Quorum Quenching
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Abstract
Many species of bacteria use quorum sensing to communicate with other bacteria in their environment. This communication can lead to activation of pathogenic factors and biofilm formation in some bacteria. The CU-Boulder iGEM team has characterized Aliivibrio fischeri as a model system for quorum activation and tested the quorum sensing inhibitor, Alia's ability to inhibit quorum activation of luminescence in Aliivibrio fischeri.

Why inhibit quorum sensing?
- Pathogenic bacteria rely on quorum sensing to activate pathogenic factors and formation of biofilms
- Inhibit bacteria from becoming pathogenic
- Reduce disease

About Biofilms
- A biofilm is an aggregation of bacteria which adhere to each other due to a change in cellular expression as a result of quorum sensing.
- Formation of biofilm is advantageous because it gives bacteria resistance to:
  1. Physical forces (such as water currents)
  2. Antibiotic treatments
  3. Environmental pH fluctuations
  4. Periods of nutrient deprivation

Background

Characterizing a Model System

Why use a model system?
- Safety concerns with pathogenic bacteria
- Biofilms are difficult to work with and hard to quantify
- Aliivibrio fischeri activates lux operon in response to AHLs
- AHL luminescent output is easily quantifiable on a plate reader

Modeling:
- Established that we could accurately measure the quorum sensing activation of luminescence as it occurred in Aliivibrio fischeri
- Gave us a baseline measurement of uninterrupted quorum sensing activation that we could use as a target for our quorum quenching construct

Stopping Quorum Sensing

Detecting AHLs:
- Finding a quorum sensing detection system with higher sensitivity to AHL types and concentration than the current standard: LuxR

Applying system to prevent quorum sensing of pathogenic bacteria
- In households our construct could clean shower heads, shower curtains, and under sinks
- Stop formation of bacterial mats on the surface of bodies of water
- A consumer indicator for produce freshness
- Take our construct to plants to help them fight biofilms and pathogens yielding a longer shelf life and decreasing pesticides
- Species specific AHL recognition to survey bacterial populations useful in the medical field (cheap way to perform fecal analysis) and in agriculture to analyze bacterial presence in soil and root systems

List of Parts

Future Work

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Applications
- Use of our construct as a "probiolec" in a human or animal system to prevent quorum sensing of pathogenic bacteria
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Ask us about Safety Measures and Human Practices.

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