Building and testing executable biological models in the BioModelAnalyzer

Executable modelling of biological phenomena offers a new set of techniques to address problems arising from biological complexity. In contrast to detailed physical or chemical models, executable models describe the underlying functional behaviour of biological signalling networks. These models therefore do not require precise knowledge of chemical rates and kinetics, whilst retaining the ability to accurately describe complicated developmental and homeostatic systems. Moreover, executable models are amenable to model checking techniques, which offers guarantees of a model's behaviour and thereby allows for rigorous hypothesis testing.

The BioModelAnalyzer is a tool designed for developing and visualising executable models, through a graphical environment suitable for non-specialists. Biological models are expressed as qualitative networks, and through the tool we can build networks of the signalling networks in diverse systems such as skin cell differentiation, vulval precursor cell development and cyclic AMP signalling in *Dictyostelium Discoideum*. Furthermore, the BioModelAnalyzer allows us to prove model stability- a property of a model which indicates that the system represents a robust equilibrium or homeostasis. Model stability and instability can be used as a powerful test for model soundness, aiding developing and refinement.

In this demonstration we will show you how executable models can be built and tested using the BioModelAnalyzer. By working through published biological models, we will demonstrate how complex biological networks can be visualised and analysed, and how modelling systems using the BioModelAnalyzer can lead to new discoveries.