Scientists have bright idea for detecting harmful bacteria in food products

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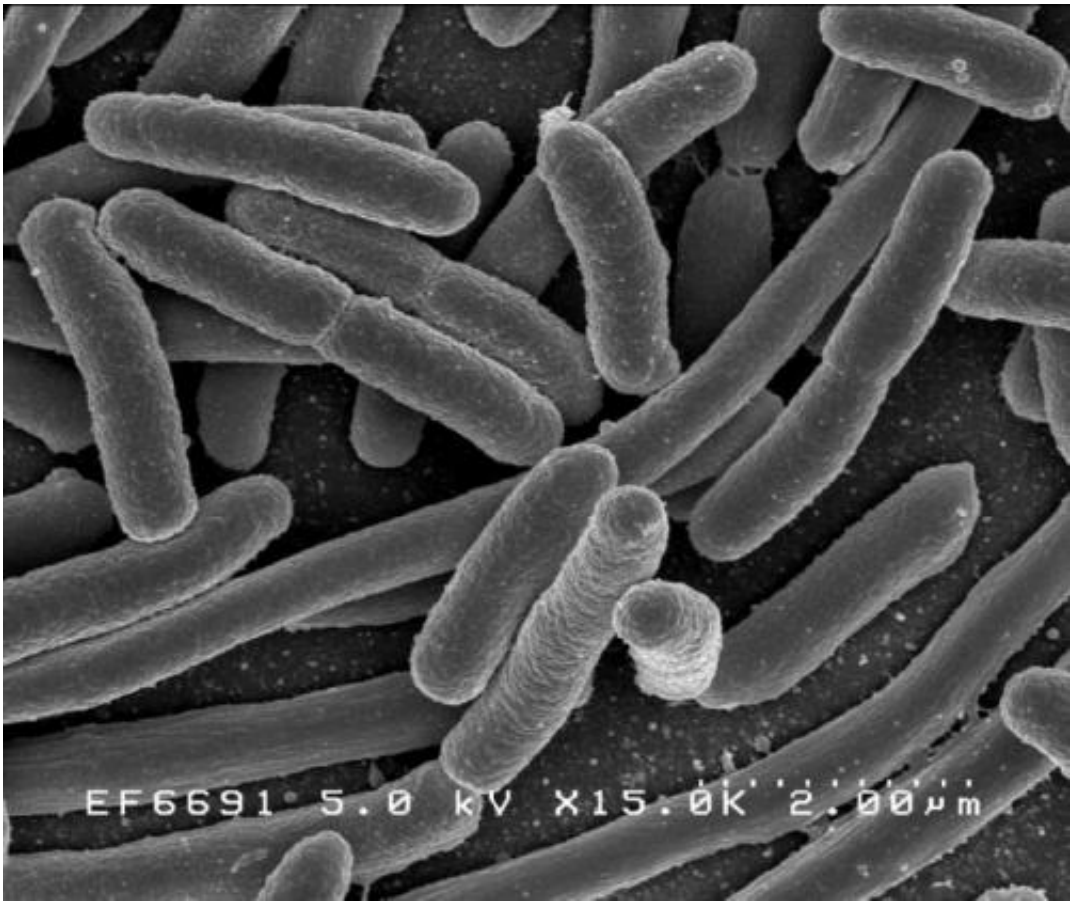

Escherichia coli. Credit: Rocky Mountain Laboratories, NIAID, NIH

Scientists looking for traces of E. coli O157:H7 contamination in foods soon could have a new detection method on their hands - turning off the lights to see if the bacteria glow in the dark.

Purdue University researchers have engineered a bacteriophage called NanoLuc - a virus that only infects bacteria - to produce an enzyme that causes E. coli O157:H7 to emit light if infected. The process can shave hours off traditional testing methods, which can be critical when stopping the distribution of tainted foods.

"It's really practical. They (testing labs) don't have to modify anything they're doing. They just have to add the phage during the enrichment step of the testing protocol," said Bruce Applegate, a Purdue associate professor of food science. "We could detect as few as four bacteria in eight hours, and the process is cheaper than tests being used today."

The study involved Purdue faculty, graduate students and scientists from the U.S. Department of Agriculture's Agricultural Research Service and the Purdue Center for Food Safety Engineering. Results were published in *Scientific Reports*, an arm of the Nature Publishing Group.

While many strains of E. coli bacteria are harmless, some can cause severe and potentially fatal illnesses. Ingesting as few as 10 colony-forming units of E. coli O157:H7 can result in serious illness.

Current detection methods cannot find just a few E. coli O157:H7 cells in a sample, so inspectors do an enrichment process, culturing the bacteria to multiply so they can be detected. With the bacteriophage added to the sample, scientists can add a reagent and detect E. coli O157:H7 before the enrichment process is even finished, within seven to nine hours.

"The current detection methods cannot bypass the enrichment process, but our technology can explore the enrichment phase. That can give us a time advantage over other methods," said Dandan Zhang, a graduate research assistant in the Purdue Department of Food Science and the paper's first author.

The process is also unlikely to create a false positive because the bacteriophage cannot produce the light-emitting protein without encountering E. coli O157:H7, which is the only bacteria NanoLuc is able to infect.

"The phage is just a virus. It cannot carry out metabolism until it infects a bacteria, which in this case is E. coli O157:H7," Applegate said. "They won't create these proteins unless they've found their specific host."

Based on the number of bacteriophage added, the amount of time that has passed and the amount of light emitted, the authors can use an equation to determine approximately how much E. coli O157:H7 is present. Their tests were done in an enrichment broth made with ground beef.

Zhang said future work would focus on detection of E. coli O157:H7 in lettuce, spinach and other produce. Other bacteriophages could also be developed to detect other pathogenic bacteria, such as Salmonella, in a similar fashion.

More information: Dandan Zhang et al. The Use of a Novel NanoLuc -Based Reporter Phage for the Detection of Escherichia coli O157:H7, *Scientific Reports* (2016). DOI: 10.1038/srep33235

Provided by Purdue University