

A Model for Genetic Switch

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Definition

Model

Criteria

A genetic switch is a biochemical mechanism that governs whether a particular protein product of a cell is synthesized or not.

Proposed Model for Genetic Switch

$$\frac{dg}{dt} = s - 1.51g + 3.03\frac{g^2}{1+g^2}, \quad g(0) = 0$$

g = concentration of the protein product

s = concentration of the chemical that activates the gene to produce the protein

Criteria

- 1) *The Threshold Effect*: There must exist a threshold for the parameter s such that for values below the threshold, the concentration of the gene remains close to zero and for values above the threshold the equilibrium gene concentration jumps to a higher level where it is considered “on.”
- 2) *Hysteresis Effect*: Once the gene concentration has reached the “on” state, if the parameter value is set to zero, the gene concentration should approach a fixed nonzero level so it can stay “on.”