

Society for Industrial and Applied Mathematics
Conference on the Life Sciences
Minisymposium on the Long-Term Dynamical Properties
of Biochemical Reaction Networks
San Diego, California, USA
7-10 August 2012

Title

Uniqueness and Asymptotic Stability of Equilibria in a Reversible, Non-Complex-Balanced Reaction Network

Presenter

Gilles Gnacadja
Research and Development Information Systems, Amgen
Thousand Oaks, California, USA
<http://math.GillesGnacadja.info/>

Abstract

The allosteric ternary complex model is frequently used in pharmacology to represent the interaction of a receptor with two ligands. Tacit conditions on the rate constants result in that equilibria are unique, detailed-balanced and globally asymptotically stable. However, these conditions cannot be verified experimentally or enforced in finite-precision numerical computations, leaving open the possibility that the uniqueness and asymptotic stability of equilibria are not robust features. We describe transformations of the Jacobian matrix of the mass-action species-formation map which lead to the uniqueness of equilibria and the existence of quadratic Lyapunov function, without restrictions on the positive rate constants. The result on the uniqueness of equilibria is quite general, while the requirements for getting the quadratic Lyapunov function are rather stringent and hopefully can be relaxed.

Keywords

Reaction Network; Asymptotic Stability

Date presented

9 August 2012