細胞を「多段階にまたがる大規模な情報ネットワーク」として読み解き、理解する

研究概要
生命現象は、エピジェネティクス、トランスクリプトーム、プロテオーム、マクロボトリームなどを用いた様々な分子からなるネットワークによって制御されている複雑なシステムである。このシステムの解明に携わって、研究者たちは、生命体におけるトランスオミクス解析により、多段階にまたがるネットワーク制御が、生体環境や生理状態を規定するという新しい視点を発見した。このような視点は、従来の単純な分子レベルの解析方法で得られない、生命現象の全体像を理解するための新視点である。

Research Projects
A cell is an elaborate system that is regulated by a huge and complex network across multiple omics layers, such as the epigenome, transcriptome, proteome and metabolome layers. Most processes of the cell are regulated by the network across multiple omic layers. For example, insulin dynamically regulates metabolites through signaling pathways involving phosphorylation in the short term, and in the long term, through the amount of metabolites that are mainly regulated by gene expression. Therefore, to truly understand the cell, we need to reconstitute a detailed network from data through multiple omic layers, and interpret the strategy of the cell (trans-omic analysis). To achieve this, we are now conducting a study with clearer integration between experiments and computer analysis. For instance, in experiments, we perform experiments based on suitable conditions for trans-omic analysis. In computer analysis, we reconstitute the global network across multiple omic layers using statistics and informatics approaches. Next, we will construct mathematical models depending on the biological phenomena from the reconstructed global network, and then validate the models with experiments. After validating the models, we will try to understand the cell from two different points of view: dynamics and information transmission. Thus, we will focus on two things: understanding the cell survival strategies focusing on the dynamics which are produced from the selected global networks across multiple omic layers, and understanding the cell system focusing on information transmission in the global network. In the future, we would like to contribute to diagnostic and medical treatment through the application of trans-omic analysis.

Major Recent Publications