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## Stochastic equations

University of  
Institute of Clinical  
Hugstetter  
martin

Expression of cellular genes is controlled by a promoter, either activating or inhibiting. This is the case when the expressed protein has features of this self-regulating promoter. The gene can be in two states. Either the gene is on or off. The state distributions of protein during the gene switching state are analyzed. Moreover, a master equation to compute the probability of the gene being on compared to an already-existing gene, which also has two states and produces protein by its protein-product.

**Keywords:** Gene expression; chemical reaction networks; master equation.

Mathematics Subject Classification

## 1. Introduction

Gene expression denotes the catalysis of RNA and proteins origin. The reactions are transcription i.e. RNA polymerase and translation. The usage of mathematical models in this well-explored field [3]. The work by Jacob and Monod [9], who studied the lac operon in *Escherichia coli*, is an essential feature for a cell. For