Seunghee Shelly Jang

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Education

University of Washington
Ph.D. in progress, Electrical Engineering - Primary focus: Synthetic Biology — Present
Emphasis : Engineering multicellular behavior in *E. coli* and *S. cerevisiae*

University of British Columbia
M.A.Sc, Chemical and Biological Engineering — May 2009
Emphasis : Nonlinear System Identification with Bayesian Inference

University of Washington
B.S., Chemical Engineering — March 2007
Minor in Mathematics and Chemistry

Publications

H. Yu, B. Moss, **Seunghee S. Jang**, M. Prigge, E. Klavins, J. Nemhauser, and M. Estelle. "Mutation in TIR1 confer auxin hypersensitivity", *Accepted*.

Seunghee S. Jang, K. Oishi, R. Egbert and E. Klavins. "Specification and simulation of synthetic multi-celled behaviors. Journal of American Chemical Society", *ACS Synth. Biol.*, 2012

K. A. Havens*, J. M. Guseman*, **S. S. Jang***, E. Pierre-Jerome*, N. Bolten, E. Klavins and J. L. Nemhauser. "A synthetic approach reveals extensive tunability of auxin signaling." *Plant Physiology*, 2012. *The authors contributed equally to the paper.

S. S. Jang, R. B. Gopaluni, Parameter Estimation in Nonlinear Chemical Biological Processes with Unmeasured Variables, *Canadian Journal of Chemical Engineering*, 2011.

S. S. Jang, H. De La Hoz, A. Ben-Zvi, W. C. McCaffrey, R. B. Gopaluni, "Parameter estimation in nonlinear chemical and biological processes with unmeasured variables from small data sets ", *Chemical Engineering Science*, 2011.

S. S. Jang, H. De La Hoz, A. Ben-Zvi, R. B. Gopaluni, "Parameter Estimation using Scarce and Irregular data from Multiple Experiments", Proceedings of *Advanced Control in Industrial Process*, 2008.

Research Experience

University of Washington

Graduate Research Assistant — Sept. 2009–Present
Advisor : Dr. Eric Klavins — Dept. of Electrical Engineering.
Project : System identification and quantitative analysis of *S. cerevisiae* synthetic auxin signaling pathway
Objective : To quantify the tunability of synthetic plant signal pathway ported into yeast, I identified a mathematical model using a minimal grey-box system identification approach. The characterization project yielded unique parameters for the tested protein pairs that can be used to design increasingly complex synthetic circuits. The next phase of the project focuses on exploring on the large design space available using these parts and selecting the network architectures that give rise to multicellular behavior in yeast.

Project : Engineering multi-cellular behavior in *E. coli*
Objective : The bottom up approach of synthetic biology enables a complementary approach to traditional biological investigation and allows the identification of design principles of natural systems. In this project, I am focusing on engineering genetic regulatory networks (GRN) in *E. coli* that mimics differentiation phenomena in the early developmental stage of multicellular organisms. Starting from a high level specification of desired behavior, possible designs of GRN are analyzed and simulated. The simulation and quantitative analysis process informs and optimizes the tuning of synthetic circuit.

University of British Columbia

Graduate Research Assistant — Sept. 2007–May 2009
Advisor : Dr. R. Bhushan Gopaluni — Dept. of Chemical & Biological Engineering.
Project : Nonlinear process parameter estimation using Bayesian inference and Markov Chain Monte Carlo approach
Purpose : Many chemical and biological processes are restricted by various physical and logistical factors and do not allow samples to be taken at regular time intervals in large quantity. The project developed an Bayesian inference algorithm that allow estimation of parameter probability distribution using a small number of irregularly sampled data from multiple experiments.

University of Washington

Undergraduate Research Assistant — Winter 2006–Summer 2007
Advisor : Dr. Buddy D. Ratner — Dept. of Biological Engineering
Project : Characterization and Analysis of polymer surface immobilized with amino acids

Undergraduate Research Assistant — Summer 2005
Advisor : Dr. Shaoyi Jiang — Dept. of Chemical Engineering
Project : Development of Surface Plasmon Resonance Biosensor

Relevant Technical Skills

Modeling and analysis : Systems and control theory based modeling and analysis for biological systems. Includes theories of Markov processes, chemical master equations, bayesian inference, Markov Chain Monte Carlo methods, Nonlinear systems, stochastic simulations, parameter identification and model reduction.

Software : *Mathematica*, `gro`, MATLAB, Adobe Illustrator, Python, LaTeX, Maple

Biology Laboratory : DNA recombination techniques, plasmid construction, gene modification, cloning, transformations and cell culture. Fluorescence microscopy, microfluidic chambers, flow cytometry.

Biomaterials Laboratory : Toxicity screening, ESCA and ToF SIMS, PCA analysis, manufacture and analysis of electrophoresis gel and polymer

Teaching Experience

Introduction to Synthetic Biology

Biotechnology Laboratory

Process Synthesis

Chemical & Biological Engineering Thermodynamics

Presentations

"Engineering with auxin: characterization of a synthetic signal processing toolbox"
q-Bio 2012, Santa Fe, NM, USA. Aug 10, 2012.

"Parameter Estimation using Scarce and Irregular data from Multiple Experiments"
Advanced Control in Industrial Process, Jasper, AB, Canada. May 6, 2008.

"Parameter Estimation of Nonlinear Process Model using Multiple Experimental Data."
Control Systems/Pan Pacific - PAPTAC, Vancouver, BC, Canada. June 18, 2008

Employment

Zheng Laboratory — Dept. of Pharmacology, UW
Laboratory Assistant — 2003–2007
Responsibilities and Acquired skill sets : Maintenance of overall lab organization, preparing various chemical buffers, electrophoresis gel and bacterial growth media for biochemical experiments for pharmacological research

Department of Nursing — Seoul National University
Freelance Technical Document Translator — 2001, 2007
Responsibilities and Acquired skill sets : Translation of academic journals and textbooks from Korean to English and from English to Korean, bi-lingual technical writing skills required for academic research

Honors and Awards

Kenney Fellowship University of Washington, 2012

Clairmont L. Egtvedt Fellowship University of Washington, 2009

Graduate Entrance Scholarship University of British Columbia, 2007

Kimberly-Clark Engineering Scholarship University of Washington, 2005

Dean's List University of Washington, 2002, 2003, 2004

Engineering Early Admission Student University of Washington, 2003

Graduate Engineering and Technical Courses

Mathematical Foundation Systems Theory

Introduction to Synthetic BIology and Laboratory Course

Introduction to Digital Image Processing

Data Networks

Optimization Methods - Gradient method, statistical inferences, design of experiments

Mathematical Operations in Chemical Engineering - Dimensional analysis and model theory

Fluid Dynamics - Governing equations for Newtonian fluids, Applied Computational Fluid Dynamics

Chemical Engineering Thermodynamics - Molecular Thermodynamics of fluid phase equilibria

Foundations in Control Engineering - State Space feedback controller and observer design

Self-Tuning Control - Adaptive control, system identification, design and implementation