**Novel Synthetic Biology Tools for Rational and Evolutionary Metabolic Engineering**

Gyoo Yeol Jung

Department of Chemical Engineering, POSTECH, Pohang, Korea 790-784

e-mail) gyjung@postech.ac.kr

Metabolic Engineering aims to purposeful design or redesign biological system for the production of commercially valuable chemicals such as biofuels, platform chemicals and biologically active compounds. To achieve the successful design or redesign of the biological systems, robustness of naturally occurring biological systems has to be relieved so that cells can be easily redesigned. Although extremely huge efforts have been made to find genetic target to improve metabolic function of the microorganisms, there still exists the additional room for the non-rational approach. Currently, typical approach for metabolic engineering uses both rational approach as well as non-rational methods such as combinatorial and evolutionary methods. One of the most critical problems of metabolic engineering is especially robustness of the biological systems. Bacterial cells are generally evolved at the various levels from DNA to protein for maintaining their robustness against the changing circumstances. Therefore, general strategy to modify cellular physiology depending the robustness or flexibility of the biological systems should be required. In this study, we developed the general tools to modify the biological robustness at the various levels including translation and protein levels. For translation level control, a model to predict the translation efficiency based on the mRNA’s secondary structure and consequently expression level can be precisely controllable for any genes of interest. Additionally, intracellular metabolite sensor named “riboselector” to regulate metabolic distribution will be presented. The potentials of the platform technology developed in this study for the application to the production of biofuels and commodity chemicals.