Hamilton Institute

Validation of Biochemical Network Models using Robust Control Theory

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Abstract

Biological systems which have been experimentally verified to be robust to significant changes in their environments require mathematical models which are themselves robust. In this context, a necessary condition for model robustness is that the model dynamics should not be extremely sensitive to small variations in the model's parameters. Robustness analysis problems of this type have been extensively studied in the field of robust control theory, and have been found to be very difficult to solve in general.

This talk will describe how tools from robust control theory and nonlinear optimisation can be used to analyse the robustness of a recently proposed model of the molecular network underlying adenosine 3', 5'-cyclic monophosphate (cAMP) oscillations observed in fields of chemotactic Dictyostelium discoideum cells.

The network model, which consists of a system of seven coupled nonlinear differential equations, accurately reproduces the spontaneous oscillations in cAMP observed during the early development of D. discoideum. Robustness analysis of the model reveals, however, that very small variations in the model's parameters can effectively destroy the required oscillatory dynamics.

Venue: Seminar Room, Hamilton Institute, Rye Hall, NUI Maynooth

Time: 1.00 - 2.00pm (followed by tea/coffee)

Travel directions are available at www.hamilton.ie

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