SEU_O_CHINA
Breaking the symmetry

Introduction
Our team, SEU Omega, aims to execute a synthetic biology project based on colony of bacteria. An initial idea concerns the control of the pattern of colony, which would be in the shape of a pentagon. Light sensing could be used as a switch to manipulate the differentiation of cells and confirm the sensing system of AHL would govern the holistic pattern with antisense RNA effecting the division rate. Further cellular differentiation would automatically lead aggregating cells with separated division rates and similar phenotype into specific patterns. Available applications may include bacterial quantitative biosensor, logical gates, and so on.

(1) Light sensor
Light sensor is one of prime parts in our whole project and is constructed by two different schemes, considering the multiple choices of light source and reliability of those two schemes. When a cell gets a light signal, the light sensor system will be triggered, and a small amount of cI protein will be produced, which can repress the cI promoter.

(2) Toggle Switch
We use a traditional lacI-cI bi-repressor for toggle switch to save certain status.
Status 1: At the beginning, we can set all the cells are on status 1 by exposure of UV light. Thus, the cI promoter is switched on and lacI protein is produced. So, at this time, the lacI promoter is inhibited and the signal molecular is not generated.
Status 2: After a small amount of cI protein received, the protein repress the cI promoter. Then, the toggle switch will be set to status 2, in which the lacI promoter is active.

(4) Division inhibitor
Receiving the AHL molecules, cells start their division inhibit system. An antisense mRNA is transcript, which can bind the mRNA of an essential cell division protein, FtsZ, and thus inhibit its expression and repress the growth of that part of colony. A vector with paired termini was constructed to constantly express different asRNAs of ftsZ in E.coli, and this part has been found inhibiting cell division considerably.

Design Scheme
Instead of the traditional method of painting a star on the culture dish, and let the colony grow into this pattern, we try to design a biobrick system which let the bacteria take the irregular shape all by itself, despite external conditions.

Modeling
In addition to the experiment, we also carry out the modeling work and test our system, here are our modeling procedure.

Simulation
In order to verify the availability and probable effect of our design scheme, simulation mathematical models based on Cellular Automata technique have been conducted.

3) Inter cellular communication
An AHL generate-receive system is used for our project to fulfill the intercellular communication. Promoted by the lac promoter, AHL molecules are generated from those special cells.

Team
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