Title-less Coli-related entry

# Scientific Reason

## Overview

In our desire to launch a functional system with a solid degree of information processing, we chose to create one in which information flows between devices was constrained on a non-biological channel, while information processing was constrained to a different channel. We therefore decided to work with light as a means of transporting information across biological devices, and with the standard biological machinery as a means of processing said information. This served our purpose in two principal ways: our signals would be feasibly isolated from one another, and the scale of transmission was considerably augmented; ergo the scale & complexity of the possible device assembly increased significantly. Consequently we had the need to establish an I/O interface coupling the connection (light) with the processor (proteins).

As a proof-of-principle, we are currently designing a 3-device assembly of cycled IF logic gates. Our devices differ from one another in that each will communicate information on different frequencies within the same channel. We therefore have 6 unique interfaces to create. Should results be encouraging we can foresee three expansion routes:

* a quaternary base for the information layer (instead of using binary),
* expansion of the available logic gates to include AND(&), OR(|), and NOT(!),
* and the implementation of a multi-processor large scale Central Processing Unit.

## Input

Our three input interfaces are photosensitive proteins. These are based on plant phytochromes (Arabidopsis thaliana), cyanobacteriochromes (*Synechocystis*), and standard chromophores (Escherichia coli). The main advantage of these proteins is their fidelity and spectral absorption segregation. As an added bonus, their signaling cascades within the processor are quite independent: there could not be crosstalk even if they were all induced within the same processor. These would effectively expand the processing power of our device from a single-core system, to a multi-core system.

## Output

Our three output interfaces are light-emitting photoreactive proteins. These are based on the eukaryote luciferase (Photinus pyralis) and variations of the bacterial lux-operon (Vibrio fischeri). The capital reason for their selection was their efficiency as well as the spectral emission segregation. Again, as an added bonus these signaling events are also independent from one another even if taken into the same processor.

## System

An overview of the layers on the system is in Figure 1. A detailed view of the system’s assembly is in Figure 2.

## Conclusion

We propose the basis for a competent biological computing unit based on existing and characterized proteins utilized in a novel organization.