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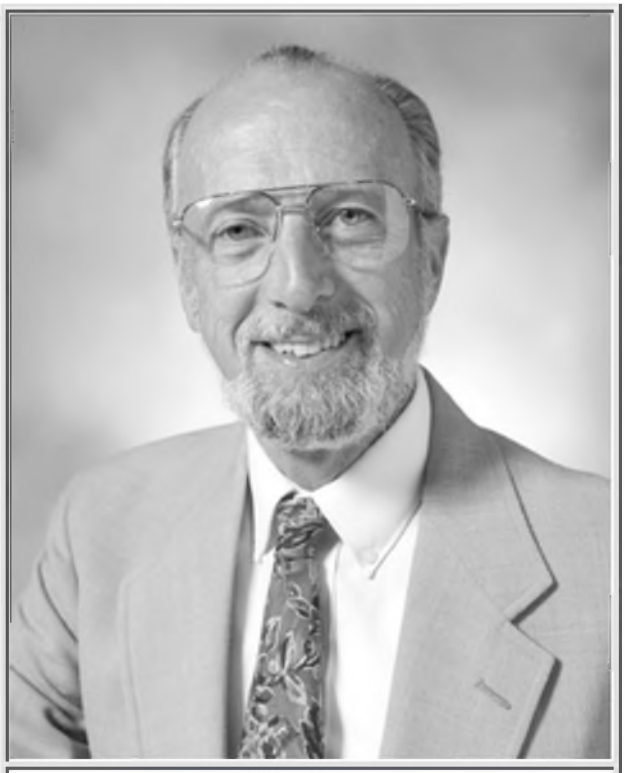
Detection of E. coli in food reduced to minutes from days by Cornell researchers with new biological sensor

NEW ORLEANS -- The era of waiting days for E. coli bacteria lab results soon will be at an end for food processors and health departments, thanks to a new type of biological sensor that works much like a home-pregnancy test in one format.



Dick Durst

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At present, it takes technicians days to incubate and then implicate harmful and deadly bacteria in food poisonings, but the new sensor does its detective work in just minutes.

The sensor, which employs liposomes, artificial microscopic, cell-like structures, has been developed at Cornell University's Department of Food Science and Technology. Field tests at Cornell have rapidly detected traces of E. coli (for Escherechia coli) and other food-borne pathogens.

Richard A. Durst, professor of chemistry at Cornell's Agricultural Experiment Station in

Geneva, N.Y., described the new sensor in a talk, "Biosensor for the Rapid Detection of E. coli O157:H7," at PITTCON 2002, an analytical technology conference at the Ernest N. Morial Convention Center in New Orleans on March 17. He described how the liposome sensor has been able to detect the presence of pathogens, such as E. coli, cryptosporidium and listeria, in just eight minutes.

For years, researchers have worked on improving methods for the rapid detection of pathogens. Currently it takes days for health department technicians to examine E. coli because the bacteria has to be cultured to obtain amounts sufficient for testing. More recently, a process called polymerase chain reaction has reduced testing time to several hours. But, says Durst, "What was needed was a simple field-screening test for rapid and very sensitive detection of E. coli. In one format design, it is very similar to a visible home-pregnancy test."

The basis for the rapid testing for the presence of E. coli is the liposome, a microscopic cell-like structure made in the laboratory by adding an aqueous, marker-containing solution to a phospholipid mixture. (In medicine, liposomes are used to transport therapeutic drugs into diseased cells.) Liposomes can contain dyes, fluorescent and visible, or other detectable compounds. On the outside of these structures' membranes, the Cornell researchers have affixed antibodies. When a pathogen, such as E.coli, is detected, it binds to the antibodies and the liposome membrane is ruptured, releasing the dye or other marker.

For example, in one format, paperlike test strips impregnated with liposomes were placed in a solution containing E. coli. As the liquid was drawn up the strip, it crossed the liposome-coated area. The pathogens were drawn to the antibodies on the liposome membrane, causing the membrane to react and rupture, releasing marker dye molecules. The change in color of the test strip indicated the presence of E. coli.

"Because each liposome contains hundreds of thousands to perhaps millions of marker molecules, there is a large amplification effect when the liposome is ruptured and the markers are released," says Durst. "Since detection and signal amplification using liposome labels are not dependent on a secondary reaction -- such as what is required for conventional enzyme-based tests -- the use of liposomes has the advantage of providing immediate warning of the presence of the pathogen."

Durst has worked with several colleagues to develop this technology, and the group has patented the work. Durst's colleagues include Richard Montagna, president of Innovative Biotechnologies International Inc., Grand Island, N.Y.; Antje J. Baeumner, Cornell assistant professor of biotechnology; and several graduate students, postdoctoral researchers and research associates.

Cornell has licensed the technology to Innovative Biotechnologies International, which has transferred the technology into field tests for Cryptosporidium parvum, an intestinal parasite, sometimes found in natural and municipal waters that causes diarrhea. "The

beauty of the Durst technologies is that they are exquisitely sensitive and they can be used alone or in a broad array of biosensors," says Montagna.

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