

# From Signal Transduction and Pharmacokinetics to Formal Reaction Kinetics: A Need for General Tools

János Tóth

Department of Mathematical Analysis,  
Budapest University of Technology and Economics,  
Budapest, H-1111 Egry J. u. 1., HUNGARY

April 1, 2005

Different areas of complex biosystems initiate similar questions which might properly be formulated and solved in a more general setting.

After introducing two concrete models we formulate the general **deterministic** model of formal reaction kinetics with or without mass action type reaction rates. We present a few general tools to deal with such models: one for the decomposition of overall reactions. three for estimating the reaction rate parameters, one for the reduction of the number of variables: lumping.

Furthermore, we also present and apply the general evolution equations for the generating function, for the moments, for the stationary and transient distributions etc. in **stochastic** kinetics, and also a general (really short) simulation program.

As to the relations between deterministic and stochastic models, we only mention a few problems, one of them is the relation between unimodality of the stationary distribution and the uniqueness and location of the deterministic stationary point.

**Acknowledgements** The present work has partially been supported by the National Science Foundation, Hungary, under Nos T037491 and T047132. The present work is based on joint works with my colleagues F. Bois, P. Érdi, B. Kovács, G. Li, M. Moreau, D. Papp, H. Rabitz, J.-P. Rospars.