

# Genomic Object Net: XML Visualization of Simulation Results from Biological Modeling on Hybrid Functional Petri Net

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**Keywords:** Genomic Object Net, XML, visualization, hybrid functional Petri net

## 1 Introduction

In [2], we showed that hybrid Petri net (HPN) provides the promising basic architecture for representing biological processes with an example of description and simulation of  $\lambda$  phage genetic switch mechanism. We launched the project “Genomic Object Net Project” whose aim is to develop the software tool which can be used by biologist easily and intuitively.

As a first step, in [3], we introduced the new mathematical expression enhanced from HPN “hybrid functional Petri net (HFPN)” for realizing biopathways naturally and intuitively. Furthermore, by using Genomic Object Net Assembler [3], we showed how the concept of HFPN is suitable for describing and simulating biological processes through the realizations of circadian rhythms in *Drosophila melanogaster*, glycolytic pathway of *Escherichia coli* with the lac operon gene regulatory mechanism, and apoptosis induced by the protein Fas.

Recently, we developed a tool “Genomic Object Net Visualizer” based on XML technology which enables us to visualize simulation results produced by Genomic Object Net Assembler. By using this tool, users in biology/medicine can view simulation results on their own aspects.

In this software demonstration, we will present several visualization examples of simulation results including lac operon gene regulatory network, circadian rhythms in *Drosophila*, and Delta-Notch lateral inhibition mechanism.

## 2 Genomic Object Net Visualizer

“Genomic Object Net Visualizer” is developed on the basis of XML technology. Users can realize visualizations of simulation results of aimed biological phenomenon by creating XML document in which CSV files produced by Genomic Object Net Assembler are included as basic data for simulations.

Figure 1 shows a visualization example of circadian rhythms in *Drosophila*. The right window describes the concentration behaviors of PER protein and dCLK protein, and these two graphs are driven by CSV files produced by Genomic Object Net Assembler where HFPN circadian rhythm model is realized. The left upper window shows an animation of PER and TIM proteins and these complexes

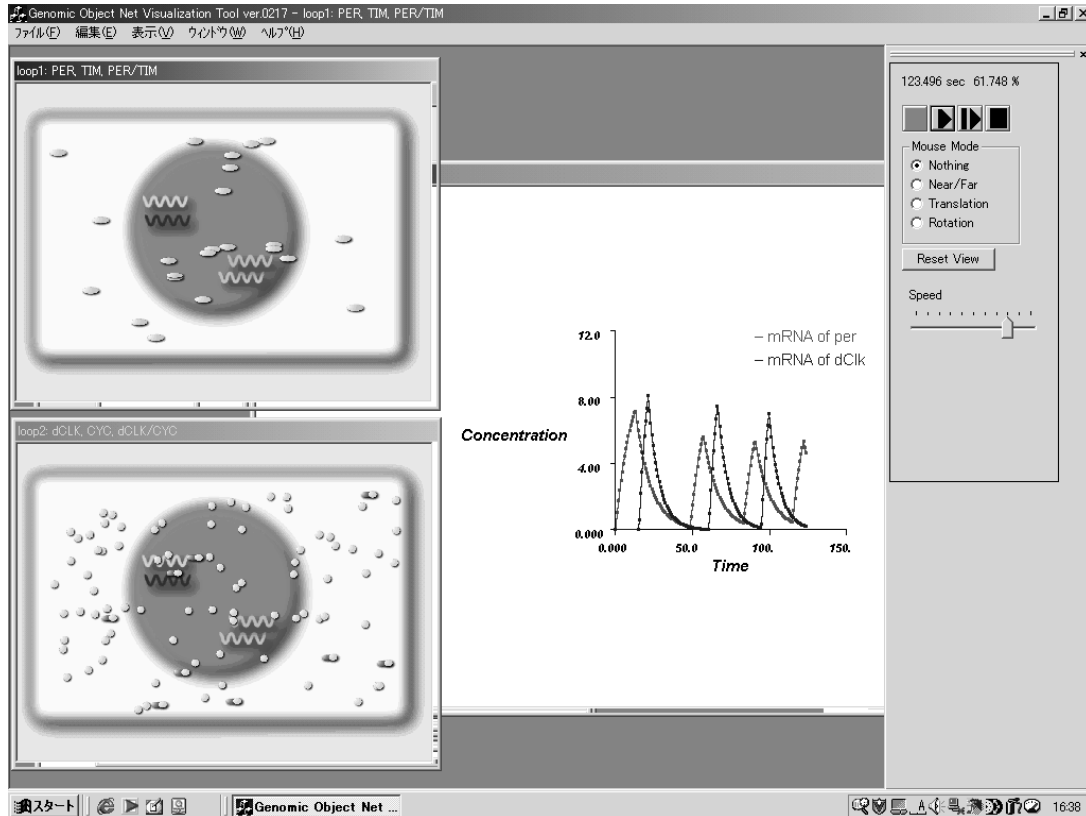


Figure 1: View simulation results as an animation by GON Visualizer.

whose numbers are changed according to these concentration levels. The right lower window shows an animation of dCLK and CYC proteins and these complexes whose number is changed according to that concentration level. Please refer to [1] for the details about genes including *per*, *tim*, *dClk*, and *cyc* which participate in gene regulatory mechanism of biological rhythms in *Drosophila*.

## Acknowledgments

This work is partially supported by the Grand-in-Aid for Scientific Research on Priority Areas (C) “Genome Information Science” and Grand-in-Aid for Scientific Research (B) (No.12480080) from the Ministry of Education, Culture, Sports, Science and Technology in Japan

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