University research develops fast biosensor for food pathogens

By Rita Jane Gabbett on 1/30/2014

A biosensor developed by scientists at Rice University in collaboration with colleagues in Thailand and Ireland may make the detection of pathogens much faster and easier for food manufacturers.

A study on the discovery appears online this month in the American Chemical Society journal Analytical Chemistry.
The process appears to outperform tests that are now standard in the food industry that can take days to culture colonies of salmonella bacteria as proof, or to prepare samples for DNA-based testing.

The Rice process delivers results within minutes from a platform that can be cleaned and reused. The technology can be customized to detect any type of bacteria and to detect different strains of the same bacterium, according to the researchers.
The “diving boards” are a set of microcantilevers, each of which can be decorated with different peptides that have unique binding affinities to strains of the salmonella bacteria. When a peptide catches a bacterium, the cantilever bends ever so slightly, due to a mismatch in surface stress on the top and bottom. A fine laser trained on the mechanism catches that motion and triggers the alarm.
The system is sensitive enough to warn of the presence of a single pathogen, according to the researchers.

The idea springs from research into the use of microcantilevers by Rice biomolecular engineer Sibani Lisa Biswal and lead author Jinghui Wang, a graduate student in her lab. Biswal was prompted to have a look at novel peptides by her graduate school friend, Nitsara Karoonuthaisiri, head of the microarray laboratory at the National Center for Genetic Engineering and Biotechnology in Thailand. Karoonuthaisiri is also a visiting scientist at the Institute for Global Food Security at the Queen’s University, Belfast.

Karoonuthaisiri and her team had isolated bacteriophage viruses associated with salmonella through biopanning and phage display, a technique to study interactions among proteins, peptides and pathogens. She then derived peptides from the phages that would serve as targets for specific bacteria.

The Rice lab compared the peptides’ performance with commercial antibodies now used for salmonella detection and found the peptides were not only more sensitive but could be used in a multiplexed cantilever array to detect many different kinds of salmonella at once.

Co-authors are researcher Josephine Morton and Christopher Elliot, director of the Institute for Global Food Security, and Laura Segatori, Rice's T.N. Law Assistant Professor of Chemical and Biomolecular Engineering and an assistant professor of biochemistry and cell biology. Biswal is an associate professor of chemical and biomolecular engineering.

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