The Singapore Bioimaging Consortium (SBIC)
presents a seminar on

"Model-guided Systems Biology framework for Characterization and Design of smart cells in Healthcare Applications"

Speaker: **Dr Lee Don-Yup**
School of Chemical Engineering
Sungkyunkwan University
Host : **Dr Jung Sangyong**
Date : **Monday, 6 August 2018**
Time : **2.00pm – 3.00pm**
Venue : **SBIC Seminar Room**
11 Biopolis Way
Level 2, Helios Building, Singapore 138667
(Please enter via Level 1)

Abstract

Constraint-based flux analysis is one of the well-established computational techniques for investigating cellular metabolism at systems-level under various environmental/genetic perturbations. The availability of software applications to conveniently implement it and related in silico methods has enabled the development of genome-scale models (GEMs) for more than 100 species across all three domains of life, thereby facilitating analysis of their intracellular metabolism. These models are also useful in contextualizing multi-omics data sets, thereby realizing the full potential of systems biology. In this seminar talk, I will demonstrate their potential healthcare applications via two case studies based on 1) human and 2) probiotic microbial models. First, we have developed the most comprehensive and biochemically consistent human genome-scale metabolic model (GEM) to-date, Recon3E, and included the necessary kinetome information to enable its ready use during the simulations to improve the phenotype predictions further. Using Recon3E, we were able to predict the metabolic rewiring which occurs during the differentiation of pluripotent stem cells into adult progenitors, emphasizing the role of unsaturated lipids, amino acid derivatives and one-carbon metabolites in maintaining self-renewal and pluripotency. We also identified certain metabolite biomarkers which could be targeted for enhancing stem cell differentiation into specific lineages. For probiotic application, we developed the genome-scale models of 6 selected lactic acid bacteria (LAB), followed by characterizing their metabolic capabilities under various diet regimes using transcriptome data, highlighting the rigid cofactor-driven metabolic nature in hetero-lactic fermentative bacteria. Subsequently, the metabolic interactions between the host and microbiome metabolic networks can be investigated to propose new strategies for personalized probiotic LAB design to ameliorate type-2 diabetes and ulcerative colitis.

About the Speaker

Dr Lee Don-Yup's main research interests focus on the application of systemic and integrative approaches to a variety of interesting systems, including chemical, biological, biomedical, pharmaceutical and nano/micro processes. Thus, his research goals are to better understand and design such systems and to effectively achieve desirable properties of the systems by integrating statistical analysis, modeling, control and optimization techniques of systems engineering. In last three years, Dr Lee has worked and focused on computational and bioinformatic analyses of complex biological systems and heterogeneous and high throughput global information & data. Currently, he is leading and managing a research group, "Process Design and Systems Engineering Lab" @ SKKU as a Principal Investigator (PI). His main research fields include: Systems and Synthetic Biotechnology/Bioinformatics, Drug & Disease Modeling and Control, Supply Chain Optimization and Health/Energy/Environmental Policy Modeling.

--- Admission is free and all are welcome ---