Modeling and Determination of the Regulation of Gene Expression: the Binary Switch Model

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ABSTRACT

The levels of expression of the genes are controlled by certain genes and by other factors. There exist many different models for these gene regulations. Most of these models only consider the case where the regulators are measured. We propose here a modification of the Boolean network model of gene regulation which permits to describe the case where the regulators are not measured. In our model, the state of the genes is not determined by values found inside the network, but by external switches. The evolution of the profiles of expression can be reduced to those switches, which are expected to represent a biological reality. A technique permitting to infer the values of the switches from the data is presented. This technique is applied to two real sets of data. The switches recovered offer a simple explanation of the behavior of the cells and permit to identify a large part of the regulatory network.