Magnetic E.coli
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Abstract
In nature, there exists a variety of magnetotactic bacteria. Interestingly, it was recently reported that even yeast can be magnetized to some extent [1]. Encouraged by this, we set the goal to transform E. coli into those that are attracted by magnets. Such magnetizing E. coli cell should be much easier to harvest, and it could be useful for the purpose of collection remediation. To this end, we conducted three small projects.

1. Oxidation
Ferrimagnetism requires both Fe (III) and Fe (II). We want to put as much iron as possible into E. coli, with Fe (III) possessing severe toxicity to the cell. To minimize damage, iron must be well sequestered from cytosolic components.

2. Sequestration
We need to put as much iron as possible into E. coli, but Fe (II) possesses severe toxicity to the cell. To minimize damage, iron must be well sequestered from cytosolic components.

3. Breaking the iron homeostasis
We would like to pump as much iron into the cell as possible, and once put them in, we wanted to stop cells from excreting it.

References

Strategy: Three steps to magnetize E. coli

1. Oxidation
Ferrimagnetism requires both Fe (III) and Fe (II). However, the cytosolic space of E. coli is too reducing to sequester iron. We tried to establish BioBrick platform that enables the temporal knockdown of any given genes using recently reported control technology CRISPRi [2].

2. Sequestration
We want to put as much iron as possible into E. coli, but Fe (II) possesses severe toxicity to the cell. To minimize damage, iron must be well sequestered from cytosolic components.

3. Breaking the iron homeostasis
We would like to pump as much iron into the cell as possible, and once put them in, we wanted to stop cells from excreting it.

As of today...
We are still in the process of assembling all of the genetic tricks we have tested this summer. As of today, we haven’t succeeded in observing the E. coli attracted by the magnet.

References

Biobrick parts improvement
Gentic switch such as pBAD/araC system is very useful for overexpression of given genes. In order to freely place and/or swap the various genes under this pBAD/araC system, we modified BBa_I746908 to inserted Biobrick in both sides of sfdh gene.

References

This enables the direct cloning of any given gene in place of GFP using "Golden Gate" cloning [5]. Because this starter construct gives green fluorescence, one can tell which one to be picked.