Biosensor Array of Radically Coupled "Biopixels"

Tech ID: 23221 / UC Case 2012-192-0

BACKGROUND

Living cell based biosensors are useful tools for monitoring environmental stimuli and can respond to changing sample conditions of physiologic relevance over a period of time. The development of biosensors has led to genetic circuits engineered to give a variety of signal readouts in response to test conditions. Signals from such cellular circuits encoded as frequency oscillations can be easily digitized and are particularly useful relative to steady-state assays. A drawback with measuring frequency oscillations from a cell-based biosensor is the noise typically seen in cellular environments. One strategy to overcome cellular noise is to average a signal from a large population of cells, however averaging an oscillating signal only works if the cells are acting in synchrony. Bacterial quorum sensing can act to couple intercellular signaling, however quorum sensing typically only works over short distances and entails diffusion limited signal delay. Therefore, it is appreciated that a number of obstacles relating to coordination of an oscillating signal must be overcome in order to develop a biosensor with a frequency based signal output.

TECHNOLOGY DESCRIPTION

Researchers at UCSD have engineered bacteria to blink fluorescently using a cellular clock mechanism which alters its cycling rate depending upon concentrations of a test compound. In one test case, the cells responded to low levels of arsenic although the system could be adapted to sense other agents such as heavy metals, toxic substances, and pathogenic contaminants. Normal quorum sensing signals allow closely-linked bacteria in a single colony to synchronize activities such as fluorescent blinking; but such signaling normally damps out over short distances. However, in an additional step, the researchers modified the cells' quorum sensing ability so that the fluorescent blinking synchronized across thousands of bacterial colonies arrayed on a microfluidic chip. Such synchronized blinking across a large population of cells not only amplifies signal intensity, but the redundancy of the system reduces variability compared to sensors using smaller populations of cells. The approach can be used to design low cost, hand held biosensors and a wide variety of licensable fields are available to interested parties.

STATE OF DEVELOPMENT

A working biosensor array using E. coli able to report on varying levels of arsenic has been published. Research is ongoing to adapt the biosensors to respond to other heavy metal, toxic, and pathogenic contaminants in water and soil. Modifying output from fluorescent to electronic signals for adaptation into electronic devices is being explored. The lead investigator is available to assist in development of new prototypes if desired.

INTELLECTUAL PROPERTY INFO

An unpublished patent application is available for worldwide licensing and may be viewed under confidentiality.

RELATED MATERIALS

- Lab info - 04/23/2013
- Blinking Bacteria Warn of Contamination | Video - 01/20/2012
- Prindle A, Samayoa P, Razinkov I, Danino T, Tsimring LS, Hasty J. (2011) A sensing array of radically coupled genetic 'biopixels' Nature 2011 Dec 18; 481 (7379):39-44. - 12/18/2011
- Researchers Create Living 'Neon Signs' Composed of Millions of Glowing Bacteria - 12/18/2011

PATENT STATUS

Country	Type	Number	Dated	Case

CONTACT

University of California, San Diego
Office of Innovation and Commercialization
innovation@ucsd.edu
tel: 858.534.5815.

INVENTORS

- Hasty, Jeff M.

OTHER INFORMATION

CATEGORIZED AS

- **Sensors & Instrumentation**
  - Biosensors

RELATED CASES

2012-192-0

United States Of America	Issued Patent	9,500,636	11/22/2016	2012-192	

University of California, San Diego
Office of Innovation and Commercialization
9500 Gilman Drive, MC 0910, ,
La Jolla,CA 92093-0910

Tel: 858.534.5815
innovation@ucsd.edu
https://innovation.ucsd.edu
Fax: 858.534.7345