4an From Process Systems Engineering to Systems Biology and Synthetic Biology

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I am interested in i) systems biology and synthetic biology, which aims to integrate mathematical modeling, computer simulation, and experiments for mechanistic studies of biological systems and for developing biotechnology; and ii) chemical process systems engineering, which involves the development of quantitative mathematical models and computational algorithms for the simulation, design and optimization of chemical processes.

Doctoral research. My background is in process systems engineering, which involves the development of quantitative mathematical models and computational algorithms for the simulation, design and optimization of chemical processes. In particular, my Ph.D. thesis focused on scheduling, planning and design of chemical processes. Under the supervision of Professor Christodoulos Floudas at Princeton University, I developed new mathematical frameworks for the modeling and optimization of a variety of complex chemical processes, including a) integrated design and scheduling of multi-purpose batch processes; b) medium-range production scheduling of multiproduct plants; c) planning of well platform developments; d) scheduling of tanker lightering; and e) robust optimization approach for scheduling problems with uncertain data. In addition, during the last year of my graduate study, I had an opportunity to work on a project aiming to elucidate the glucose signaling pathways in yeast using global gene expression data. In collaboration with Dr. James Broach's group in the Molecular Biology Department at Princeton, we developed a new computational framework to identify the complex network topology of glucose signaling pathways in yeast. Our analysis generated network topologies which are consistent with, and extensions of, known biological interactions in glucose signaling.

Postdoctoral research. Greatly inspired by what I discovered through the above-mentioned project that my training in mathematical modeling and computational analysis are potentially very useful to biological research, I decided to shift to biology for my postdoctoral research. In Dr. George Church's lab at Harvard Medical School, I have been enjoying working with biologists and other researchers on the following projects: a) investigation of artificial microbial symbiosis with modeling and experiments; b) development of a bioinformatics pipeline for the automatic generation of whole-cell metabolic network models from genome annotations and application to the study of marine cyanobacterium *Prochlorococcus marinus*; and c) study of mechanisms of biological switching arising from multisite modifications of single molecules.