are quite stiff, that is simply because CSF derivatives can no longer reach diverse ligaments, or constant K can no longer tighten enough to issue CSF-ligament conjugations. (Ligament training issues strengthening effects and CSF (or stationary) training issues weakening effects, based on constant K converging.) Whether certain physical training can benefit health is still whether it can strengthen the CSF-ligament conjugations while training. Due to the lack of effective stationary training, diverse modern sports are not fit for people over a certain age or after physical higher performance age.

The only converging training in modern society is the squatting training in body build as in **(Fig.2b①)**. Those who difficult to get muscular results can first train this way to converge the constant K and then take a normal body build training to get good results. (However, a warning is that this training must be started at an earlier age, if starting over 28 years old or so, it will not only quite difficult to get converge effect but also will damage knee joints and lumbar joints.) It is still not a real stationary training; we call it “modern converge training” just because it is the only one that can get some similar CSF training effect as that of an ancient stationary training. **(Fig.2b②)** shows a jade artifact from Shang dynasty (1250 -1046 BCE) with a kneeling posture. (The device in the waist is an official scepter at that time.) It is the earliest physical stationary training recorded on artifacts, possibly originated from people mimic fetal posture in the womb. In that time it is not just for personal training; all people in society from the public to the emperor took this posture for all social & family activities, even horse wagons were designed for this posture. Tatami culture in Japan actually transferred from China in Tang dynasty (618 to 907 CE). In China, this social posture was kept till the end of the Qing dynasty (1912 CE) and after that gradually lost. However, today’s Japan still keeps this tradition well than that of its original place---China. (Japanese people averagely the most longevity people in the world are because of this posture and their Tatami. China really should recover this tradition; it can make use of daily life for physical training time.) It is difficult to find from Jiahu symbol till Sang dynasty, what is the exact time of this posture began to use, who

invented it and how it became prevalence. We only know it has been the secular basis of physical stationary training for thousands of years. Later, we'll refer to some other advanced converge training; however, those later postures require partial or full religious forbiddance, only this posture is an exception. The significance of the invention and prevalence of this posture in ancient China should not be inferior to the invention of the wheel in the history.

Another posture of (**Fig.2b**②) is the basis of all sect physical training. (This posture needs two soles to face heaven, much more difficult to train than that in (**Fig.2b**①)). In Wudang, it generally needs 3 years to gradually upgrade the secular posture into sect posture. "Sect" here not necessarily means religious; any (commercial) groups or even academes with certain inner regulations are also sects; religions are just small part of sects. The time of posture should be well before the establishment of Shaolin.) The converging function of (**Fig.2b**②③) is more advanced than that of a squat. In ancient time there are also diverse Wushu (the skills for use diverse ancient weapons) training which same with diverse modern sports required strength and speed, etc., from part instead of whole body; also same with modern sports they will not benefit health after certain ages or high-performance stage, people then interweave (**Fig.2b**②③) with Wushu training to reduce such negative effect. (This is the origin of kungfu, just Wushu or sports mixed with (**Fig.2b**②③)). There are hundreds of recorded sects in history rely on such level one kungfu training as professions.) We can see that while people are in the postures of (**Fig.2b**②③), the blood circulation for lower limbs is in stress conditions. CSF with the higher recovering capability will then compensate for the suffering of lower limbs; this in return can strengthen the stability of CSF and spinal cord in the long term. In modern time, people in kungfu training generally take two hours of such postures daily, in ancient time it will be much longer than this. For people at an advanced level, they can keep the postures for a few days; means CSF or wave function can pass through the ligaments into bone marrow and attain the foot toe joints. For untrained people, CSF or wave function only in the spinal cord and brain; such "stationary training" can make CSF or wave function attains all part of bone marrow. This is the biological significant why both stationary and fluctuation training are necessary. We also can understand CSF wave function from quantum mechanics; CSF has been modulated by the infinite potential well model in (**Fig.2a**). Following this model, CSF can oscillate out of the spinal region by quantum tunneling effect under probability. Classical quantum mechanics uses probability since it doesn't realize the effect of gravity, and its wave function actually only fit for the

region where gravity uneven distribution can be neglected or where the Schrödinger equation is still linearity. In bio-systems, with 10^9 levels of gravitational binding, the CSF or wave function has to be steering by gravity binding. The gravity binding most close to the spinal cord region is in diverse bone marrow regions; therefore, under stress condition CSF or wave function will first permeating into the bone marrow regions nearby the stress. It is the prior path of CSF; and in some part while “emergent” (such as a wound, disease) higher recovering capability required, CSF also strength. (Physical strike can greatly increase such “emergent” path.) Old men especially women usually get varicosity. This is a senility problem which CSF derivatives escape from the tibia & fibula bone marrow regions. It can be simply solved by the posture of (**Fig.2b②**). However, to perform this posture at old ages need to start from younger ages and continue to old stages. (The hematopoietic shifting figure of (**Suppl.ExpL.2**) also can give us a vivid scene of the regulation of CSF for bone marrow hematopoiesis. Only in the bone regions where CSF or wave function can reach, the hematopoiesis can be sustaining; if CSF or wave function decays in that region by age, the hematopoiesis will equally decaying thus get the patterns in the figure for non-training people. Ancient physical stationary training can greatly expand the hematopoiesis curves in this figure; the method is just utilizing CSF or wave function steering from the postures of (**Fig.2b②③**).) It is difficult to know the exact time of the starting of the posture in (**Fig.2b③**), and also difficult to know when physical strike technology is starting and prevalent.

The artifact of (**Fig.2b②**) is from the Tomb of Hao Fu. She was the wife of King Ding Wu and also a stronger warrior general, height 1.75m and commanded 13000 stronger male soldiers won a lot of battles. The tomb has been dated to 1200 BCE, at that time Hao Fu as a woman had already got physical strike training. Jiahu symbol stage had already belonged to Neolithic times, before that there was long Paleolithic or even earlier period which physical strike had long been used as a punishment all over the world; people use slaps, fists, whips, rods, etc. to beat the wrongdoers in their tribes or prisoners from the enemy, with at least 2.5 million years of evidenced history. Even today, some of the modern countries still keep the physical strike punishment in their law. It is quite curious why only ancient Chinese people could upgrade physical strike punishment into physical training techniques and all over the world failed to do such an upgrade. (The time of starting physical strike should be some point between Jiahu symbol stage and the Hao Fu Tome.) Also, Japanese people as the earlier branch and later nearest neighbors of China have inherited Tatami culture and ancient

Chinese language pronunciations & meanings quite successful still failed to inherit physical strike technologies. (In Japanese there are substantial Chinese characters still kept the ancient pronunciations & meanings, while in modern Chinese language such things have been evolved for the same characters. The Needham puzzle just wonders why the industrial revolution didn't originate in China. It is not difficult to understand all cultures have their fluctuation periods, no eternal dominance for any culture. However, for the puzzle of the unique upgrading of physical strike punishment with millions of years of history into superior healthy technologies, it is really not easy to understand. Even worse, I've traveled to some western countries and found their laws banned any physical strike on babies. This just means by law their children will lose the most advanced physical training system in the world, their early educations are unavoidable contrary to human evolution.)

Like most of the training, the physical strike will also meet bottleneck after a long period of training. Bottleneck means the CSF-ligament conjugation can't be further strengthened. Shaolin (established in 495 CE) gradually invented the "Shaolin converge" posture of **(Fig.2b④)** to solve the bottleneck of training. After 10-15 years of diverse physical strike training, people can gradually take this posture by procedure; everyday daily 1-2 hr then mixed with normal strike training, then after 5-8 year can increase the physical strike strength at least 20 times, also diverse other performances are equivalently improved. We can see the equation on the top of the figure, increasing of L_{vertebra} will decrease the E_n of each level; that is converging. The converging of the spinal cord transfers to the whole body, then all the quantum levels from genomic to organs are also converged. Converge will result in a narrow δK thus expand the bottleneck boundary. **(Fig.2b⑤)** is the "Wudang converging" stationary training for the bottleneck stage, need to sustain the body weight by the back head and the heels (Sanfeng Zhang was born in 1247CE, studied in Shaolin at youth and later establish Wudang sect.). **(Fig.2b⑥)** is similar just take the hanging method. Such training is a stationary training; therefore, must finish N=1 to N=6 training in **(Fig.1j①)** and successfully open the spinal joints first as fluctuation training, then can start; generally start from 12-18. The ancient book said the highest level of this kungfu can support three persons on his abdomen for two hours while in posture, however, nowadays only find those can support one person as in **(Fig.2b⑦)**; therefore, put this photo. As we see the bio quantum paths in **(Fig.2a)**, this posture increases the resistance for z dimensional oscillations; therefore, increases the transferring from x, y to z and also converges the spinal cord since this posture evenly distributes on all vertebrae, the converging effect

is much better than that in (Fig.2b④). (Use a ruler to measure a people in the posture of (Fig.2b④), each cervical vertebra can observably stretch 3-5mm, however, the thoracic and lumbar vertebra not observably shifting to over 1mm.) Wudang (Taihe) becomes the only level-three ancient physical training is due to the posture of (Fig.2b⑥) for spinal training, finalized in 590 years ago (Suppl.ExpL.8). (Fig.2b⑧) shows the sampling of CSF in modern times; the blood is just from peripheral tissues and not from CSF. Start from earlier development, CSF has been separated from the blood. (Fig.2b⑨) is the needles for sampling CSF and a textbook instruction for CSF sampling. These can offer side evidence for the ancient model so put here. (Fig.2b⑩) reveals the developmental origin of the spinal cord CSF and derivatives. In summary, kungfu is a physical training system concerning body CSF-ligament conjugations, quite different from diverse other ancient or modern sports not realized such conjugations. (The strength any person can physically issue doesn't depend on how stronger his muscles are, it depends on the harmonic of CSF-ligament conjugations. Muscles need superposition on the spinal cord to issue physical strengths; stronger muscles first need lower "inner resistance" from the CSF-ligament conjugations to efficiently issue. Kungfu is such a set of training for the CSF-ligament bio-inertia conjugations. Senility is the weakening of such conjugations.)

We have mentioned commutation time in bio-systems before. However, the commutation concept in bio-systems is still not the same as that of quantum mechanics. In quantum mechanics, the commutation is generally referred to as $[\hat{x}_i, \hat{p}_j] = i\hbar\delta_{ij}$, such operator relation can't include binding or such a mathematical tool itself is for the exclusion of constant K binding. If commutation happens in two operators each with a binding network, some inversions will have to occur, and the mathematical definition can't be used. Wave-particle duality is a kind of regenerative duality, time commutation is also a regenerative inversion process. Inversion is actually much more abundant in bio-systems, albeit only developmental inversion¹³ is reported. To understand biological or time commutation, we have to go to some musical tools. (Fig.2c) shows the fundamental formula of 12-TET which we have mentioned before in quantum superposition, $f_n = f_1 \times \sqrt[12]{2^{n-1}}$; f_1 has been set as 440 Hz since 1955 ISO norm. Before that standardization, historically diverse other frequencies 20-30Hz up or blow 440 Hz had also been used for centuries. A440 means the No.49 key of a piano is tuned into 440 Hz, then all the frequencies of each key can be calculated by the formula,

E.g. the No.50 and No.52 key is $440^{12}\sqrt[12]{2^1}$ and $440^{12}\sqrt[12]{2^2}$, if the f_1 is tuned as 432Hz then they become $432^{12}\sqrt[12]{2^1}$ and $432^{12}\sqrt[12]{2^2}$. Not only an 88-key or 108-key piano is turning in this way but also include all musical instrument. Since there is only one f_1 we omit it and just write down the Chu's constant $^{12}\sqrt[12]{2^k}$ in the C major staff notation on the top of the figure. They multiple with f_1 can get the actual oscillation frequencies of each pitch. The left hand of the figure is a simple harmonic frequency level of a C major scale. The scales for any kind of musical systems are never evenly distributed, as in the figure for a C major, each note equal to 2 frequency levels and those between pitch E - F and B - C_{octave} are only one frequency level. We call these positions as “converging” regions and marked with red color in the figure. The musical tone just means the position of such converging regions in a scale. (If the converging regions fall on E - F and B - C of a scale then it is a major tone, if they shift two levels to D - E and A-B then it becomes a minor. Historically there still many other tones, now only major and minor are still in use. In bio-systems, the regenerative scales and chords could be more complex than these in music; however, the mathematical patterns are the same. For simple, we only use major & minor triads in the examples of this paper.)

(**Fig.2d①**) are some of the most commonly used chords. Music is based on the scale as in (**Fig.2d②**), combinations of part of the scale are chords. (In (**Fig.2d②**), the scale has been transposition just for the convenience of illustration. “Transposition” is a fundamental technology in music which can be defined by the mathematical operator, $\left|^{12}\sqrt[12]{2^{n-1}}\right\rangle + k = \left|^{12}\sqrt[12]{2^{(n-1)+k}}\right\rangle$, here k, n are integers.) Chords can range from triad till thirteen chords which possess diverse inversions, as in the figure for a triad the root note jump for an octave get the first inversion; the note above the root jump for an octave then get the second inversion, and so on (E.g. C-E-G first inversion $\Rightarrow$ E-G-C_{octave}, second inversion $\Rightarrow$ G-C_{octave} - E_{octave}). Here any note “jump for an octave” means its oscillation frequency is doubled, as in (**Fig.2d②**), frequency of C_{octave} = 2C. (For bio-systems DNA, RNA or cells, etc., inversion takes the same model, if a few genes binding together by a constant K with certain oscillation frequencies, then one of the frequencies double will get one type of inversions. In CSF, the movements of certain peptides, RNA, mtDNA, etc., only depend on their frequencies, so CSF is the highest inversion structure of bio-systems. Previously we have mentioned a concept of “turnover stationary structure”, actually, “turnover” must depend on “inversion”. Senility is simply the weakening of CSF inversion capacity by certain reasons; therefore, equally lose “inversion”

capacity or “time commutation”.) Any note has its strengthening & weakening effect while running in a melody, accompaniment just compensates for the strengthening & weakening effects of each note in a melody. Accompaniment of a melody by chords can have different “splicing number”, as “columned chords” in **(Fig.2d③)** (splicing number =1) or “arpeggio” in **(Fig.2d④)** (splicing number = k), here the columned chords and the broken chords are just different in their melody strengthening & weakening effect binding.) To facilitate the application of Einstein frequency energy and harmonic superposition in bio-systems, we can transfer conventional staff notation into frequency notation by the manner in **(Fig.2e①)**. **(Fig.2e②)** shows the scale frequencies used for transferring (omit f_1 440Hz). **(Fig.2e③)** and **(Fig.2e④)** are the transferred frequency notation come from staff notation in **(Fig.2d③)** and **(Fig.2d④)** respectively. This notation system can directly use for playing the piano and composing music, outstanding in children early education for music and math, no need of any accidentals (the non-note symbols in Maj/Min^{7#9} of **(Fig.2d①)**); accidentals are used for keeping the same converging in inversions for staff notation) and people can quickly perceive the composing skills of great musicians like Beethoven without decades of training in a musical school, etc. However, the establishment of this system is not for such musical impacts; it is for real applications in bio-systems and quantum mechanics. In music just one f_1 of 440Hz, in bio-systems there are possibly a few f_1 frequencies such as $f_{1\text{-DNA}(360\text{bp})}$, $f_{1\text{-RNA}}$, $f_{1\text{-stem cells}}$, etc., or even just for a 360 bp segment DNA there is more than one f_1 , however, no matter how many f_1 are existing and how complex the system, the structures of biomaterials will not be changed, here the structures just mean the regenerative converging positions will keep the same. (In the future, possibly most of the publications in biological sciences will have to take a format with this kind of notation combined with biomaterials (DNA, RNA, epigenetic converge, cells, tissues, organs, etc.) to express the ideal bio-system conditions.) From the right hand of **(Fig.2f①)**, we can see that music converging point represents the frequency energy ideal Le Chatelier's process. From C to C_{octave} the frequency is doubled and system Le Chatelier's effect will counteract this change, then the frequency energy step for the converging point is reduced to the half of a normal step as the ideal result. In “major” tone, the direction of the E-F converge should be reverse to C-C_{octave} shifting direction. Music as a discipline with thousands of years of history is just developed by arranging the Einstein frequency energy ideal Le Chatelier's effect in advanced for composing. Music tonality reveals to us how the ideal frequency energy Le Chatelier's effect means. Bio-systems should be complicated than

those of a musical system; however, the concept of ideal frequency energy Le Chatelier's converge is absolutely the same. Therefore, we can practically use the same frequency notation for both of them. For quantum mechanics, the above ideal converging is a “regenerative” process which quantum mechanics fails to describe. The energy levels calculated by quantum mechanics don't include any Le Chatelier's converge. (Albeit music still calculates frequency steps as $f_n = f_1 \times \sqrt[n]{2^{n-1}}$, it doesn't directly use these “steps”; they must “regenerative” to give normal notes two steps and converging position for one step as in (Fig.2f①)). In contrast, quantum mechanics directly uses its calculated energy “steps” from $E\Psi = \hat{H}\Psi$ or $E = h\nu$ and no regenerative and converging process, such a direct utilizing is totally different with “regenerative” utilizing. We have mentioned “repeatability fluctuation superposition” definition before, now we can understand that “fluctuation superposition” is actually “converging superposition” under certain non-isolated environment; “regenerative” is for integrating environmental signal into superposition converging pattern.) Also, the probability of quantum mechanics is actually coming from the lacking of the converging of its quantum superposition. The main focus of the Bohr–Einstein debates is about probability, $E\Psi = \hat{H}\Psi$, energy becomes $|E_n\rangle$, and certain resulted E_k is presented by probability which measurement will induce to collapse into certainty. Quantum state is written down as $\Psi = \sum C_i \Psi_i$, therefore, we can mathematically unlimitedly superposition $\sum C_i \Psi_i$ probability. Bio-systems never take such sort of Copenhagen superposition. If there is a quantum state Ψ_1 and we want to superpose another state Ψ_2 on it, the prerequisite condition is that the regenerative state Ψ satisfies the converging position with ideal 1/2 frequency shifting or musical tonality frequency model. The participation of each Ψ_i must satisfy the above ideal condition continuously splicing with the environment. Such a prerequisite condition needs quite a long time with the increase of “n” and automatically narrows the probability based on the successions of environmental parameters. (Even for composing music without considering environmental parameters the probability is also progressively narrowed. At the start of music there are only a few notes then will available many ways of composing, with the increase of notes the probability of next notes gradually restricted since all the superposition must satisfy the prerequisite condition. For the final part of music, none of the notes can be modified. In summary, quantum mechanics superposition follows “atonal music” and bio-systems follow “tonal music” model. To apply the frequency notation into quantum mechanics need substantial

modification of its superposition from the Copenhagen's superposition into converging superposition. Schrödinger's cat doesn't need time and Schrödinger cat's baby does need time consideration.) Classical music had offered us a lot of great works, with new notation their patterns can be directly applied into bio-systems, far more profound impacts to biology than those from other disciplines.

The left hand of (**Fig.2f**①) reveals the frequency converging positions of each octave are all the same. (**Fig.2f**②) shows some of the commonly used chords written into the cyclic format, with this tool we can see the inversion relations more clearly. In the figure only show one octave, as the first chord C_{major} set $C = {}^{12}\sqrt{2^0}$, then in situ chord is $({}^{12}\sqrt{2^0}) - ({}^{12}\sqrt{2^4}) - ({}^{12}\sqrt{2^7})$, some people call all these ${}^{12}\sqrt{2^0}$ on the root position and other notes shift as in situ, so all the in situ chords should be all $({}^{12}\sqrt{2^0}) - ({}^{12}\sqrt{2^{4+12m}}) - ({}^{12}\sqrt{2^{7+12n}})$; 1st inversion will be the in situ root note double the frequency and the second in situ note falls on the root position, $({}^{12}\sqrt{2^4}) - ({}^{12}\sqrt{2^{7+12j}}) - {}^{12}\sqrt{2^{0+12k}}$; 2nd inversion will be the third note on root position, $({}^{12}\sqrt{2^7}) - ({}^{12}\sqrt{2^{0+12p}}) - ({}^{12}\sqrt{2^{4+12q}})$, and so on, here all m, n, j, k, p, q are integers. We omit other outside layers and only show a C_{octave} . In music, most of the inversions happen in three octaves. However, in bio-systems, the inversion distance (frequency spectrum) could be quite large. The “constant K” or “recovering capacity” we mentioned before is acquired by means of “inversion”. Suppose there are three sorts of molecules or cells like the C_{major} triads binding by a constant K with certain frequencies. (Not every molecule can reach ideal frequencies; however, the eigenoscillation part fits 12-TET frequencies well than other parts.) The movement of these molecules, including pass certain membranes or structures still via inversion. From in situ states, the frequency of “pilot” (root) molecules or cells doubled and pass through certain membranes or structures, get the 1st inversion movement; then the frequencies of the second molecules or cells doubled and pass through the membranes or get 2nd inversion movement, and so on. (De Broglie had suggested a “pilot wave” model for wave function, it is partially correct so we use his term in bio-systems, call the frequency double process as a pilot. We can say pilot RNA, pilot cell, etc., for certain concrete inversion materials. The wave function is not the pilot of running materials; however, eigenwavefunction can pilot other wave functions by inversions.) All the movements of bio-systems running through inversions, no matter CSF movement, blood running, developmental cell migration on the primitive streak, nutrients pass through cell membranes or

absorption from the gut (**Suppl. Exp. 15**), and even memory are unexceptionally following this model. (We have mentioned before there is a stationary Schrödinger equation, actually stationary equation must depend on diverse inversion processes, just this discipline never realizes that.) E.g. suppose there are three peptides binding like a C_{major} triad inside the spinal cord, start from the 4th lumbar vertebra, the frequencies of three peptides in CSF running in this vertebra can be written down as $^{12}\sqrt{2^0} - ^{12}\sqrt{2^4} - ^{12}\sqrt{2^7}$, the full inversion to next vertebra is $^{12}\sqrt{2^{12}} - ^{12}\sqrt{2^{16}} - ^{12}\sqrt{2^{19}}$, then the inversions to all vertebrae can be written as $^{12}\sqrt{2^{0+12l}} - ^{12}\sqrt{2^{4+12m}} - ^{12}\sqrt{2^{7+12n}}$, here all l, m, n are integer. In CSF, there are so many molecules with different inversion frequencies entangled together; therefore, clinically the CSF sampling on each vertebra are different in composition and concentration. The Principle of Least Action just means for all $n, m, k = 1$ to 24, the system shifting remains the “least action”, or follow Le Châtelier’s Principle, the calculation of constant K for all $n, m, k = 1$ to 24 remains the same. (All chords are “regenerative” wave-particle duality which based on the whole system. “Chords” will possibly more complex in bio-systems than those in music, one hundred sorts of molecules’ inversion means the “centennial chord” which far beyond the “thirteenth chord” in music can include. However, inversion mechanisms are the same and still can be empirically written into frequency notation. A “ n ” chord could have “ $n-1$ ” inversions.) Inversions sustain the constant K binding and recovering capability in bio-systems. (For certain components at the early stage can inversion for 24 vertebrae in CSF, at old age, possibly less than 8 vertebrae. Such inversion level decaying will be equivalent to certain constant K or recovering capacity decaying.) For this reason, the time in bio-system is “inversion time” or “commutation time”, the time we usually use is “human calibration time” which we can use the time of certain objects or events to calibration the time of others. (Inversion time is difficult to calibration without attached inversion processes.) While life ended there is no inversion time; however, the human calibration time for the system or the dead body is still there.

In music, any composing skills or operations such as chords fluctuation, accompaniment, counterpoint, etc., must under same tonality or the converging positions of any levels are the same. So for “major” tone music, all the melodies, accompaniments, notes, etc. are belonging to the “major” tone; for “minor” tone music, all the things are belonging to the “minor” tone. Majority of the piece music only has one tone. Small numbers of piece music have more than one tone, such as chapter

one major tone, chapter two shifts to minor tone and chapter three shifts back, etc. However, within one chapter it is impossible to use more than one tone. Bio-systems still take the same way; all the things inside one animal can only take one tone at a certain period. (Animals could have more than one tone in one lifespan; however, in certain age periods could only have one tone.) From here we can understand what is cancer, as mentioned before tone just regenerative converging position. Some of the bio-materials shift out from correct converge positions are carcinogens. E.g. one type of stem cells have certain inversion relationships with the other two types of cells and can be written as C_{major} inversion frequencies as $^{12}\sqrt{2^0} - ^{12}\sqrt{2^4} - ^{12}\sqrt{2^7}$, diverse inversions could be written as $^{12}\sqrt{2^{0+12l}} - ^{12}\sqrt{2^{4+12m}} - ^{12}\sqrt{2^{7+12n}}$ to issue various functions. However, due to certain mistakes, these cells incorrectly become C_{minor} inversion frequencies as $^{12}\sqrt{2^0} - ^{12}\sqrt{2^3} - ^{12}\sqrt{2^7}$, then any types of inversion $^{12}\sqrt{2^{0+12l}} - ^{12}\sqrt{2^{3+12m}} - ^{12}\sqrt{2^{7+12n}}$ will become tumor cells. Cancerous cells are not just certain cells with certain chemical or biological definitions; they will finally physically include wrong inversion frequencies with other relevant cells, as in the case frequency shifts from $^{12}\sqrt{2^4}$ to $^{12}\sqrt{2^3}$ will be tumor cells, the quiddity of which is the shifting of process converging position. The immune system also depends on frequencies or converging positions for judgment; therefore, once immune cells become the same inversion frequency pattern with that of cancerous cells, they will no longer detect and attack the cancerous cells. There are substantial publications claimed Car-T with certain peptidyl or genomic modifications of T cell then infuse back to “kill” the cancerous cells, etc., now we can understand any interference fails to recover the oscillation strength and also the converging patterns of the immune cells will be impossible to kill the tumor cells, the acquired immune cells not only need correct converging pattern (finally superposed on the spinal cord) but also need enough oscillation strength. Dealing with senility problems takes a similar process with that of composing.

(Fig.2f③) shows the elementary memory model. (The memory could be very complex, however, the fundamental pattern just like this which still follows the stability of tone or converging pattern.) No matter how complex of memory, it just uses a small signal to activate a large system, in the process tone or converging position still must keep the same. *In vivo* memory is equivalent to *in vitro* butterfly effect in complying with signal converging position. Butterfly effect still follows the same principle, suppose the butterfly has two types of manner to flap the wings, “major” inversion

signal ($^{12}\sqrt{2^0}-^{12}\sqrt{2^4}-^{12}\sqrt{2^7}$) or “minor” inversion signal ($^{12}\sqrt{2^0}-^{12}\sqrt{2^3}-^{12}\sqrt{2^7}$), then no matter what happens or how complex of the activating system; “major” inversion signal can only activate “major” converge butterfly effect and “minor” inversion signal can only activate “minor” converge butterfly effect. It is impossible for a “minor” converge signal to activate a “major” converge system under any circumstance. This means any amplification can’t change the converging position of the amplified system or the shifting of converging position in an amplified Le Châtelier’s system will greatly decay the amplification level. The strength of the amplification under certain environment strictly depends on the stability of the original converging pattern. In bio-systems, from diverse recovering processes till human memory all observe this principle. We can call this “Basic Law of Evolution”. It is originally from the music tonality. The constant k stability we mentioned before is equivalent to system converging stability. (This is why bodybuilders can perform squatting to enhance the whole-body muscular effects which outside the range of leg muscles and ancient Chinese people developed so many converging training. Modern medical problems such as type II diabetes, atherosclerosis, cirrhosis, organ failure due to AID, and even cancer, etc., are indeed come from converging stability decaying.)

Upgrade Einstein’s space-time mass distribution curvature into $F_{horizontal} / F_{vertical}$ (R_{hv}) converging superposition in bio-systems and binding of gravitational waves

In conventional biology, only developmental inversion¹³ as in (**Fig.2g(1)**) reported, albeit it is so general in bio-systems. And even for this only report, no oscillation frequency is concerning. Such observable inversion is the inevitable result of all the inversions at diverse levels from molecular till system all steering by frequency energy. Avian yolk sac homing we mentioned before is also a higher level inversion. For all the inversions in bio-systems, the driving forces are the gravitational binding we mentioned before. (**Fig.2g(2)**) demonstrates the difference between the horizontal and vertical gravitational forces of two objects. For two non-living objects, both the vertical & horizontal gravitation forces can be calculated by Newtonian equation $F = G \frac{mM}{r^2}$ ($G = 6.674 \times 10^{-11} \cdot \text{m}^3 \cdot \text{kg}^{-1} \cdot \text{s}^{-2}$), then the ratio between the horizontal and vertical gravity should be:

$$\frac{F_{horizontal \text{ gravitational forces between objects}}}{F_{vertical \text{ gravitational forces between an objects and earth}}} = G \frac{m_{ball} \cdot m_{ball}}{r_{ball}^2} / (G \frac{m_{ball} \cdot M_{earth}}{r_{earth}^2}) = \frac{m_{ball}}{M_{earth}} \cdot \frac{r_{earth}^2}{r_{ball}^2}$$

Here $M_{earth} = 5.965 \times 10^{24}$ kg, Average Radius of the Earth: 6371 km, suppose the metal ball is 1kg and the radius is 0.1m, then the above calculation $= 6.80 \times 10^{-11} \approx G$. This means for all the non-living beings at non-relativistic condition $F_{horizontal}/F_{vertical}$ is around 10^{-11} . For living beings, the vertical gravitational force still can approximately use the formula $F = G \frac{mM}{r^2}$ since bio quantum paths can't change the z dimensional signals. For horizontal gravitational force, things become non-linear and quite complicated, even difficult to measure on a generic Cavendish device. The methods in (**Suppl. Exp.6-7**) are just indirect and damaging ways for horizontal gravitational forces between living beings; the result is 10^9 enlargements for most of the available multicellular bio-systems at young stages compare to non-living beings. (For human beings, possibly the horizontal gravitational forces between two lovers can attain upper limit and for two people dislike each other the gravitational forces just attain the lower limit; however, still in the 10^9 enlargements range. We should carefully note that human love or dislike each other is physically based since apples put on a generic Cavendish device could present attractive forces and repulsive forces, even including a small number of apples from the same tree. The explanation is still converging pattern; some apples developed with different converging patterns then present repulsive force. Apples lack brains still present two types of reversing gravitational forces; that means human love or dislike each other is physically based and not fully come from their brains. For single-celled species, we still fail to find the correct way to measure, centrifuge and weight the cell precipitation as in (**Suppl. Exp. 7**) is not a good method. Single-celled species should be quite lower than 10^9 level of horizontal gravitational binding. For earlier forms of life, the binding should be even lower than extant single-celled species. The gravitational binding should be a gradually accumulating process corresponding with evolution. Viruses are generally not regarded as life by conventional biology; however, if correct technologies available for measuring the gravitational binding of single viral particle, it should be quite higher than those of non-living beings; estimated around 10^3 enlargements for most of the viruses including prions since viral infection still equivalently needs gravitational binding.) We have mentioned before a lot of horizontal & vertical splicing in various bioprocesses. The term “horizontal” & “vertical” is not the conventional coordinates; vertical means frequency energy levels increase and horizontal means the spread of these energy levels, from conventional coordinates they can be any directions and only differ in frequency energy levels. (This is the reason

why we need to upgrade the Newtonian motion & rest concept and take the spinal cord as the only stationary reference.) However, we should realize that the fundamental difference between horizontal & vertical in Le Châtelier's system is the "inversion" we mentioned before. We also need to note that both horizontal and vertical are include board binding; therefore, it not just a ratio. It is the "axis" for various bindings and inversions. (Inversion model only exists in music and ancient hexagrams system, even for some of the other disciplines such as arts besides music which the main driving forces are also inversions, still failed to show any inversion model.) In the scientific world, those closest to the inversion model are Schrödinger wave function and Einstein's gravitational waves, just need some final upgrading. (We mentioned before a frequency notation, in a Le Châtelier's system while vertical frequency energy accumulated into certain levels there will inevitably present inversion processes under certain environmental conditions. Our frequency notation is for describing those inversion processes.) The energy levels which calculated by quantum mechanics, $E\Psi = \hat{H}\Psi$, actually should include board inversions, just this discipline has never realized that and then interpreted them into probability. For Einstein's gravitational waves, as mentioned before the holistic horizontal & vertical splicing at diverse levels in the whole bio-systems decides the binding of gravity. The less difference between the horizontal & vertical gravitational forces means the more binding or splicing. Senility is just a process of decaying of the gravitational binding (microcosmic) or the $F_{horizontal}/F_{vertical}$ ratio (macrocosmic) in bio-systems. In advanced species including human beings, even for an old dying person estimated there are still 10^6 enlargements of gravitational binding; just after death the $F_{horizontal}/F_{vertical}$ ratio of the corpse will retrograde back to 10^{-11} . Einstein calculates the space-time curvature R by mass distribution, in bio-systems for a small *in vivo* scale, $F_{horizontal}/F_{vertical}$ becomes "curvatures" which Einstein described. (We can no longer take mass to calculate curvatures and light velocity c has to be replaced by oscillation amplitude for reference which mentioned before in Eq.12 and Eq.17.) Einstein's gravitational waves model is still a horizontal-vertical transferring system if we can make above modifications and also reduce the astronomical scale into a small *in vivo* scale. Following his describe under approximation conditions, metric tensor $g_{\mu\nu}$ can be written as Minkowski metric $\eta_{\mu\nu}$ and a tiny perturbation $h_{\mu\nu}$ for spacetime geometry: $g_{\mu\nu} = \eta_{\mu\nu} + h_{\mu\nu}$, input into Einstein's field equation in the vacuum: $(\nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2})h_{\mu\nu} = 0$, then get the quadrupole of gravitational waves:

$$h_{\mu\nu}^{TT} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & h_+ & h_\times & 0 \\ 0 & h_\times & -h_+ & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} e^{-i\omega(t-\frac{z}{c})}$$

This equation means transverse space-time distortions induced by the acceleration of mass can be propagated at the speed of light like ripples. Mass and energy can be transferring each other and the more acceleration of mass the more gravitational waves. There are two polarizations, plus (+) and cross (×). (**Fig.2g③**) shows the quadrupole polarization with blue colored rings. There is a ring of test masses with radius L on xy plane responding to wave propagating along z , space stretches and squeezes while gravitational waves transverse this ring and it will become an ellipse with the major axis & minor axis as " $L + \delta L$ " & " $L - \delta L$ ", respectively; then $h_+(t) = \delta L/L$, the direction of distortions $\delta L/L$ orthogonal with gravitational waves' propagation vector. (In bio-systems the coefficient matrix of Eq.16 is a triangular matrix, so only h_+ and no $h_\times$ polarization.) From here, the origin of gravitational waves still unavoidable includes fluctuation, $L + \delta L$ & $L - \delta L$ is a kind of very general "fluctuation". Just this model needs astronomical scale and mass to work since $\delta L/L < 10^{-21}$. (We can notice the item $t-z/c$ which the c needs to be transferred to amplitude in bio-systems.) Adapting in bio-systems, the infinitesimal item $\delta L/L$ evolved into relative huge z dimensional oscillation amplitude/input, we then get bio quantum path. (Bio quantum path is from the experiment in (**Suppl. Movie. 3**) and not from here, at the beginning few years of writing down bio quantum path I even didn't know the concept of gravitational waves, just years later serendipity such correlations.) The scale of δL in bio-system can range from microcosmic (should $> h_{mt}, h_{bio}$) till macrocosmic (around a few vertebrae or the whole spinal cord size), $\delta L/L$ is therefore equivalent to $F_{horizontal}/F_{vertical}$ ratio at diverse levels from genomic till spinal. For this reason, we can use R_{hv} to replace $F_{horizontal}/F_{vertical}$ as curvatures. (Here R_{hv} is the R in Einstein's field equation $R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} + (\Lambda g_{\mu\nu}) = \frac{8\pi G}{c^4}T_{\mu\nu}$ adapt in a small bio-systems. Einstein's field equation is no longer fit for bio-systems; however, the concept of R_{hv} with fluctuation quiddity is still transferrable. Einstein's gravitational waves are the energy difference between curvatures which express as $T_{\mu\nu}$, due to $\delta L/L$ are so small they are challenging to be measured. However, while infinitesimal $\delta L/L$ is enlarged so greatly in bio-systems, the macrocosmic measure will not be that difficult, the difference between the ideal R_{hv} or statistical data and the actual measurement R'_{hv} is

therefore the gravitational binding in bio-systems. From here we could know, not only the binding part of Einstein's gravitational waves has changed significantly but also the emission part should be quite different from what described before. For microcosmic measurement of R'_{hv} of each biomaterial, it is not easy since we can't separate the gravitational binding of a gene, a protein or a cell from their *in vivo* environment; however, inversion tools can offer judgments for ideal states or minimum inner resistance states among diverse biomaterials.) The relative conservative of frequency energy (different with indiscriminate energy conservation) could also offer some alternative ways as:

$$k_{process} = \frac{(R_{hv})_{spinal \text{ after process}}}{(R_{hv})_{spinal \text{ before process}}} = \frac{(R_{hv})_{CSF-ligaments \text{ after process}}}{(R_{hv})_{CSF-ligaments \text{ before process}}}$$

$$= \frac{(R_{hv})_{gene \ i-after}^{CN \ i}}{(R_{hv})_{gene \ i-before}^{CN \ i}} \cdot \frac{(R_{hv})_{RNA \ j-after}^{CN \ j}}{(R_{hv})_{RNA \ j-before}^{CN \ j}} \cdot \frac{(R_{hv})_{protein \ k-after}^{CN \ k}}{(R_{hv})_{protein \ k-before}^{CN \ k}} \cdot \frac{(R_{hv})_{cell \ l-after}^{CN \ l}}{(R_{hv})_{cell \ l-before}^{CN \ l}} \dots\dots \quad (23)$$

(Here “.....” means possibly other binding. R_{hv} is the “empirical” bio-inertia, refer to (**Suppl. Movie 7.42**) for ancient physical training which directly binding gravity from horizontal & vertical transferring, such transfer is gravitational binding. This is a macrocosmic observation. For microcosmic measurement in Eq. 25, K is from Le Châtelier's process; CN, copy number, i, j, k, l , series of integers of subscripts of genes, RNAs, etc., which concerning with the process.)

$(R_{hv})_{spinal \ cord}$ can be roughly measured by some generic Cavendish designs or even physical strike calibration method, the damaging way in (**Suppl. Exp. 6-7**) can use for ranges. Microcosmic measurements have to be estimated from the equation. This equation reveals what governing bio-systems is no longer energy conservation, Principle of Least Action (δK) and Basic Law of Evolution (converging pattern stability which established by diverse inversions) “conserve” this equation. In contrast, conventional physics is fully governing by energy conservation; mass & energy are transferable. In bio-systems, what transferable are signal & oscillation, mass only belongs to corpses and difficult to be transferred to “frequency energy”.) We could also understand even for non-living beings, classical Newtonian gravitational formula under non-relativistic conditions should still include “fluctuation” due to fluctuation is so general in our universe, then we could get two types of gravitational forces, F_+ and F_- as following (apple experiment could offer evidence):

$$\begin{cases} F_+ = G \frac{mM}{r^2} + \frac{\delta L}{L} \\ F_- = G \frac{mM}{r^2} + \frac{\delta L}{L} \end{cases} \quad (24)$$

Eq.24 is slightly different from what on the textbooks. This means the gravitational balance is a

kind of “fluctuation” or oscillation balance. (If gravity is not an oscillation balance, life doesn’t possess so much gravitational binding by evolution.) In Eq. 24 according to Einstein’s description $\frac{\delta L}{L} < 10^{-21}$; however, even under non relativistic conditions we can’t simply say that for non-living beings $\frac{\delta L}{L} < 10^{-21}$; since while a non-living being is nearby a living being the item $\frac{\delta L}{L}$ could be enlarged greatly, especially when it participated into the metabolism. Like salt in food is regarded as non-living being, while eat and digest in the gut, it participates in the spinal cord converging establishment. At such condition, $\frac{\delta L}{L}$ is enlarged and close to other *in vivo* biomaterials. Even not considering such metabolism condition, just for two non-living objects on a generic Cavendish device, a nearby animal will impact on the gravitational interaction (no air disturbance); that means the $\frac{\delta L}{L}$ is enlarged, thus in Eq.24, $\frac{\delta L}{L}$ is not fixed even for non-living beings. Quantum mechanics has already closed to such kind of oscillation gravity, due to lacks “converging superposition” then fail. Life evolution is the geological growth of the fluctuation item: $\frac{\delta L}{L}$ into the bio quantum path.

We have defined Schrödinger wave function as “repeatability fluctuation”, the binding part of Einstein’s gravitational waves still can use the same definition, just the “repeatability” need come from the superposition of horizontal & vertical gravity; life evolution is to enlarge horizontal gravity to increase such “repeatability”. Under this definition, Schrödinger wave function or Einstein’s gravitational waves become the same things in bio-systems. (About Schrödinger wave function should include gravity; it still could be verified by quantum entanglement. Previously we mentioned experiments should on different planets. Now alternative way could be on Earth; for two pairs just one on Earth polar location and one on the equator is likely to show Bell's inequality, then prove that Schrödinger wave function should include gravity.) However, no matter Schrödinger wave function or Einstein’s gravitational waves have included board inversion processes. (Inversion is a phenomenon more general than any other processes that have been described by conventional physics, Life has depended on it for evolution billions of years ago; in contrast, diverse industrial devices born from Newtonian theory have only presented on Earth for centuries, other devices & theories are younger than that of the Newtonian system.) For the frequency notions in (**Fig.2e**②,③), just to show where are the original frequencies come from we don’t make any mathematical simplification. Now we can do some simple math, as the highest and lowest frequencies in those two

pieces of music are $^{12}\sqrt{2^{22}}$ & $^{12}\sqrt{2^{-29}}$, we then can simplify them into $2^{12}\sqrt{2^{10}}$ & $4^{12}\sqrt{2^{-5}}$, all the notes can take this format. The power over 2 is the indicator for inversion process (inversion number) and the coefficients before the radical is the indicator for level, and also the quantum number in quantum mechanics. Now we can see where the horizontal & vertical are demonstrated in frequency notation, the quantum number is vertical and the inversion number is horizontal, they are entangled. Quantum mechanics only emphasizes the vertical and the horizontal part is still Newtonian system, its unitary method $\int_{-\infty}^{+\infty} \Psi^*(x)\Psi(x)dx = \int_{-\infty}^{+\infty} |\Psi(x)|^2 dx = 1$ is incomplete, however, it is the first theory to introduce superposition concept and Schrödinger wave function does can be redefined. Einstein's gravitational waves possess the vertical & horizontal superposition as in (Fig.2g③). In bio-systems, vertical & horizontal part must possess the same converging patterns; we define Einstein's gravitational waves as "horizontal & vertical repeatability superposition", the term "repeatability" means same converging patterns, only oscillations with same converging pattern can be superposition; and only in such a way, Schrödinger wave function and Einstein's gravitational waves can then be unified in bio-systems. Music takes the simplest way, just use the same note and tone to them can solve the problem. (Actually, we even can go back to our earlier experiments, mung bean physical strike experiments have been designed into horizontal & vertical water flow, diverse physical strikes on animal or human beings always need to consider horizontal & vertical transfer. Ancient people have profound technologies, "organ strike" is one of the examples and we just study from them. The quiddity of bio quantum path is still horizontal & vertical entanglement.) For R_{hv} in Eq.23, we even can directly replace them with diverse combinations of inversion / quantum number in embryonic state eigenoscillation; evolution goes to a fixed number of organs and limbs from that stage. From here, no matter Schrödinger wave function and Einstein's gravitational waves can be expressed by combinations of integers for their eigen part, albeit such an integer part must depend on attached non-integer part for sustaining; the more binding the more eigen part frequency accuracy.

We must also understand that R_{hv} is not just certain data we can measure by certain experimental designs; it is the empirical bio-inertia which demonstrates the oscillation or bioactivity on-site which drives evolution. All the bioprocesses, no matter somatically or mentally, take inversions and follow stable converging patterns. Inversion is a "regenerative" process. Frequency notations (musical notes) are regenerative therefore can represent diverse eigen part of "regenerative"

movements. The converging superposition capability of any system is strengthening by diverse inversion processes. While the inversion process is decaying the converging superposition stability is equivalently decaying. (**Fig. 2h①**) shows a typical regenerative inversion map, any complex inversion processes are composed of such simple maps. (**Fig. 2h②**) shows an example of the inversion process in plasmid gene transferring. Suppose there are three genes on a plasmid with frequencies as $^{12}\sqrt{2^0}$, $^{12}\sqrt{2^3}$, $^{12}\sqrt{2^7}$ (these are regenerative ideal frequencies), as mentioned before plasmid genes are generally on top of the large gene binding networks; therefore, on the genome they follow with inversion frequencies as $^{12}\sqrt{2^{0+12l}}$, $^{12}\sqrt{2^{0+12m}}$, $^{12}\sqrt{2^{0+12n}}$, no matter where their processing locations on the genome. (All genes must first and foremost observe such regenerative physical frequency energy pattern then can comply with other chemical or biological models. Those fail to follow the pattern will be cleaned by the immune system.) Nearby the prokaryotic genome, there is a set of human chromosomes, the gene expression or gene movements on the chromosomes still follow the same inversion way; the higher of a gene on a binding network, the more it needs inversion process to drive the whole network. Not only genes, other biomaterials such as RNA, protein, cells, etc., still follow the same way, the higher of the level of certain biomaterials on a binding network, the more it follows the inversion model or possesses the higher inversion capability. (This is negatively regulating with copy number increase. The increase of CN for certain genes in a network is reducing inversion capability. However, such an increase must rely on the hierarchy root, reduced inversion capability then superposed on the hierarchy root gene. As in (**Fig.1i⑤**) gene 1 is the hierarchy root, with the increasing of the network, the CN of terminal genes such as gene 3_{11} is increased thus its inversion is reducing; however, the reduced inversion capability goes to the root gene 1. In immunology, all the acquired immunity such as macrophages, B, T cell reactions, etc., are equivalent to increase the higher CN or decrease the inversion. These processes will then increase the inversion capability of innate immunity that finally superposes on the spinal cord. Such copy number VS inversion capability or gravitational binding model is very general in bio-systems. Anti-unitary or turnover stationary structure is established from such correlations. CSF sampling threats the life of animals is also due to CSF is the highest inversion part of the animal body, releasing it means body loss large inversion capacity for life maintenance. Even sleep is due to such correlations, diverse day time activities can be regarded as CN increase processes, their inversion capacities need to be

transferred to diverse hierarchy roots, night sleep is for such transferring and the method still diverse inversion recovering. Insomnia induced by senility or other reasons is also due to diverse binding network can't supply enough inversion capacity for diverse binding "hierarchy root" parts.) The actual inversion processes could be very complex and combining many sorts of biomaterials, and even the converging positions need to be modulated by the matrix. However, no matter how complex the system, the converging stability is maintaining. All the converging positions at diverse levels keep the same; only on the boundary regions, the converging patterns need to be reversed. (In bacteria some lower binding or near lost genes and the endosomes; in advanced species such as skin horny layer, hair and gut excrements, etc., are such boundary regions.) For "memory" still keeps the same rules; most of the memory keeps the same converging pattern, only small boundary regions can reverse the converging pattern. Memory process happens in the spinal cord and only thinking happens in the brain. If modulated by Chu's constant, memory mainly composes of vertical part or level and thinking mainly composes of horizontal or inversion part albeit they are inseparable and entangled. However, no matter how complex the processes, thinking inversions still can't change the converging patterns of memory. We can understand from (**Suppl. Movie 6.0**) albeit it is presented as a cell migration model at the start. As in the movie and the figure of (**Suppl.ExpL.6**), outside detectable signals can be regenerated into three types based on their impact to the cell; "strengthening", "weakening", and "fluctuation". (Undetectable signals will not induce any regenerative effects; evolution is just a process of enlarging system detectable signal ranges on the same environment.) Three sorts of signals, especially the fluctuation type are all "regenerative" signals. Suppose a ring of bacterial genome can "remember" 6 fluctuation signals in a certain period and the cell has already growth with 3 fluctuation signals in that period, then while the 4th fluctuation signal add into, it will be compromised into an eigensignal which composed of these 4 fluctuation signals; while the 5th fluctuation signal enters into the system, even everything of 4th and the 5th signals are totally same at every aspect, the results are different: one condition is an eigensignal establish from 4 signal, another condition is an eigensignal establish from 5 signal, "regenerative" comes from here and just mean based on all previously available signals to establish the eigensignal, not the Copenhagen superposition. All the "regenerative" signals have "converging positions" and the superposition is converging superposition. While evolution hits advanced species like human beings, the condition is the same, just all detectable signals superposed on the spinal cord and

establish eigensignal for certain period. For a newborn baby the spinal cord even can't support the head, diverse signals from eating, eyes, ears, noses, touch etc., gradually superposed on the spinal cord and establish the converging patterns (what frequency notation represents just the ideal pattern instead of all patterns), the shifting of converging pattern of memory need long term training, estimated 3-5 years from the baby stage and with the increasing of age the shifting becomes increasingly difficult. (As we mentioned before, inversion capability or gravitational binding need depend on a large network and conjugate with terminal part copy number and inversion frequency decides the converging pattern. Therefore, the shifting of the converging pattern means the whole network needs to follow this change. This is why shifting of converging pattern is increasingly difficult with age. Previously while we talked about tumor cells just say inversion frequency pattern mistakes, that is for simple and actually omit the inseparable attached network.) For the somatic body, the time for shifting converging pattern will at least double to 6-10 years at an early age. (Shaolin converge or Wudang converge just ancient physical training for recovery of original spinal converging patterns which have been driven to divergent by ordinary life. It generally needs decades. Even for a simple bacterium, the shifting of converging pattern is quite rare, it is estimated no more than three converging shifting can be tolerated in one lifespan.) So for a cell or a human being, the "memory" just bundles of regenerative fluctuation signals superposed on the genome or the spinal cord with one or bundles of eigensignals, as we show in the movie and the figure. While "thinking", it needs to take the original signal interacting with the eigensignal. The simplest memory just one fluctuation signal participates into bundles of signals on the superposing structure to establish an eigensignal, and the simplest thinking just this signal interacting with the eigensignals and come out for using, albeit the complex memory and thinking processes are entangled together. We can simply regard memory as frequency increase inversions and thinking as frequency decrease inversions with different ration in diverse processes. (Brain neuron CNV show wide variability (9 to 100% of brain neurons in different studies)³³ can offer side evidence.) For the integration of the converging pattern of the spiritual world and somatic body, refer to (**Suppl. ExpL. 9**), this is the Basic Law of Evolution we mentioned before. In the scientific world, "There is no absolute truth". Eigensignal model of thinking and memory vividly shows how this happens in the processes.

From the simple model of thinking, we also can understand the reason that AI lacks creativity as that of human beings. When human need to solve a real problem, it has to unexceptionally composed

of two parts: “observe the rules” and “shift the rules” with a different ratio as the formula: $\text{constant} = (\text{observe the rules}) \times (\text{shift the rules})$. Such conjugation comes from the converging superposition, albeit no one consciously realizes this equation in one’s solutions; therefore, no matter how deep this formula is hidden, none item can be zero. AI is running by the probabilities under present rules; therefore, the strength of model-able AI or “deep-learning” is “observe the rules”, the weakness of which is impossible to find any “shift the rules” solution without extra outside system input. It is then groundless for AI to get above human equation. Practically we can see, what AlphaGo⁹⁹ learned from human are the skills to play go “under the rules”, not the skills to “shift the rules” such as the invention of the game or apply the rules from the go game to other fields. For these reasons, it is still a tool for human beings no matter how powerful it is performing in a fixed rule condition. Some people attributed the malfunction of AI in multi-task jobs as lack “common sense” and still didn’t clear what exactly the “common sense” is. The human equation seems too “clumsy” at first; however, the advantage is while needing to “shift the rules”, any info available with same converging patterns can be used as “common senses”. It is actually not the so-called “common sense” turns the tide; it is “equal converging pattern” info offer the solution. (Human is an open system; any info with the same converging patterns can go into the brain for help. AI is an isolated system; no way to acquire shifting information unless *de novo* re-modeling by humans. Not mention great shifting of rules; tiny shifting such as board from 19×19 to 17×17, etc., must *de novo* re-modeling by humans; here *de novo* just means what AI “deep learned” from 19×19 board is useless for 17×17 board application. Shorting of human thinking equation, AI totally lacks “self *de novo* re-modeling” capability. For humans, more extensive than such kind of shifting will be no need for any re-modeling, just input various “same converging” info is enough.) If we wish to solve the malfunction of AI, the method is still to try the human equation for AI running. However, even in the future people can really solve the problem of “shift the rules” for AI, “available resources” are still restriction factors. As the story of AI war, the side with AI only has limited munitions and inferior generation of weapons, they still can’t match another side with ample supply of superweapons, like AI can’t help one group of people with bows and arrows, to declare war with another group of people with machine guns and ample supply of munitions; such restriction factors are called “available resources”. Also, AI still faces the challenging of model-ability. We can say that human-guided model-able AI can defeat another group of people without AI tool under “equal rules” and “equal available resources” conditions; however,

AI can't govern the human world without human resources. Legendary “AI governs human” story can only be possible under the guidance of another group of human; it is still a “human governs human” quiddity instead of an “AI governs human” story. Human Le Châtelier’s effect defeats AI.

(**Fig. 2h③**) refers to the shifting of Chu’s constant $\sqrt[12]{2^{n-1}}$. For humans, $n=12$ has been practically verified by a long history. We call $\sqrt[k]{2^{n-1}}$ as Chu’s constant mutation, it possibly presents in other species. As in the figure, from regenerative quantum number combination 2^n , $\sqrt[k]{2^{n-1}}$ still fit for Le Châtelier’s effect which we still can use the similar inversion pattern, just Chu’s constant $\sqrt[12]{2^{n-1}}$ should be the most efficient one. (Even in human beings there less like to fully follow $\sqrt[12]{2^{n-1}}$, mitochondria with prokaryotic origin could possibly take mutated Chu’s constant; just these mutations can’t impact on the inversion processes of the whole system.) In music, it is only available frequency double and inner 1/2 converge model as a basis, then superpose to other complex converges. However, some of the derivative ways still follow Le Châtelier’s effect. E.g. a scale from ground note to next higher level note with triple frequency raise and inner converging position with 1/3 converge, or with 5 frequency raise and inner 1/5 converge, etc., it is unknown whether such derivative converging manners could present in bio-systems. They still can also be regarded as other types of mutations of Chu’s constant. We need first to understand “double_1/2 converging” pattern which possesses so many classical musical works in bio-systems, then can shift to these “mutations”.

The only difference between the superposition of non-living beings and living beings is the converging superposition stability and life evolution is also the evolution of innate & acquired converging stability of the whole organism. (Generally, the active parts of DNA, RNA, peptides, etc., are on the converging positions, also blood vascular bifurcations, the nerve fibers bifurcations, etc., are on the converging positions. Since diverse superposition needs to correlate by converging positions; therefore, the common characteristics falls on these positions will be efficient.) The reason that inversion as the basis of converging still not well-known is due to most of the logical tools lack components for such a process. Converging includes two critical steps, first, “regenerative” based on the whole system or the minimum sampling parts which at least can reflect the system's “least action”; second, converge with what “regenerated”. To achieve the first step is not a problem; however, the successive second step becomes quite challenging for most of the logical systems. As in

(**Fig. 2h(4)**), Laplacian $\nabla^2 = 0$ as a harmonic function is a general “regenerative” process; however, after that “regenerative”, converging should be happened in certain place where the red marker indicated, and every converged harmonic function superposed together with same converging pattern to get a dynamic superposition. For this step, it lacks a good mathematical tool. Also as in (**Fig. 2h(5)**), stress-energy tensor, the regenerative part is on the diagonal T^{11} , T^{12} , T^{13} ; however, the converging and superposition of this part to modulate evolution becomes challenging. The converging of bio quantum paths can only happen on z dimension and following Basic Law of Evolution. We use red color and arrows to roughly represent the converging positions on z dimensional signals, equivalent to the C major scale in right of (**Fig.2h(3)**). Now we can understand what “resonance” means in bio-systems. As we mentioned before and also in this figure, from C to C_{octave} the frequency doubles, then the frequency steps on E-F and B- C_{octave} converging. We call this concept bio-resonance. In conventional physics, there are many types of resonance such as amplitude synchronized, frequency synchronized model, such as a parade of solders pass a bridge and shakedown it by resonance, etc.; these types of resonance are lower probability in nature. In contrast, the highest probability resonance condition in nature is still the bio-resonance or called “Le Châtelier’s system inner resonance”, which is the basis of splicing. Life evolution takes quite a long time since the system needs to superpose diverse bio-resonances and to strengthen the converging position of all the superposition. However, the “time-consuming” in evolution can’t deny the fact that bio-resonance tendency is a very general phenomenon that is the easiest to happen in nature, even if the actual converging frequency just tends to and rarely attains 1/2 converging. Also, the reason that conventional scientific world lack inversion model is still due to indiscrimination energy conservation in diverse physical laws. We can easily write diverse indiscrimination energy equations such as a spin mass $E = \frac{1}{2}m\omega^2r^2$; a spring oscillator, $E = T + V = \frac{1}{2}m\omega^2rA^2\sin^2(\omega t + \varphi) + \frac{1}{2}kA^2\cos^2(\omega t + \varphi)$, etc., and then justify by indiscriminate energy conservation thus no need to consider the real transferring pathways. In bio-systems, the only available energy is frequency energy which is transferred by means of inversions; the frequency energy partially come from the environment and partially come from the inner system depends on the adaptation of R_{hv} ; take above isolated system energy conservation laws will induce big errors. However, biological studies chemically accept such errors; therefore, retarding the understanding of inversion. All our previous

discussion can be generalized into the application version of **Basic Law of Evolution** as:

Life on Earth is a gravitational polarizing binding Le Châtelier's regenerative converging superposition inversion oscillation memory system, any inversion capacity depend on an attached network will keep a relatively stable converging pattern for this network which the binding eigen part can be physically modulated by Chu's constant or derivatives until this network is retrograded. Gravitational binding or its regenerative wave-particle duality can be empirically modulated by R_{hv} or bio quantum path and ranges from molecular ($>h_{mt}$) till somatic level.

There are many ways for validating the model, we even have a clinical trial (**Suppl.ExpL. 10**); however, the best one is still spaceflight. On Earth, a simple bone fracture can be recovered if get alignment and fixed. If an animal is in a spaceflight short of gravity, the bone fracture will be notoriously difficult to recover. Also for blood vessels, the direction of the blood flow is z dimensional oscillations, and the circumference of the vessel establishes bio quantum paths. In spaceflight with lower gravity for sustaining z dimensional oscillations, the risk for atherosclerosis will greatly enlarged. Possibly just a few months in such an environment will equivalent to decades on Earth to accumulate such problems. Osteoporosis is also such a time quickening process. For an animal in a short term spaceflight, the decrease of elastic of blood vessels has been observed quickly; long term will then be atherosclerosis. With similar mechanisms, animals or human in spaceflight will face severe ED problem at once due to lower gravity (short of z oscillation transferring capability on bio quantum path or decaying of R_{hv}). And animal growth, especially the spinal column will be severely reversed in spaceflight in a long term. Also, the resistance of physical strike (empirical bio-inertia, can be calibrated by certain mass strikes on the certain part of the body with certain speed, $p = mv$) will be greatly reduced for the same animal or human, no matter these animals or human beings have gotten ancient physical training before. All these are easy to be predicted, just not find relevant literature. However, other changes such as muscular hypotrophy, protein express change and dysfunction of the vascular endothelium, etc., have been published⁹⁴. Following the model, the story that takes Mars as the next habitat of human beings is not as simple as people thought it would be. The gravity of the Mars only 38% with that of Earth, even if we can find water and bring some species on Earth to Mars to strengthen our inner constant K, we are not evolved from there with billions of years of gravitational binding,; therefore, finally either mankind

fail to adapt to that planet or evolve to a species which totally different from those of us on Earth. It's just a seeding place instead of a habitat. We still need to take care of the environment & civilization of our planet instead of migration to a new place that short of gravity.

Life abiogenesis and evolution by R_{hv} polarizing converging superposition on Earth, horizontal & vertical superposition at molecular level

As mentioned before, life originated on Earth around 1 billion years after the formation of Earth^{1,2}. For this geological period, short of fossil or geochemical evidence for earlier life has left ample scope for hypotheses, which fallen into two main groups: Earth origin and panspermia⁹⁵. Panspermia just stories while people lack the understanding of gravitational binding quiddity of life. For Earth origin, the theory of RNA world⁹⁶ and iron-sulfur world⁹⁷ has suggested. Such chemical origins still lack physical consideration which steering species. Life evolution should geologically start from Hedeon⁹⁸ and the primary biomolecules should from “Miller concoctions”. Miller¹² experimented in 1953 with a continuous spark discharge at 60,000 Volts through a flask containing the gases identified by Urey, along with water. From the aqueous solution showed 25 amino acids (the main ones being glycine, alanine, and aspartic acid), several fatty acids, hydroxyl acids, and amide products. Following his idea, diverse modification experiments have also carried out by many people. E.g. ribose and deoxyribose were acquired in 1966 by dealing the HCHO with uv and γ -ray. Cytosine acquired by heating $N\equiv C-C\equiv CH$, KCN and water under 100°C (1966). Adenosine can be by uv dealing with a diluted solution of adenine, ribose, ethyl- metaphosphate and phosphate (1977), etc. Even a long fatty acid chain can be acquired by uv dealing the CO_2 and $CH=CH$, most of the small molecules acquired by simulating certain primordial Earth conditions. All these could be called “Miller concoctions”. The gravitational binding and regenerative oscillation frequencies for these earlier organic small molecules are still quite lower, possibly even close to non-living beings. On the Earth environment, the only accumulation of gravitational binding for these primordial molecules should be happening in the whirlpool. The left hand of (**Fig.2i**) shows a whirlpool we manually draw some “superposition levels”. Every molecule can fluctuate into two layers of oscillations at diverse environmental conditions, inner & outer oscillations. Not mentioned the primordial amino acids, even as small as a water molecule could be written as a general equation: (inner oscillation) $\cdot$ (outer oscillation) = constant. The R_{hv} or gravitational binding of a molecule should be equal to inner

oscillation amplitude/outer oscillation amplitude. (To measure the individual R_{hv} of a molecule is difficult and also irrational; the critical thing is the how diverse molecules correlate to each other by their gravitational binding; therefore, R_{hv} should be expressed as an eigencycle format, such as via certain processes, the R_{hv} of a certain molecule gets increased. We can go back to (**Fig.1d**), gravity keep the same impact to the ball no matter its motion then splice out system resistance. Now it is same, the inner oscillation of molecular R_{hv} relies on the gravity and keeps almost the same value no matter how it is running in the whirlpool, the outer oscillation which impacts by diverse environmental factors will then shift, under certain conditions, it can superpose into large molecules. In Einstein's theory $R_{hv} = \frac{\delta L}{L} < 10^{-21}$, this is roughly the R_{hv} of the primordial molecules; after the physical movements in a whirlpool to produce diverse molecular agglomerations, the value of 10^{-21} will be shifting even with almost same L (primary gravitational signal), such an agglomeration shifting is polarization. It is definitely controlled by converging pattern, that means among so many molecular agglomerations only those with same converging patterns are bio-molecules and can be further superposition with converging patterns. We must carefully note that Einstein's $\frac{\delta L}{L}$ comes from space-time polarization and the only driving factor is mass distribution; therefore, it is only an infinitesimal. Molecules on Earth can't get differential polarization only based on mass distribution. Suppose a solar system or even a black hole nearby the earth, it will impact on all molecules and almost can't make some molecules get a large $\frac{\delta L}{L}$ and some molecules get a small $\frac{\delta L}{L}$ within so small a molecular scale. We can calculation, the "least fluctuation" scale in bio-systems is h_{mt} , around 3 bp equals to 5 water molecules; take this "least fluctuation" as δL , it needs to resonate with a L size of 10^{11} m agglomerations or 10^{11} of the water molecular agglomeration weight then can satisfy 10^{-21} , this is less likely to happen for earlier evolution. Therefore, early evolution must depend on a whirlpool to enlarge $\frac{\delta L}{L}$. For the differential polarization of $\frac{\delta L}{L}$, a whirlpool to polarize molecules by "binding differential cycle number" is even stronger than a solar system just by mass distribution. This is why R_{hv} or $\frac{\delta L}{L}$ can growth into bio quantum path.) Modern chemistry has some molecular relationships such as van der Waals forces, hydrogen-bond, hydrophobic bond, and diverse other chemical bonds; biochemistry also has diverse affinity sites for DNA, RNA, protein, etc. These correlations are getting from pure products and lack polarization modulation; therefore, all of them

need polarization modifications; the methods are either bring their parameters into Le Châtelier's constant K or from existing structures. (The polarization scale of biomolecules should correspond to the transferring of “regenerative” oscillations among agglomerations. The “least fluctuation” scale in bio-systems is h_{mt} , around 3 bp equals to 5 water molecules. Larger active polarization scale at the genomic level is possibly 1500bp since CRISP/CAS usually within 50 arrays with each around 30bp. At the somatic level, the polarization scale could attain the size of a human spinal cord.) In a whirlpool, most of the molecules only pass it for one cycle, a small number of molecules can pass through via many cycles, or some molecules can pass through many whirlpools, etc., no matter which conditions, the equation (inner oscillation) · (outer oscillation) = K is the simplest Le Châtelier's effect; and the equation R_{hv} = inner oscillation amplitude/outer oscillation amplitude is the simplest format of Basic Law of Evolution, it just mean structures with similar R_{hv} converging will be further binding:

$$k_{whirlpool\ cycles} == \frac{(R_{hv})_{molecule\ i-after}^{CN\ i}}{(R_{hv})_{molecule\ i-before}^{CN\ i}} \cdot \frac{(R_{hv})_{molecule\ j-after}^{CN\ j}}{(R_{hv})_{molecule\ j-before}^{CN\ j}} \cdot \frac{(R_{hv})_{molecule\ k-after}^{CN\ k}}{(R_{hv})_{molecule\ k-before}^{CN\ k}} \cdot \dots \quad (25)$$

In a whirlpool, suppose three molecules move from top to bottom, the geometry shape composed from the three molecules only shift in a certain range; this is one type of quite weak “binding” and will be dispersed after reach the bottom. Among many such kinds of “binding”, if they further binding with certain factors in the process, then their probability of dispersing will be reduced to some degree. (This is a kind of “binding” based on geometry. Einstein's theory is still a geometry steering theory based on mass.) Therefore, under certain environmental conditions, the “binding” stability will gradually increase and dispersing probability will gradually reduce. The whole process is similar to diverse *in vivo* processes we mentioned before; just R_{hv} or bio-inertia is much lower or divergent. *In vivo* inversion process needs to depend on the higher binding of attached structures, *in vitro* inversion still similar, just need geological time to establish such binding or growth of $\frac{\delta L}{L}$ to enlarged inversion capability; therefore, whether the binding or even inversion relationships of these three molecules can be finally survived depends on how much binding they finally can evolve. From the molecular level R_{hv} of each primordial molecule evolved into human somatic level R_{hv} takes around 35 billions of years and the gravitational binding is enlarged to 10^9 , averagely just 3.5 years can get 10 folders of gravitational binding for bio-systems. Estimated viruses have 10^3 gravitational

binding, then just a few thousands of years the life forms similar to viruses could come out. If bacteria have 10^6 of gravitational binding; then just 0.1 million years could come out. Possibly such kind of “average” calculation method still need further modifications since earlier life developed very slowly and advanced species developed in the acceleration. Also, we still lack methods to measure R_{hv} of viruses and single-celled species, their empirical measurement will be quite critical to understand the time frame of earlier evolution. The growth of R_{hv} into bio quantum path should be very quick after the present of the primordial molecules; just a few molecule agglomerations can show bio quantum path effect. However, observable growth of R_{hv} , and abiogenesis of life from miller’s concoctions in a whirlpool is still quite longer compare to routine experiments we see. And it is quite difficult to imitate the processes by a laboratory whirlpool since diverse parameters which can be binding will be much less than those of a natural whirlpool. It possibly needs some special ways to make these time frames to be observable. (And such kind of efforts should combine with *in vivo* study; two conditions just differ in bio-inertia.)

In the figure, there are some stationary structures. The length of a molecule can stay in these places, the more chance of it to be located on the higher level of a future binding network in evolution. (Suppose one of three-molecule “binding” can stay longer in these places, then the other two molecules can cycle again in the whirlpool, such repetitive of two molecules of the previous binding will then drive the molecule which can stay longer in the stationary structures into the higher binding network in the future possible evolution. Such different in “cycle number of a binding component passes through certain structures” is the basis for network binding and can be memorized by the same converging structures under certain conditions. We even can go back to earlier experiments in (**Suppl. Exp. 3**) for understanding, while validation inertia mass VS gravitational mass in conventional physics, we design an empty ball with spin inside. All small mass units inside a ball can be regarded as “binding”; however, before hitting on the ground some mass units spin more and some spin less, induce significant macrocosmic “cycle number differentiation of binding components”. It is such kind of “cycle number differentiation” binds gravity. This is a macrocosmic fundamental gravitational binding structure, albeit weak due to lack resonance like an organism, enough to get the difference for the experiment. Digestion also takes the same “cycle number differentiation” model (ref. **Suppl.Exp.15**). Now for the weak binding of three molecules in microcosmic condition; it is absolutely the same, “cycle number differentiation” of this weak binding

in a whirlpool is equivalently a gravitational binding structure, any cycle number different in this binding induced by the whirlpool will binding gravity and shift R_{hv} to store in molecule under certain conditions, albeit this binding is so weak. The only way to enlarging or polarization of this weak gravitational binding is to form larger molecular agglomerations with same converging patterns, that is by way of “memory”; “memory” is just a physical process which exchanges of converging information between binding. It grows $\frac{\delta L}{L}$ with same converging pattern into large molecule agglomeration to show bio quantum path effect.) In bio-systems or such a whirlpool evolution condition, gravitational binding is still acquired by polarity which concerning with network and not by mass. For a network (no matter which kind of materials) if there is no binding, gravity should be evenly distributed and only shift a little for each molecule by R_{hv} on the environment. While a network is established, all the R_{hv} of each member will shift and polarizing the network; the higher gravitational binding will then shift to the hierarchy root. And such a network shifting starts from the polarity of molecules which indicated by R_{hv} . The biomolecules such as a DNA segment, RNA, a peptide, and a cell, etc., all have polarity, means their gravitational binding is not evenly distributed, such binding network polarity is the basis for further superposition. Anything without polarity means there is no need for further superposition. For a certain species, the polarity or gravitational binding of the embryonic stage is the highest, with growth or differentiating such polarity gradually entangled with the environment and partially replaced by environmental parameters, only refer to the *in vivo* range the polarity is decreased; generally speaking, it should be embryonic “polarity” partially shift to binding environmental signals and establish equilibrium, the shifting of embryonic polarity follows the Principle of Least Action with the increase of agglomerations. The converging superposition is indeed a kind of polarized superposition with component molecular polarity R_{hv} as its basis, comes from the physical origin of life---a whirlpool. In bio-systems, all the sperm cells need a long journey to hit the ovum, such kind of travel is also for oscillating diverse R_{hv} of the genome and protein. As mentioned before, parental mtDNA only enter into gamete by chance and possibly establish the alpha male; this chance depends on whether the primary gamete can have enough polarity. Following the Basic Law of Evolution, mitochondria DNA in the middle piece (around 22-75 mt /cell¹⁰⁰ after spermatogenesis bottleneck) should keep the same converging patterns with its genome via the strengthening & weakening effect from the long journey; while

gamete genome established, if the converging patterns keep the same or the R_{hv} not shift too much, mtDNA will then enter into the gamete; otherwise, they will not enter into the gamete. Final R_{hv} of the gamete decides the fate of parental mtDNA and such R_{hv} is still the same with those in earliest life form acquired from a whirlpool, just with different bio-inertia level. The gravitational polarized R_{hv} in primordial molecules equivalent to the mtDNA polarized R_{hv} acquired in the sperm long journey which steering the parental mtDNA transfer; they are all polarized gravitational binding just with different level. Not only parental mtDNA works in this way but also reproductive segregation is still decided by such R_{hv} , whether the sperm cells can fertilize an ovum is a physical process, not just a few proteins or RNAs can trigger the process. It should be the “ground converging patterns” of mtDNA decides the fertilize process, no matter mtDNA is separated with nuDNA or put together in sperm cells as in lower evolved species. In prokaryotes, it should be palindromes to decide the limited sexual behavior of the plasmid, and even plasmid needs enough oscillation for transferring, so does transformation segments. All the reproductive processes are steering by gravitational binding or inversion converging superposition oscillations; therefore, we write down Einstein’s gravitational wave quadrupole and its “biological growth” in bio-systems model nearby the whirlpool (our remotest physical ancestor) in (Fig.2i). The highest gravitational binding structure on Earth is the human spinal cord which can attain $10^{-2} R_{hv}$, so we write $\frac{\delta L}{L}$ grow from 10^{-21} to 10^{-2} .

In the figure, there are many shifting converging positions represent by red color since there are so many molecules or molecular agglomerations inside the whirlpool. This means at the start of evolution there are many types of inversion patterns; there is no biological “common ancestor” for all species. Among so many converging patterns, all those can grow their superposition will evolution. “Common ancestor” model will result in the dendrogram; however, among extant species there are substantial network patterns presented. Just rely on genomic information to find evolution trend is challenging since the conventional DNA lacks the physical binding model. Only the migration of *Homo Sapien* has been tracked. The problem is the method believes in maternal mtDNA and no parental mtDNA source. However, mtDNA does present in next-generation under certain conditions, not only in human but also in many species. (Actually, the method even faces the methodological problem, if we believe something can modulate human migration, it should unexceptionally include in and out processes for bio-systems, if we claim some part of it can only

come in and not come out of bio-systems, that thing will definitely be incomplete for modulation.) Life is an “equal opportunity” system; all the discernable information can freely enter into and come out of the system, just information with the same converging pattern stays and information with the different converging pattern are splicing out. Bio quantum path can make use of the same converging pattern information to splice out the different converging pattern information. Also, the concept of “semipermeable membrane” is incomplete. Bio-membrane is not “permeable” for something and shutoff something; it is just a structure for strengthening *in vivo* converging pattern and not “selective permeability”; most things need in and out the bio-membrane for many rounds, that is for strengthening the correct converging pattern. We also can understand from (Suppl. Movie 8.4), the function of bio-membrane is equivalent to that simulation of a vertebral barrier; what passes the barrier is still agglomerations following with the same “converging pattern”, no matter the pass-through amount is more or less; with equal “converging pattern” they can be recovered later, with different converging pattern it will be dangerous to the system. Converging pattern possesses a lot of combinations of biomaterials, thus impossible to modulate by something pass and something left. “Same converging pattern” just means all these biomaterials with “lower inner resistance” while entering into the system. We should also note, the above “danger” is not just come from few molecules which contribute to the incorrect converging patterns, the whole pass-through package will then become “dangerous” under certain conditions.) For these reasons, we have to use the converging pattern of mtDNA & nuDNA and integrate with other *in vivo* or environmental converging patterns for modulation, since evolution is holistically driving by stable converging patterns instead of certain molecules, this way is quite challenging; however, it is the real happening.

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Authors' contributions

L.Y.Y. received ancient physical training, perceived the models, performed all the experiments and

wrote the manuscript.

Competing financial interests

The authors declare no competing financial interests.

Supplementary information

Supplementary information is available in the online version of the paper.

Figure Caption

Figure 1 | Definition of bio-inertia and physical aspect of life

a) constant K shifting from human ancient physical strike training

b) constant K pattern for diverse species in evolution

c) bio quantum path

d) modulation of bio quantum path by Newtonian mechanics, introduction to “splicing”

e) mathematical equation of bio quantum path conservative forces (conserve for a larger resonating system which issue this bio quantum path)

f) introduction to gravitational binding and fluctuation superposition in bio-systems

g) quantum number in Crisp/Cas 9 and some bio-processes

- h) quantum number of RNA splicing and gene expression, introduction to horizontal & vertical splicing at the genomic level
- i) quantum number at the membrane proteomic level, introduction to copy number variation in a hierarchy network
- j) quantum number at the somatic level, ancient CSF-ligament conjugation training
- k) water clock model prepare for the spinal CSF modulation

Figure 2 | Life evolution and converging superposition

- a) modulation of the human spinal cord by quantum mechanics potential well model
- b) macrocosmic modern and ancient physical converging training
- c) introduction to musical tonality and historical Chu's constant
- d) conventional musical staff notation
- e) frequency notation, introduction to inversion number and quantum number in eigen part of Schrödinger wave function and Einstein's gravitational waves
- f) inversion and elementary "memory" model
- g) modulation of gravitational binding and wave function by empirical bio-inertia R_{hv}
- h) converging pattern of the spiritual world (memory and thinking model) and somatic structure, ancient physical training system
- i) Life is abiogenesis from a whirlpool by gravitational binding R_{hv} polarization, fundamental gravitational binding "cycle number differentiation" model (also need to depend on binding) at the macrocosmic & microcosmic level

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