Swarming response of E. coli to Octanoic acid.

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Project Purpose
A current goal in research is to use E. coli cells as a biocatalyst to produce fatty acids that can be used as a bio renewable product in the production of various chemical industrial products. However, intracellular acidic conditions and membrane damage cause the growth rate of E. coli cells to decrease and results in eventual cell death. A strain of E. coli, LAR1, was evolved from a parent strain, MLC-115, to be more tolerant toward short chain fatty acids. Goal was to determine what may be responsible for the swarming of E.coli on 0.35% LB agar containing octanoic acid. Hypothesis is that the flagellum will act as a proton pump to help maintain intercellular homeostasis with regards to pH.

Materials & Methods
Swarming of E. coli
- Prepare LB swarming agar with varying concentration of octanoic acid. (7/3/13 JAF)
- Grow E. coli on LB agar, so individual colonies are visual.
- Using a sterile stick, transfer 3 colonies to the center of each of plate.

<table>
<thead>
<tr>
<th>Strain and Plasmid</th>
<th>Genotype</th>
<th>Reference</th>
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<tbody>
<tr>
<td>MG1655 ATCC#700926</td>
<td>F- lambda- ivG- rfb-50 rph-1</td>
<td>Wildtype</td>
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<tr>
<td>LAR1</td>
<td>MLC115 evolution mutant</td>
<td>See CBiRC Year 3 report p. 48</td>
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</tbody>
</table>

Results & Discussion

![Swarming rate vs. octanoic acid concentration](image)

Figure 1: The microarray data highlights the downregulation of the motility genes upon addition of 10mM octanoic acid during logarithmic growth of the wildtype strain MG1655.

![Swarming distance vs. Octanoic Acid concentration](image)

Figure 2: Bacterial flagellum1. The source of energy is not ATP but rather the electro motive gradient of protons or sodium ions across the cell’s membrane.

Conclusions
- The transcriptome data showed that genes attributed to chemotaxis, reduced motility, and flagellum assembly2 were downregulated upon octanoic acid addition.
- The results showed that the wild-type strain, MG1655, was able to swarm at a faster rate than either the MLC115 or the LAR1 strains.
- The results confirm reduced motility upon octanoic acid addition.
- It is also noted that environmental conditions such as humidity and storage conditions of media play a very important part of bacterial swarming that may cause variation.

Acknowledgements
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