The Emergence of Multistationarity in a MAPK Network Model

Maya Mincheva[1], Carsten Conradi[2]

[1] Northern Illinois University, USA
mincheva@math.niu.edu

[2] Max Planck Institute for Dynamics of Complex Technical Systems, Germany.
conradi@mpi-magdeburg.mpg.de

The MAPK network is a principal component of many intracellular signaling modules. Multistability (the existence of multiple stable steady states) is considered an important property of such systems and its origin is not yet completely understood. Theoretical studies have established parameter values for multistability for many models of MAPK networks. Up to now deciding if a given model of a MAPK network has the capacity for multistationarity (the existence of multiple steady states) required extensive search of the parameter space. Two simple parameter inequalities will be presented. If the first inequality is satisfied, it guarantees multistationarity (and hence the potential for multistability). If the second inequality is satisfied, it guarantees the uniqueness of a steady state (and hence the absence of multistability). The method also allows for the direct computation of the total concentration values such that multistationarity occurs. The emergence of multistability in the ERK – MEK – MKP model that previously required a delicate numerical effort will be discussed.

References

[1] C. Conradi and M. Mincheva, *Catalytic constants enable the emergence of bistability in dual phosphorylation.* J. R. Soc. Interface **11**, 20140158; doi: 10.1098/rsif.2014.0158, 2014.