P.A.S.E - Programmable Autonomous Self Elimination

Project Description

The processes of bioremediation, biosensors and bio-medicine often require the release of genetically modified organisms (GMO's) to the environment. After being released, these GMO's are no longer under direct control, therefore posing potential threats such as substituting the natural bacterial population, horizontal gene transfer, and lastly, creating public concern and opposition to the field of genetic engineering.

In order to overcome these issues, we are designing a genetic circuit that limits the lifetime of a bacterial population after it is released into the environment.
Our ultimate goal is to allow the end user to program a GMO population to survive in the environment until it has completed its task, after which the entire population will disappear. Crucially, our mechanism will function independently, without any external intervention.

We are approaching this goal from two angles: "P.A.S.E. 1" is based on the dilution of a vital component through cell division, while: "P.A.S.E. 2" is based on the lifetime of an essential protein. The two methods utilize novel mechanisms such as a recombination cassette, the innovative use of an unnatural amino acid (UAA) in a biologic gate, and more. We also intend to introduce new biobricks that will be useful for a wide range of purposes, including bacterial genome incorporation parts and UAA incorporation machinery. This project will be the first modular, independent and generic bacterial control system.

We want our construct to pave the way to a safe synthetic revolution: one that will allow developers to innovate and create freely without arousing public opposition or harming the environment.

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