content

The Challenge
Our solution
Approach & Methods
Future Applications
Accomplishments

the problem
one organism. one solution.

- report toxins
- degrade target chemical
- move to contaminated site
- Sustainable/non-intrusive approach

why *C. elegans*?

- Excellent chemotaxis mechanism
- Multi-cellular= multiple processes
- Hardy organism
**part design**

*Teng et al., 2006; UCSF 2010*

Interchange GPCR genes

**chemotactic assay**

- Conducted preferential assay between target and control substances

\[
\text{Chemotactic Index} = \frac{\# \text{ total worms on Target quadrants} - \# \text{ total worms on Control quadrants}}{\# \text{ total worms}}
\]

**results**

**Chemotaxis Parts**

<table>
<thead>
<tr>
<th>GPCR</th>
<th>Source</th>
<th>Ligand</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADBR2</td>
<td>Mouse</td>
<td>Phenol</td>
</tr>
<tr>
<td>Orexin</td>
<td>Human</td>
<td>Toluidine, 4-Chlorobenzoic acid, Naphthalene</td>
</tr>
<tr>
<td>OX1R</td>
<td>Mouse</td>
<td>4-Chlorobenzoic acid</td>
</tr>
<tr>
<td>MARM1</td>
<td>Rat</td>
<td>Phenol</td>
</tr>
<tr>
<td>NPYR1</td>
<td>Mouse</td>
<td>Naphthalene</td>
</tr>
</tbody>
</table>

**graph**

Part: ODR-7:ADBR2:UNC-54 (BBa_K631032)

- Chemotactic Index vs Concentration (g/mL)
naphthalene degradation

Naphthalene converted to salicylic acid

part: BioBrick nahD

nahD Coding
from *Pseudomonas putida*,
2-hydroxycromene-2-carboxylate isomerase

1C3
Plasmid backbone

future applications

- Characterize in *C. elegans*
- Assembly with other enzymes in *C. elegans*, create full pathway
- BioBrick Registry: develop bioremediation pathways for other chassis
part improvement

- Modify existing eCFP part
- Test new promoters effectively

**eCFP**
Coding
Genetic mutant of GFP (Green Fluorescent Protein) from *Aequorea victoria*

**UNC-54**
Terminator
*Caenorhabditis elegans* regulatory

**1C3**
Plasmid backbone

**BioBrick Part: BBa_K6310**
GPC-1:eCFP:UNC-54:1C3

**C. elegans** neurons

<table>
<thead>
<tr>
<th>Water-soluble attractants and pheromones</th>
</tr>
</thead>
<tbody>
<tr>
<td>- ADP: gpa-3, 10, 13, osh-3</td>
</tr>
<tr>
<td>- ASE: gpa-3</td>
</tr>
<tr>
<td>- ASI: gpa-3</td>
</tr>
<tr>
<td>- ASR: gpa-1, 3, 4, 5, 6, 10, 14</td>
</tr>
<tr>
<td>- ASB: gpa-1, 3, 9, 10, 14</td>
</tr>
<tr>
<td>- ASK: gpa-1, 3, 14, 15</td>
</tr>
<tr>
<td>Aversive compounds</td>
</tr>
<tr>
<td>- ADL: gpa-1, 3, 11, 15</td>
</tr>
<tr>
<td>- ASH: gpa-1, 3, 11, 13, 14, 15, osh-3</td>
</tr>
<tr>
<td>Odorants</td>
</tr>
<tr>
<td>- AWA: gpa-3, 5, 6, osh-3</td>
</tr>
<tr>
<td>- AWB: set-3</td>
</tr>
<tr>
<td>- AWC: gpa-1, 3, 13, osh-3</td>
</tr>
</tbody>
</table>

Expression in AWB neuron

injection reporter

Expression in *C. elegans* neurons.
kill switch mechanism

conventional methods of BioBrick assembly

novel assembly: PCR ligation
acknowledgements

Faculty Advisors: Dr. Chin-Sang, Dr. Greer, Dr. Ko, Dr. Bendena, Dr. Ramsay, & Dr. Young.

Lab Support: Tony Papanicolaou, Jeff Boudreau and rest of Chin-Sang lab.

Past QGEM Team Members: Steve Goldie, Chris Palmer, Geoff Halliday, Harry Zhou and James MacLeod.


QGEM 2010/2011 Executive Team

references


Graphics (order of appearance)
http://www.rnai.org.uk/rna.png
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC205370/
http://www2fgg.eur.nl/ch1/cellbiology/images/jansen1.jpg