The presence of arsenic in drinking water provides a complicated obstacle for developing countries. Some 100 million people are affected by arsenic poisoning worldwide, and the problem is exasperated by the unpredictable patterns of contamination. This necessitates frequent and comprehensive testing of well water; Bangladesh alone has 10 million water wells that must be checked twice a year. Effective arsenic tests have been created in the past, yet they often require expensive reagents, advanced technology and specialized technicians – not feasible for large-scale operations in the developing world.

Our team endeavors to create a simple, biologically-based test for arsenic. Using existing BioBricks and building off the ideas of previous iGEM projects, we have designed two systems that work within *E.coli* to detect the presence of arsenic in a water supply and generate a strong, noticeable response. The first links an arsR promoter (BBa\_J33201) turned on in the presence of arsenic to a firefly luciferase reporter gene (BBa\_K325909) that emits a bioluminescent glow. Additionally in the system is a second luciferase reporter gene, (BBa\_K325209) attached to a constitutive gene that will constantly emit bioluminescence of a different color to serve as an indicator of normal cell function. Ideally, the end result would be cells that will glow in a dark room, change colors (yellow to green) in the presence of arsenic, and stop glowing entirely if they are killed by arsenic or any other toxin.

Additionally, we are in the process of designing a cascade sequence to detect and react to the presence of arsenic. A cascade sequence provides the benefit of customizability: we can control the reaction at many levels, both by ensuring when the sequence is turned on or off and by controlling the amount of output created by the system at different levels of arsenic.