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Development of the simulation system to evaluate the responses for nervous network system under the low frequency band EMF exposure with the mathematical model of C.elegans

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The electromagnetic field exposure in the low frequency band (1-100 kHz) is known to cause nerve stimulation in the human body [1]. Currently, impedance method [2] [3] is used as an evaluation method of magnetic field (MF) exposure in the low frequency band to estimate the electric fields and the current densities induced in the living body. The numerical model used for the dosimetry consists of millimeter order voxels to express macroscopic organizations in the human body. However, it is not considering the microscopic nervous network system (NNS). Therefore, the purpose of this study is to propose a method to consider responses for the complex NNS under the EMF exposure. If this system will be realized, it will be possible to understand the interaction between the EMF exposure and the NNS in the biological body more accurate than the conventional method.

As mentioned above, we are aiming for developing the simulation system to analyze the influence of EMF exposure on the nerve stimulation transmission. If there is an accurate mathematical model of the whole NNS of the living body, the influence of EMF exposure will be quantitively evaluated. However, the NNS for the human is complicated, because there are many parts that has not been clarified. Therefore, the mathematical model does not exist to express whole the NNS within the human body. In response to this problem, we focused on a nematode named C.elagans (Caenorhabdis elegans). The NNS of C.elegans is much simpler than that of human. The number of nerve cells is very small as 302, and its arrangements and connections are all clarified [5], so there is a mathematical model of the NNS [6]. Therefore, it thought that it is possible to simulate the whole NNS for C.elegans to understand the responses for the NNS of the actual living body under the EMF exposure with mathematical model, before considering the responses for the NNS of the human.

Currently, we are developing and implementing the NNS model for C.elegans into the simulation system to evaluate the responses for the NNS under the EMF exposures by using the NeuroML[7]

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