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低温大気圧プラズマにより摂動された細胞機能のモデリング
Modelling on cellular functions perturbed by cold atmospheric plasmas

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Plasma medicine is an interdisciplinary research spreading over physics, chemistry, biology and medical sciences. The review [1] focuses on mechanisms coupling the physics and chemistry of low temperature plasmas to medically relevant biochemistry and biology. Instead of the great progress in this fields, many aspects still remain to be explored. From the viewpoint of modelling, computational biology, i.e. theoretical or mathematical modelling and computational techniques to the study of biological systems [2], should be a powerful tool for the plasma medicine.
The computational biology includes the simulations of inner-cellular systems. For example, mitochondrial function in cellular energetic metabolism is one of the most important inner-cellular systems. The essential parts of this system are the tricarboxylic acid cycle (TCA cycle), the respiratory chain (electron transport chain) and the adenosine triphosphate (ATP) synthesis machinery. The aim of this modelling work is to understand low temperature plasma-induced multiphase reactions and biological processes systematically by quantifying reactive species behavior and correlating with the plasma induced biological mechanism. In particular, the key issues on the modelling to link the plasma-physics and –chemistry with biological systems will be presented and discussed in the talk.
Figure 1 shows the simplified schematic diagram of the above described mechanisms. Figure 2 shows the time series of the intracellular hydroperoxide H_2O_2 concentration without and with the external H_2O_2 inflow up to and after t=0 min, respectively. The numerical result suggests that the H_2O_2 onset modifies the intracellular chemical dynamics, i.e. the oscillatory behavior.

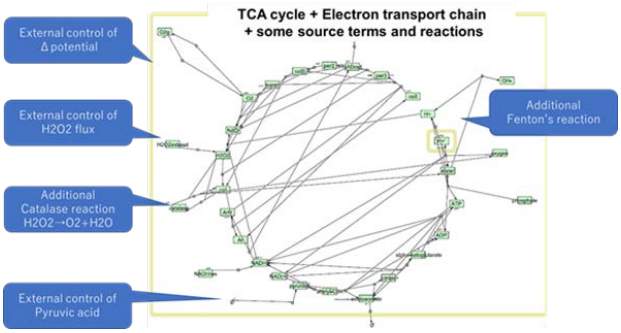

Fig. 1. A simplified diagram of mitochondrial energetic metabolism.

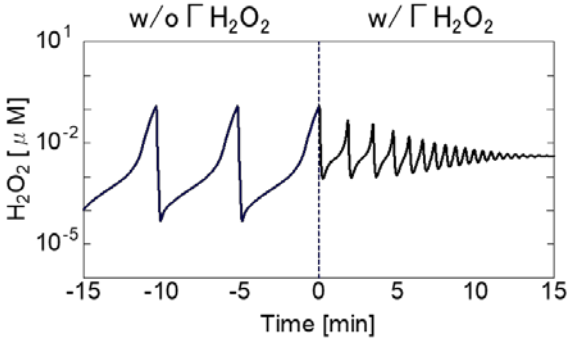

Fig. 2. Time series of intracellular H_2O_2 concentration modified by external H_2O_2 inflow.

References
[1] D. B. Graves, IEEE Trans. Rad. Plasma Med. Sci. (1) 281-292, 2017.
[2] For example, International society for computational biology http://www.iscb.org/