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Article 6-6. The Parameterization of Time-varying Electromagnetic Field for Biophysics Simulation/生物物理模拟实验中时变电磁场参数的确定方法

Author: Liu Huan (1983-), Master of Science (First Class Honours, 2009), The University of Auckland.

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Method：

This section presents a novel method to determine the parameters of time-varying electromagnetic field, on the basis of 'Skin Effect' equations in combination with 'Maxwell' equations:

1.Skin effect equations:

$I(t) = \sqrt{2}\, I \sin(wt)$; $w = 2\pi f$;

2.Maxwell's equations:

$I(t) = j\, H(t)$

$S = I(t) * H(t)$

I is the effective intensity of electric field, t is the varying time, w is the angular frequency (rad/s), f is the frequency, H is the intensity of magnetic field, j is the conductivity, and S is the energy of wave (or the electromagnetic wave intensity) [1]. This time-varying electromagnetic field can be used for biophysical training, and the biophysical training method by simulation of bio-signals is designed in my previous journal article [2]. For the simulation of bio-signals by time-varying electromagnetic field, the frequency is constant with time change, which is pre-determined as F1, F2, ..., Fn designed in previous article [2], whereas the intensity of electromagnetic wave (S) is the time-varying one. Consequently, the new procedure is designed below for time-varying simulation:

Step 1. Host cells (such as blood cells) are cultivated during simulation of electromagnetic wave conditions;

Step 2. Different frequency of electromagnetic wave (or different wavelength) are simulated, and labeled as F1, F2, ..., Fn;

Step 3. Metabolomics test is conducted individually after cultivation in F1, F2,...Fn, respectively;

Step 4. Under each simulated frequency of electromagnetic wave, different intensities of electric field (different from the electromagnetic wave intensity in article [2]) are simulated, and labeled as I1, I2, ..., and In; Then different time-varying electromagnetic wave intensities are simulated correspondingly as S1(t), S2(t), ... and Sn(t).

Step 5. Metabolomics test [3] is conducted individually after cultivation in S1(t), S2(t), ... and Sn(t) respectively. The amount of N×N metabolomics tests are conducted in total.

In this situation, the rhythm of electromagnetic wave in terms of intensity (S) and frequency (f) fluctuates around 3 times earth electromagnetic field and sunshine frequency respectively [2]. Obviously, the intensity of I also determines the amplitude of waves. The intensity of electromagnetic waves is determined by both parameter I and j. This is important for cells to recognize the bio-signals.

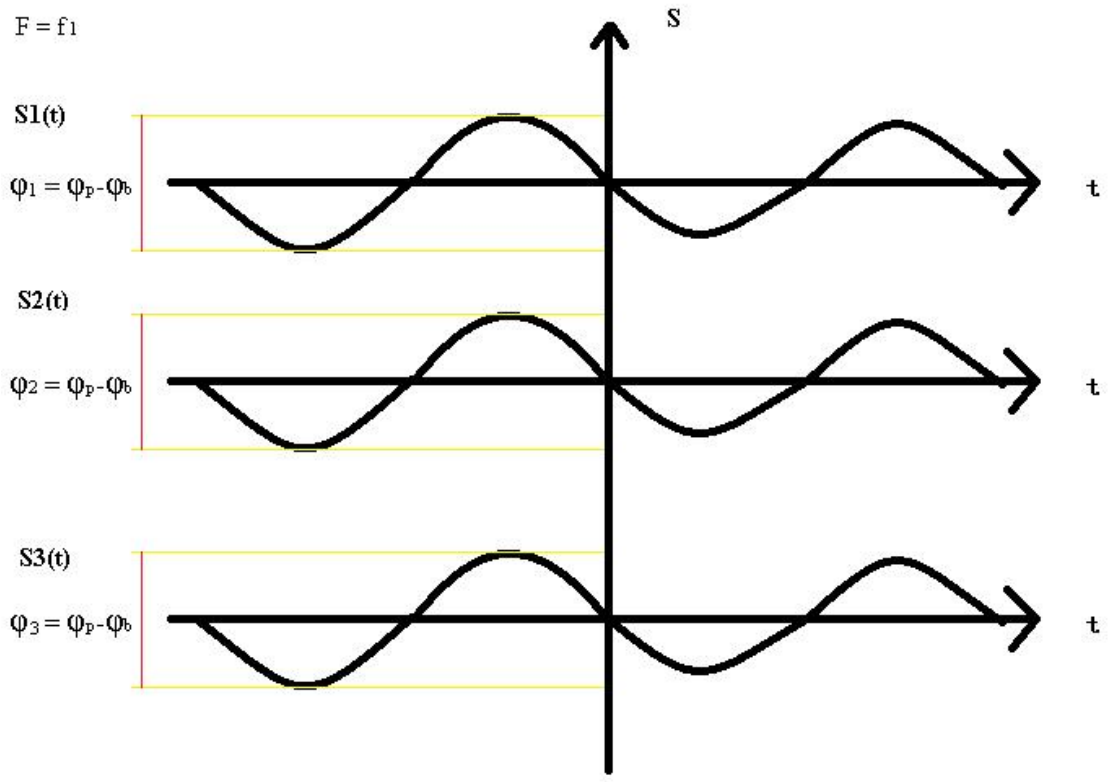

Fig 1. Bio-signal simulation functions: when I = I1, time-varying electromagnetic wave intensity S = S1(t). φ1 is the phase distance between wave peak and bottom point; When I = I2, time-varying electromagnetic wave intensity S = S2(t). φ2 is the phase distance between wave peak and bottom point; When I = I3, time-varying electromagnetic wave intensity S = S3(t). φ3 is the phase distance between wave peak and bottom point.

The above figure illustrates the function of time-varying electromagnetic wave

intensity under each intensity of electric field (I1, I2, ...In) when the frequency is set to be f1. The phase distance between wave peak and bottom points (φ) changes correspondingly when electric field is changed from I1, I2, ... to In. This article has further modified the Skin effect equations into

$I(t) = Pk \times I \times \sin(wt)$; $w = 2\pi f$;

Pk is the parameter of physiology which influences the effectiveness of simulated bio-signals that are capable of being identified by cells.

As simulation of bio-signal waves, the shortage of artificially simulated bio-signals is that the frequency of simulated waves can not vary continuously without breaking points like the real bio-signals, which has been discussed in my previous article [4].

Discussion:

As discussed in previous article, it is deduced that the biochemistry dynamics of the first three isozyme families, which show the highest variation by PCA, determines the conclusion of the whole biochemistry dynamics in this research. Consequently, three different and dominant frequencies of electromagnetic wave are applied concurrently on this biophysical training of host cells for enhancing immunology, which requires three emitters (or launchers) of electromagnetic wave to work concurrently. However, the receptors (or cells) of electromagnetic wave can NOT identify more than three different and dominant frequencies of electromagnetic wave concurrently (This is the environmental pollution of electromagnetic wave), which is similar to the limitation of three spatial dimensions in direct perception capacity of human species (The cell is not so clever to deduce the equations at more than three dimensions like me!). Additionally, the significance of each dominant frequency must be different rather than even significance in PCA analysis.

Pathogen ‘army’ behaves as camouflage, ambush, or other intelligence strategy for invasion, and host cells need to defend punctually and effectively by training for survival (host cells adjust their skills by themselves on the basis of biophysical learning during this ‘war’ until invasive enemy dies) --- this is the evolutionary physiology of environmental adaptiveness, the foundation subject of environmental science.

This is the revised materials in book “Proceedings for Degree of Postgraduate Diploma in Environmental Science (3rd Edition).” Published in 2016. The ‘chapter’ content mentioned in this article is in previous book. Firstly Revised on 05/01/2021; Secondly Revised on 10/02/2021. This journal article is previously published as: Liu Huan. (2021). Article 10-6. The Parameterization of Time-varying Electromagnetic Field for Biophysics Simulation. Journal of Environment and Health Science (ISSN 2314-1628), 2021(02)., which is converted into Journal of Biological Sciences (ISSN 2958-4035). Both Journals belong to the same publisher, Liu Huan. The previous journal article is closed to the public, but the previous reference is still valid. Latest revised on 02/03/2023 a , b.; Revised on 10/04/2023; 30/05/2023.

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