103

Simulation of cell activities in pharyngeal pumping in *Caenorhabditis elegans*

Yuya Hattori[1], Michiyo Suzuki[2], Zu Soh[3], Yasuhiko Kobayashi[2], Toshio Tsuji[1]

[1] Hiroshima University, Japan
[2] Japan Atomic Energy Agency, Japan
[3] Osaka University, Japan

Presenter: Yuya Hattori

Living organisms exhibit various rhythmic movements, which are important for their survival. The *Caenorhabditis elegans* shows several rhythmic movements including the pumping motion for chewing and swallowing involving the pharyngeal muscle. Various biological signals have been measured in pharyngeal cells using the electropharyngeogram (EPG), which represents the electrophysiological responses of the pharyngeal cells in a lump, and there is evidence that the pumping rhythms are generated by the pharyngeal muscle cells and controlled by pharyngeal neurons. In addition, we recently reported that the pumping rhythms temporarily change after ionizing irradiation. Thus, the pumping motion in *C. elegans* is considered a useful system to investigate the mechanisms of rhythmic phenomena in living organisms. However, it is difficult to measure the membrane potentials of individual pharyngeal cells by electrophysiological techniques, and as such the mechanisms of rhythm generation and control in pharyngeal cells are not well understood. In this study, we propose a simulation-based approach to investigate the mechanisms of rhythm phenomena. To conduct the simulations, first, we developed a pharyngeal muscle model including 29 cell models, which simulate the activity of each cell as a membrane potential based on FitzHugh-Nagumo equations. Next, we calculated the EPG by using the outputs of individual cell models. As the result, our model successfully generated the EPG similar to that observed in a wild type *C. elegans*. Furthermore, we could simulate the responses of some mutants such as the *eat-5* mutant by ablating certain gap junctions virtually so as to correspond to the defects. We will discuss the usefulness of the simulation-based approach to examine mechanisms of rhythmic phenomena.