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Quantum Computation in the Brain and Emergence of Unperturbed Mind Due to Inductive BIS Load

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Abstract
"Solitons", are comprised of a loosely coupled coherent system of subquantum entities. This coherent solitonic system of loosely coupled entities can be viewed as a partial description of consciousness. BIS stands for breakdown of integrated system. It is of three kinds: resistive, capacitative and inductive. In our present paper we will study the behavior of unperturbed mind due to strong inductive BIS processes.

Keywords: *BIS effect, quantum computation, microtubules, quantum zeno effect, solitons*

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INTRODUCTION

Emergence of Consciousness

Different works on the brain and mind problems have used quantum theory to explain the emergence of consciousness. There are, in quantum theory as well as in statistical physics, collective phenomena irreducible to individual components of the system. The conjecture is that collective quantum phenomena produce coherent states in the brain. As we shall see in this paper, decoherence was not taken into account generally in current quantum models of mind until very recent polemical works.

Physiology of Microtubules

The walls of microtubules in the cytoskeleton of neurons can work as cellular automata, able to store information [1], and to make computation by using combinations of the two possible states (as dimmers) of the tubulins that constitute these walls [2–6]. The interior of the microtubule works as an electromagnetic wave guide, full of water in an organized collective state, able to transmit information through the brain.

MATERIALS AND METHODS

Interaction between System (brain) and Environment

The number of tubulins was calculated by Hameroff and Penrose [7]. The coherence time t is based on typical response time of the brain to external stimulus (Figure 1).

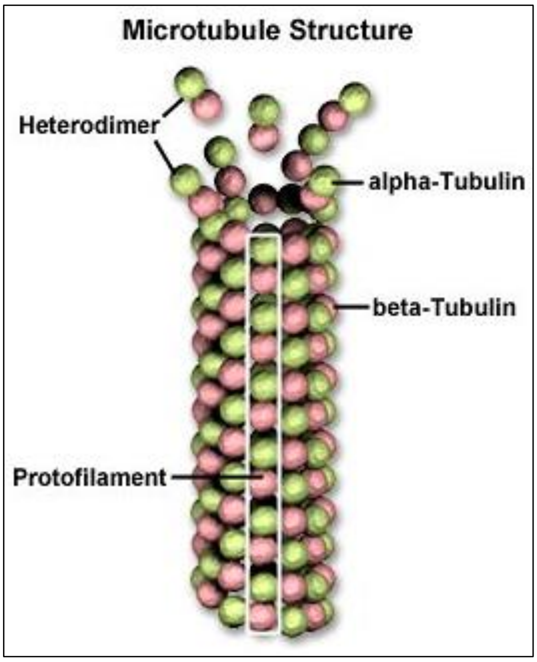

Fig. 1: *Alpha and Beta Microtubules.*

Using Heisenberg's uncertainty principle, the critical energy for OOR can be written as:

$$E = \hbar / t \tag{1}$$

The numerator is the Planck constant ($6.6260755\times10^{-3}4$ Js) over 2π and the denominator is the time t which gives the order of magnitude. Critical energy, E= gravitational self-energy. The idea is an integral aspect of pragmatism. The penultimate goal of thought is to have correct representations of the world, and these are ultimately grounded for the pragmatist in the goal of effective action in the world (Figure 2).

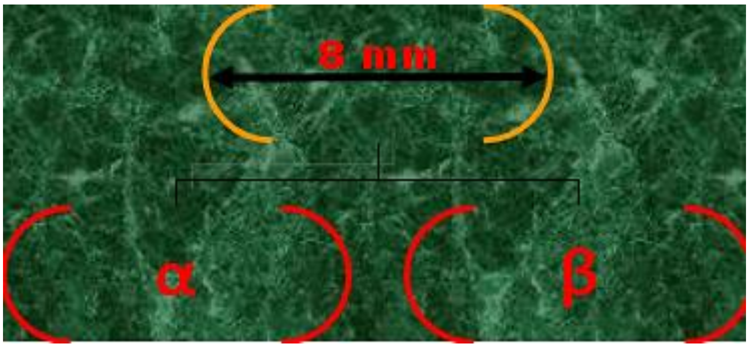

Fig. 2: *Tubulin Heterodimers.*

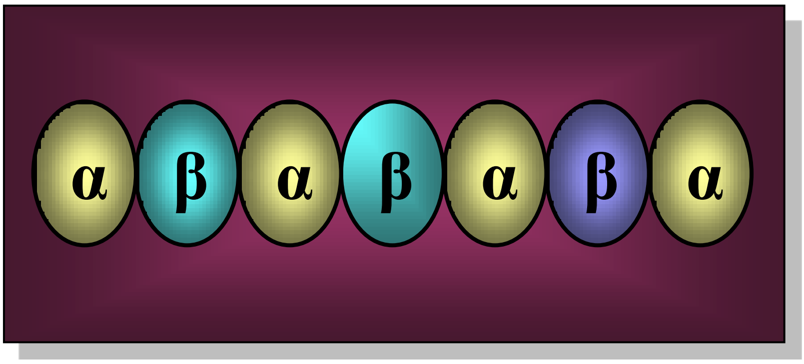

Fig. 3: *Protofilament.*

The Effects of the Uncertainty Principle

There exists an operator P in quantum mechanics called a projection operator which satisfies the relation PP=P and hence the predicted feedback YES may be given by the formula:

$$\langle P \rangle = TrP\rho / Tr\rho \qquad (2)$$

Where; ρ is the operator (density matrix) that represents the system upon which the measurement action is performed. This formula connects the physical description of the system that is being examined to an empirical (i.e., experiential) feedback from the probing action that the agent performs (Figure 3).

$$\rho = \frac{R^3\sqrt{M\kappa T}}{KNe^2 s} \qquad (3)$$

$$\tau = \frac{R^4\sqrt{M\kappa T}}{3Keps}\Omega_{dipole} \qquad (4)$$

If we apply Eq. (4) with R, M and s having the same order of magnitude of the values used by Tegmark, but using for the tubulin dipole momentum and considering the direction of the microtubule axis the value $p=10^{-27}$ cm, we go back to our previous result, $t=10^{-10}$ s.

RESULTS AND DISCUSSION

We have criticized Eq. (3) used by Tegmark because it predicts that the decoherence time, increases with the square root of the temperature [7]. We can see from very general Eqs. (1) and (2) that time t decreases when temperature T increases. On the contrary, according to Eq. (3) of Tegmark at low temperature, where the interaction with the environment must be minimal, the decoherence is faster, in contradiction with experience. Coherent macroscopic states, such as superconductivity, happen at temperature approaching zero. We show in what follows that Tegmarks formula is not valid at low temperature [8]. This is not the case of the human body but it shows that Tegmark's estimates cannot be used generally [9]. That is, the Eqs. (3) and (4) are just an approximation for a right regime of temperature. To discuss Tegmark Eq. (3), let us consider the density matrix for the positions of the two particles 1 (charged macromolecule) and 2 (environmental ion) interacting through a potential V(r). From the Schrodinger equation for density matrix r the system evolves as:

$$\frac{d\rho}{dt}(r,t) = [H,\, \rho(r,t)] \qquad (5)$$

Here; H is the Hamiltonian of system. In this case, we assume H=V(r); therefore, we have:

$$\rho[r_1^2 P_2,\, F_1',\, F_2',t) = \rho(0)\exp\left[-\frac{i}{h}[V(\vec{R}) - V(\vec{R}')]t\right] \qquad (6)$$

Here;

$$\vec{R} = \vec{r}_2 - \vec{r}_1$$
$$\vec{R}' = \vec{r}_2 - \vec{r}_1 \qquad (7)$$

Decoherence drops the nondiagonal part of the macroparticle 1 reduced density operator due to the interaction with particle 2; when we assume that systems 1 and 2 start in a tensorial product state $\rho = \rho_1 \rho_2$, the density operator is averaged by tracing over the environment [10]. The result is:

$$\rho_1(\vec{r}_1, \vec{r}_2, t) = Tr[\rho(\vec{r}_1, \vec{r}_2', \vec{r}_2', t)] = \rho(\vec{r}_1,\, \vec{r}_2,\, t)\mathrm{ex} \qquad (8)$$

That is, nondiagonal part vanishes for t>1. To obtain this result, we choose:

$$\vec{r}_1 = (0,0,0)$$
$$\vec{r}_1' = (x_1, y_1, z_1)$$
$$r_2' = \vec{r}_2 - (x_2, d, 0) \qquad (9)$$

The first two relations mean a coordinate axis choice, while the last one means an approximation where the environmental ion (particle 2) moves along the x-axis (d is a constant) and the change of direction of its motion is neglected in the interaction, assumed as too small [11–13]. The shortest distance from it to the particle 1 is d. So;

$$\vec{R} = \vec{r}_2 \qquad (10)$$

$$\vec{R}' = \vec{r}_2 - \vec{r}_1' \qquad (11)$$

We can expand the Coulomb potential up to the second order term,

$$V(\dot{R}') = Kq_1q_2 \frac{1}{|\vec{r}_2 - \vec{r}_1|} \cong Kq_1q_2\left(\frac{1}{|\vec{r}_2|} + \frac{x_1x_2 + y_1d}{|\vec{r}_2|^3}\right)$$

And hence;

$$V(\vec{R}) - V(\vec{R}) = Kq_1q_2\left(\frac{x_1x_2 + y_1d}{|\vec{r}_2|^3}\right) \qquad (12)$$

Where; q_1 and q_2 are the charges of particles 1 and 2. The next step is to assume a separable form for the density matrix and a Gaussian distribution with zero mean and variance $\lambda\sqrt{2}$ for particle 2,

$$\rho(4\vec{r}_1, \vec{r}_2, t) = \frac{\rho(0)}{\sqrt{4\pi\lambda}} \int \exp\left[-\left(\frac{x_2}{2\lambda}\right)^{-2}\right]$$
$$= \exp\left[\frac{Kq_1q_2t}{ih}\left(\frac{x_1x_2 + y_1d}{x_2^2 + d^2t^{3/2}}\right)\right]dxy \qquad (13)$$

For d>>x_2 we can approximate $(x_2^2 + d_2^2)^{3/2} \cong d^3$ and with an appropriate algebraic manipulation, Eq. (13) becomes:

$$\rho_t = C\exp\left[\frac{ty_1Kq_1q_2}{ihd^2} - \left(\frac{tx_1\lambda Kq_1q_2}{hd^3}\right)^2\right]\Phi$$

Here;

$$\Phi = \int_{-\infty}^{+\infty} \exp\left[-\left(\frac{x^2}{2\lambda} + \left(\frac{itx_1\lambda Kq_1q_2}{hd^3}\right)^2\right)\right]dx_2 \qquad (14)$$

$$C = \frac{\rho_1(0)}{\sqrt{4\pi\lambda}}$$

The last integration in Eq. (14) yields a constant number; the first imaginary term in the exponential is a phase factor, while the second one produces a decrease of the nondiagonal part of the density matrix with a characteristics decoherence time,

$$\tau = \frac{hd^3}{x_1\lambda Kq_1q_2}. \qquad (15)$$

If we assume thermal constraint $(\Delta\rho)^2 / M \approx \kappa T$ and take uncertainty principle $\Delta x \approx h/(M\kappa T)^{1/2}$ as Tegmark did, we rescue Eq. (3).

The square root of κT in the numerator of Eq. (15) depends on the approximation used λ≤d and $x_2 \ll d$. However, if we use a much broader function to represent the environmental ion in the density matrix, such that it vanishes effectively for $x_2 = \lambda \ll d$, the situation is changed in the Eq. (13).

$$\rho_1(\vec{r}_1, \vec{r}_2, t) = C\int \exp\left[-\frac{1}{4} - \frac{Kq_1q_2t}{ih}\frac{x_1\lambda + y_1d}{(\lambda^2+d^2)^{3/2}}\right] \quad (16)$$

The integral above will vanish if the imaginary exponential oscillates upwards too close to the limit, producing a cancellation between positive and negative parts of the function in the integration, which vanishes when

$$t \ll \frac{h}{Kq_1q_2}\frac{(\lambda^2+d^2)^{3/2}}{x_1\lambda + y_1d}\frac{h}{Kq_1q_2}\frac{\lambda^2}{x_1} \quad (17)$$

By simple inspection we see that, with $\lambda = h/(M\kappa T)^{1/2}$, the factor κT goes down to the denominator in Eq. (17), as usual, differently from the Tegmark Eq. (3):

$$\tau = \frac{1}{Kq_1q_2}\frac{h^3}{x_1M\kappa T} \quad (18)$$

Corresponding dipole potential can be written as:

$$V(\vec{R}') = Kq\frac{\vec{p}.(\vec{r}_2 - \vec{r}_2')}{|\vec{r}_2 - \vec{r}_2'|} \cong Kq\left(\frac{\vec{\rho}.\vec{r}_2}{|\vec{r}|^3} + \frac{3\vec{\rho}.\vec{r}_2|\vec{r}_1'|}{|\vec{r}_2|^4}\right) \quad (19)$$

From Eq. (5) and taking all previous considerations,

Density matrix of the system=

$$\rho_t.(\vec{r}_1, \vec{r}_2, t) = C\int \exp\left[\left(\frac{x_2}{2\lambda}\right)^2 - \frac{3|\vec{r}_1'|Kq}{ih}\left(\frac{p_xx_2 + p_yd}{(x_2^2+d^2)^2}\right)t\right]dx_2 \quad (20)$$

For a regime where $d \gg x_2$ we can approximate $(x_2^2 + d_2^2)^2 \cong d^4$ and therefore;

$$\tau = \frac{d^2\sqrt{M\kappa T}}{3Kqps}\Omega_{dipole} \quad (21)$$

Where; we assume $p_x = p\cos(\alpha)$ with Ω_{dipole} =sec(α) and |r|=S. Now, if we consider another regime with a broad function to represent the environment, so that it vanishes effectively for $x_2 = \lambda \gg d$, where, $\lambda = h/(M\kappa T)^{1/2}$.

$$\tau = \frac{h^4(M\kappa T)^{3/2}}{3Kqps}\Omega_{dipole} \quad (22)$$

Eq. (22) shows that in the very low temperature regime our calculations for the dipole case yield a result compatible with the high decoherence time in the limit of very low temperature, as does Tegmark's [7].

CONCLUSIONS

In spite of our disagreement with Tegmarkv, concerning his refutation of the quantum brain together with the Hameroff and Penrose OOR model [14, 6]. We have shown that our calculation does not agree with the response to Tegmark's paper by Hagan *et al.* [8]. We still propose a new quantum model in the brain where the most important thing is the sequence of coherent states accumulating in the microtubule. In this manner, the quantum activity could appear in another formulation for the brain [15]. The quantum models of the mind and their applications to individual and collective behavioural changes and the mitigation of the chaotic effects of BIS catastrophies on the global scale have been established.

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REFERENCES

1. Penrose R. *Shadows of the Mind*. London: Vintage; 1994.
2. Tuszynski JA, Brown JA, Hawrylak P. *Philos. Trans. R. Soc. Lond. A.* 1998; 356: 1897–1926p.
3. Brown JA, Tuszynski JA. *Phys. Rev. E*. 1997; 56(5): 5834–5840p.
4. Tuszynski JA, Trpisova B, Sept D, *et al. B''o-Systems*. 1997; 42: 153p.
5. Tuszynski JA, HamerofT S, Sataric MV, *et al. J. Theor. Biol.* 1995; 174: 371p.
6. Hameroff SR, Penrose R. In: Shear J, editors. *Explaining Consciousness: The Hard Problem.* Cambridge: MIT Press; 1998.
7. Tegmark M. *Phys. Rev. E*. 2000; 61: 4194p.

8. Hagan S, Hameroff SR, Tuszynski JA. *Phys. Rev. E*. 2002; 65: 061901p.
9. Penrose R. *The Emperor New Mind.* New York: Oxford University Press; 1989.
10. Pokoorny J, Ming Wu T. *Biophysics Aspects of Coherence and Biological Order*. New York: Springer; 1998.
11. Stapp H. *Mind, Mailer and Quantum Mechanics*. Berlin: Spring-Verlag; 1993.
12. Eccles JC. *How the Self Controls Its Brain*. Berlin: Spring-Verlag; 1994.
13. Aifinito E, Manka R, Vitiello G. *Class. Quantum Grav.* 2000; 17: 93p.
14. Hameroff SR, Penrose R. In: Hameroff S, Kasszniak AK, Scott AC, editors. *Toward a Science of Consciousness*. Cambridge: MIT Press; 1996.
15. Meyer David A. e-print; quant-ph/9604003.

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