MOBILE HEALTH PATHOGEN DETECTOR

Pathogen detection is a major topic related to the access to health care. We designed a novel portable pathogen detector for mobile health monitoring. The system consists of two separate modules: the sensing module, which senses the pathogen and the reporting module which warns the user by color change, combined by yeast mating. Hing the yeast powder onto the test paper, we expect to obtain the result applicable to medical diagnosis as well as food and environment quality monitoring.

**BACKGROUND**

Life-threatening pathogenic infections cause thousands of deaths every week all around the world. An effective and efficient identification of the infectious pathogens would facilitate the clinical treatments of these diseases. Nevertheless, current methods for identifying pathogens have many drawbacks including a long period for testing and high cost. Clinical diagnosis of infectious pathogens would benefit significantly from specific and sensitive pathogen identification methods.

**DESIGN**

**PPO sensor**

We reconstituted the PPO system in yeast by introducing the plasmid pUT-2 into yeast cells. The sensor and reporter modules were designed to detect the presence of pathogenic cells.

**PPO reporter**

We used ADE2 gene as a reporter gene, which, upon expression, could switch the color from red to white in ADE2 knockout yeast strain. The expression of the reporter gene is controlled by a promoter containing the consensus sequence of the P0 promoter.

The yeast powder was spread onto the test paper, and viewed under a microscope. The control zone contains only the yeast powder, the reaction zone shows the interaction between the yeast and ADE2 DNA probe. The yeast color is red, indicating a positive test result.

**MODELING**

Simulation of the model predicts how yeast color changes with time.

**RESULTS**

**PPO sensor**

To test the function of PPO sensor, we used mcHay to report the transfection efficiency of the plasmid pICXC200 mini-promoter after ADE2 induction.

**PPO reporter**

In order to test if the Tet-off switching system and the reporter worked as expected, we co-transformed pTET and pGFP-UAS1 into each yeast strain. The transformants were assayed for the ability to express the reporter gene. The results showed that the reporter gene was expressed only in the presence of doxycycline.

**Product testing**

The final goal of our project is to make a portable test paper, which can be used to detect pathogens without any special equipment, but with effectiveness during a certain period of time. We transformed the reconstructed yeast into dry powder successfully.

**FUTURE WORK**

1. Extend the application of the established system to detect other pathogens involved in human diseases, food safety issues and environmental pollution.
2. Create more portable pathogen detectors by combining different sensors and reporters.
3. Improve our products for commercial use.

**OUTREACH**

**Human practice**

The human practice part of Tsinghua (iGEM team) includes routine events of the Association of Synthetic Biology in Tsinghua, scientific movie series and surveys targeting to a wide range of people from different backgrounds.

**Collaboration**

We established a long-term collaboration with DUC-C HNA team and helped them build the mathematical model, the Gillespie Algorithm, for their project. We also collaborated with other iGEM teams, including Nanjing, Beijing, BIT and BIT-CHINA, via various forms.

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[iGEM team members]
- [name1]
- [name2]
- [name3]
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