

**Statistical Inverse Problems for Differential Equation Models with
Applications to Biomathematical Modeling by Rigorously Using
Experimental Data**

Hulin Wu, Ph.D.

Professor of Biostatistics and Computational Biology

Director, Center for Biodefense Immune Modeling

Department of Biostatistics and Computational Biology

University of Rochester School of Medicine and Dentistry

601 Elmwood Avenue, Box 630, Rochester, New York 14642

Email: hwu@bst.rochester.edu

Differential equations are widely used to describe dynamic systems in many scientific fields. In bioinformatics and systems biology research, differential equation models can be constructed to represent the dynamic biological processes. However, both model structures and model parameters need to be determined based on experimental data. It is very challenging to solve the inverse problems of differential equation models by rigorously using experimental data. In particular, most statistical inverse problems often boil down into a complex optimization problem. In this talk, I will discuss the model construction procedure in biomedical research, which includes model parameter identifiability, model structure identification, parameter estimation, model validation and evaluation based on experimental data. Experimental data from recent studies on immune response to influenza infection will be used to illustrate the modeling principles.