A Genetic Approach to Designing a Novel Biological Sensor to Monitor Water Contamination

Cynthia Bui  
*Madison High School*

Anissa Rosbaugh  
*Madison High School*

Israel Gonzalez  
*Madison High School*

Julie Lu  
*Madison High School*

Colin Kuhns  
*Madison High School*

See next page for additional authors
Follow this and additional works at:  [https://pdxscholar.library.pdx.edu/innovation_challenge](https://pdxscholar.library.pdx.edu/innovation_challenge)

Part of the Engineering Education Commons, Environmental Engineering Commons, and the Hydraulic Engineering Commons

Let us know how access to this document benefits you.

Bui, Cynthia; Rosbaugh, Anissa; Gonzalez, Israel; Lu, Julie; Kuhns, Colin; Crandall, Joel; Faulk, Alyssa; and Nguyen, Miriam, "A Genetic Approach to Designing a Novel Biological Sensor to Monitor Water Contamination" (2016). *PSU High School Innovation Challenge*. 1.  
[https://pdxscholar.library.pdx.edu/innovation_challenge/2016/presentations/1](https://pdxscholar.library.pdx.edu/innovation_challenge/2016/presentations/1)

This Event is brought to you for free and open access. It has been accepted for inclusion in PSU High School Innovation Challenge by an authorized administrator of PDXScholar. Please contact us if we can make this document more accessible:  [pdxscholar@pdx.edu](mailto:pdxscholar@pdx.edu).
Presenter Information
Cynthia Bui, Anissa Rosbaugh, Israel Gonzalez, Julie Lu, Colin Kuhns, Joel Crandall, Alyssa Faulk, and Miriam Nguyen

This event is available at PDXScholar: https://pdxscholar.library.pdx.edu/innovation_challenge/2016/presentations/1
A Genetic Approach to Designing a Novel Biological Sensor to Monitor Water Contamination

Cynthia Bui, Anissa Rosbaugh, Israel Gonzalez, Julie Lu, Colin Kuhns, Joel Crandall, Alyssa Faulk, & Miriam Nguyen

Madison High School, Biomedical Sciences, Portland Public Schools, Portland, Oregon

THE MECHANICS

Our biosensor is mainly based on the concept of quorum sensing, a stimulus and response system used by bacteria to communicate about population control (Miller et al., 2001). It uses a harmless strain of genetically modified E. coli to detect levels of nitrogen, phosphorus, and the AHL protein (a signaling molecule used to coordinate group activities among bacteria). On top of their naturally occurring AHL receptors, our modified bacteria have also been equipped with nitrogen and phosphorus receptor proteins (by the use of an exogenous signaling cascade). Thus, our E. coli has been genetically modified for transmitting transient water contamination to a stable fluorescence stimulus response in real time (Nasser et al., 2007).

The biosensor we designed encloses the modified E. coli in a dark chamber, with a valve that lets a water sample in. Enclosed along with the E. coli is a fluorescence detector that quantifies the amount of emitted light—if it were to cross a specific threshold (which can be determined by the city), a wireless transmitter connected to the light detector signals the water bureau to be on alert for a possible contamination situation.

POSSIBLE APPLICATIONS

Our main objective is to equip the city with a precautionary system to better handle E. coli outbreaks as well as any post-chlorination contamination; there is no sensor in place to detect water contamination after it has already been through the filtration system. To address this problem we have devised a genetic strategy to putatively detect contamination in real-time using genetically modified bacteria. We have created a biosensor that detects phosphorus, nitrogen, and lead, as well as AHL, a signaling molecule that coordinates group activity among bacteria. By targeting these particular substances, we aim to make this system specific enough to counter any potential post-chlorination outbreaks while simultaneously remaining general enough to be applicable to other situations and locations.

LITERATURE CITED