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Morphable Logic Gates using Logical Stochastic Resonance in Engineered Gene Networks

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Invention Description

Using engineered gene "circuits" to control cellular function in the presence of background noise has many potential applications in the emerging field of synthetic biology. Such a technology would also be relevant to the creation and design of cells controlled by chemically-synthesized genomes. The "holy grail" would be the ability to apply this control by externally manipulating an engineered circuit.

Researchers at Arizona State University have developed an auto-regulatory gene network in the bacteriophage λ. This network emulates a logical AND gate. Through varying internal system parameters, the gate will morph into an OR gate. This change happens via stochastic resonance, wherein the noise level within the network determines the output (i.e., which gate is emulated). Additionally, if the outputs are reversed, NAND and NOR gates can be emulated.

Potential applications for this technology include control networks for synthetic biological system of engineered bacteria with synthetic genomes, and cellular computers capable of reproduction.

Potential Applications

- Basic building blocks of cellular computation
- Reproducing cellular computers
- Synthetic biological systems that can be controlled via externally-applied (deterministic) signals

Benefits and Advantages

- Biological system that can emulate four different logic gates
- Gate function can be manipulated externally

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