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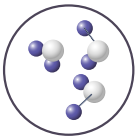

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Editorial

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# Systems Biology and Synthetic Biology: From Systematic Understanding to Rational Design of Cells

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## What is Systems Biology and Synthetic Biology?

Systems biology aims to systematically characterize and understand cellular behaviors in molecular level. High-throughput – Omics technologies, including transcriptomics, metabolomics, proteomics, and lipidomics, have been wildly adopted to achieve such a global view of the molecular mechanism of cell functions.

Rooted in traditional genetic engineering, synthetic biology is a nascent field that aims at rational engineering a single cell or a population of cells, enabling new functions and behaviors to the cells. Such new cellular functions may offer great applications in biotechnology (e.g., production of biofuels and commodity chemicals, and environmental remediation) and biomedicine (e.g., production of drugs, and novelcell therapies). In many of these applications, the cells' metabolism is usually manipulated to achieve the overproduction of metabolites that have commercial values. Metabolic engineering strategies have been developed to steer cells' metabolic pathways by genetic manipulation of cells, which is one of the synthetic biology efforts. In addition to the engineering of cell metabolism, other cell behaviors can also be rationally programmed, for example, cell-cell communications, motility properties (cellular chemotaxis and diffusion), cell signaling pathways to sense and respond to extracellular and intracellular environmental changes, etc. Many molecular biology technologies (e.g., protein engineering by rational design; directed evolution and gene/genome synthesis) can be adopted to achieve such objectives.

## Knowledge Gained from Systems Biology Helps Rational Design of Cells via Synthetic Biology

To achieve a rational design or programming a target cell, a detailed understanding of the biological pathways of the target cell (including cell signaling, gene regulatory pathways, and metabolic pathways, etc.) is a prerequisite. In a sense, using systems biology approaches to have a thorough characterization of the target cell's metabolic and genetic pathways is of great value to guide thesubsequent engineering of the cell. Such a systematic understanding of the cellular physiology can provide clues on how to identify the potential genes or biological pathways of the cell to control its behaviors, e.g., to realize the overproduction of a secondary metabolite as an antibiotic or a biofuel molecule.

## Understanding Engineered Cells and Further Optimization of Cell Behaviors Need Systems Biology Characterization

According the design purpose, programming new cellular components into cells via synthetic biology or metabolic engineering approaches may or may not enable purposely altered cell properties. Thus, multiple rounds of efforts may be necessary to optimize the properties of the engineered cells to fully fulfill our design purposes. To further optimize the cellular functions, a detailed knowledge on the changes of cell physiology upon the implemented genetic modifications should be obtained. To this end, systems biology characterization of physiology of the engineered cells will provides clues for further optimization of cell behaviors.

## Journal of Metabonomics & Metabolites (JMBM) Invites Leading Researches in Systems and Synthetic Biology

JMBM has tremendous interests on both systems biology research on characterizing cellular systems using various –Omics technologies, and synthetic biology research on engineering cells for a variety of practical applications such as bio-energy (biofuels production); environmental biotechnology; biomedicine and food industry. In particularly, JMBM is interested in the researches related to cellular metabolism, either characterization of metabolic pathways in native or engineered cells or the novel researches on rational engineering cellular metabolic pathways.

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