

## **The concept on cell electrophysiology (I)**

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(This paper is the satellite letter of *The Eukaryotic Mechanism Directed by Bioelectricity: Creation and Enlightenment (I)* [1 Shen])

Cell electrophysiology states the molecular biology-founded bioelectricity mechanism of eukaryotes that the eukaryotes generate the bioelectricity of action potential and utilize the bioelectricity for eukaryote working. It is the mechanism that essentially (i) excites the activity of organelles, and manages organelles and cell elements into the coordinated and systemized work, (ii) generates the energy resource that supports the activity of cell, and (iii) operates the informationized work of eukaryote.

The optimal way to understand the mechanism is that takes regard the work of eukaryote as an electronic engineering, and need a dialectical logical mind, flexibly rather not inflexibly, since the contexts of biologic conditions are different from those of abiological conditions.

### **1 The biomaterials for bioelectricity generation**

The defining feature of eukaryotes is the highly developed membrane systems that enclose the organelles of plasma membrane, endoplasmic reticulum (ER), mitochondria, and nucleus. The membrane systems are not made of membrane only but made of the strictly organized sandwich structure (polymer/membrane/polymer') that the membrane is sandwiched between the coupled negatively charged polymers [1 Shen]. The strictly organized sandwich structure is where the

bioelectricity of action potential arises from, functioning as the electric generator of alternating current (AC) [1 Shen].

The motion of positively charged mobile counterions performs electric current and the latticed gridding meshwork of negatively charged polymers (ground substances) performs magnetic field so that the interaction between polymers and counterions performs the electromagnetic interaction [1 Shen, 2 Shen].

## **2 The excitation and control mechanism**

The membrane which sandwiches between the coupled polymers acts as the switch to tune off (deactivation) and on (activation) of action potential with membrane potential, and the membrane is functionally compartmentalized into junctional zones (local zones) which act as the control-panel that manipulates the membrane potential to control the frequency of action potential at working zones (somatic zones) with the endogenous mechanism of action potential excitation [1 Shen, 2 Shen, 3 Shen].

## **3 The compositional AC bioelectricity**

The bioelectricity formed by action potential has the superiority that it is the compositional AC electricity formed by the charge carriers of mobile ions. The compositional AC electricity has the double effects of 'wave-particle duality', in which the periodic oscillations of AC electric current perform the property of electromagnetic waves, and the individualized property of ions performs the property of chemical particles that can act as the enzyme activators to activate biochemical reactions.

## **4 The bioelectric resonant components**

## **5 The resonant coupling meshwork and the flowchart of bioelectric power system of eukaryote**

## **6 The informationization of bioelectricity**

## **7 The connotation of cell electrophysiology: quality and qualitative leap on energy**

## **8 The essential principle of eukaryotic electrophysiology: the ingenious relativity**

## **9 Apperception**

## **Reference**

- [1] Shen H. The eukaryotic mechanism directed by bioelectricity: creation and enlightenment (I). <http://viXra.org/abs/1711.0316>.
- [2] Shen H. The dynamics of action potential: the bioelectromagnetized interaction created by cell biology (I). <http://vixra.org/abs/1711.0332>.
- [3] Shen H, Choe W. Spontaneous high-frequency action potential. *Sci China Life Sci.* 2011;54(4):311-335.
- [4] Seely S. An electrodynamic (moving field) theory of muscular contraction. *J Theor Biol.* 1986;121(2):233-48.
- [5] Ronen D, Rosenberg MM, Shalev DE, Rosenberg M, Rotem S, Friedler A, Ravid S. The positively charged region of the myosin IIC non-helical tailpiece promotes filament assembly. *J Biol Chem.* 2010;285(10):7079-86.
- [6] Shen H. Action potential, bioenergy resource, and the principle of perpetual natural electromagnetic dynamics: the living essence and eternal elegant-beauty&#8212; from biology to the universe (I). <http://vixra.org/abs/1711.0315>.