Plastic Degradation

Background

Ideally, waste plastic would decompose quickly. Our goal is to create and BioBrick a biosynthetic pathway that can degrade plastic. We chose to bioengineer a pathway to degrade a particular plastic, polystyrene (PS), and all our efforts were focused on producing an enzyme that would degrade PS completely.

Methods

We used a two plasmid system, the first plasmid containing two genes. The first gene, polystyrene esterase, encodes an enzyme that is able to break down PS. When expressed in E. coli, this enzyme is able to degrade PS to small molecules that can be metabolized by the host cell. The second gene, nopaline synthase, encodes an enzyme that is able to produce and export nopaline. This latter gene is used to select for the plasmid in E. coli.

To assay the functionality of csoM, sfGFP-­‐csoM expressing cells were tested against a suite of single alkane hydrocarbons at different concentrations. Our results suggest that csoM is able to degrade PS completely.

Results

When exposed to red light, our system produced very high fluorescence. We used this system to measure the expression of our gene in cell cultures. We found that our system was able to detect very low levels of expression, which is important for future applications.

Optogenetics

The most important part of optogenetics is the light-inducible protein expression system. We developed a system to express the protein photocytosin using a light-driven enzyme that is able to cleave a specific sequence in DNA. This allows us to control gene expression using light.

Methods

Using the turbidostat we created, we were able to detect the expression of our plasmid. We found that our system was able to detect very low levels of expression, which is important for future applications.

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Flu Binders

Background

Turbidostat App

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Conclusion

We were able to design and test 6 HB16.5 variants and 14 HB160.4 variants (another small designed protein that already broadly binds to many substrates of hemagglutinin). Our most dramatic results were with HB16.5 H312A (left), which was able to bind HB1A strongly where the original design variant could not.