Spray-on DNA bar codes help trace food-borne illnesses

In the field of forensics, DNA profiling has solved many whodunits over the last forty years. Find a hair on the carpet near the bloodied victim, send it to the labs for testing and compare it to the DNA profiles of known criminals — If the detective finds a match, *voila*, the crime is solved.

Now scientists are using DNA techniques on errant vegetables, ones that have carried food-borne bacteria and other contaminants such as *Salmonella* into the homes of their unsuspecting victims. But, in this case, the question's not so much "whodunit" (the cider in the kitchen with the *E. coli*) as it is *where* the contaminated foods originated.

Take the listeriosis outbreak from contaminated melons that killed 30 people in the U.S. in 2011. The key to stopping further fatalities was finding out where those melons came from and alerting people who might have purchased melons from the same place. Who were the growers and what was the distribution chain? (The lines between farm and consumer in the modern world can be very long and very twisted, it's hardly ever as simple as pointing to a farm down the street from those who become ill.)

By the time people start feeling the symptoms of *Salmonella* or *E. coli* poisoning, tracing the origin of the contamination might be tricky, time consuming and expensive. The store may receive produce from multiple farms and have already disposed of shipment boxes. The contamination might not even have occurred on the farm, but somewhere *en route* as part of the distribution process. But a Californian start-up, DNATrek, has come up with a solution to this conundrum: spray-on DNA barcodes.

In the labs at DNATrek, the scientists create different liquids that each contain a unique DNA sequence. The sequences would be combined with safe-to-eat food additives, such as the waxes that are now sometimes added to the surfaces of apples and cucumbers. Growers, packers, shippers and others in the supply chain would spray food with their unique liquid formulation—stamping the produce with their signature genetic bar code.

If needed in the case of an outbreak, investigators could use polymerase chain reaction technology to decipher the bar code and determine where the produce was grown and what route it had traveled. According to Anthony Zografos, founder and CEO of DNATrek:

> If there's a problem at home and there's a piece of the cantaloupe left, you can pick it out of the trash, you can scrub the surface, and all the available information is there and you know exactly where it came from.

In only 15 to 20 minutes, scientists would be able to find out all the particulars of the produce. In an outbreak, time is of the essence; lives could be saved. And the technology is relatively inexpensive too. The spray will probably cost $1 for every 1,000 pounds of produce. Compare that to the estimated $150 billion a year that the U.S. directly or indirectly, spends on food-borne illnesses in a year.

Photo courtesy of DNATrek

Currently, The Food and Drug Administration has already recognized the technology as safe, but it isn't yet in use. Large-scale tests are due to begin next year but already some are questioning the safety of the technology.

The company has stressed that sprinkling bits of DNA on an organism is not the same as genetically modifying one. And at roughly 100 base pairs long, the added DNA is too short to be a health risk or cause changes to the food item.

But Dana Perls, who tracks food and technology issues for the environmental group Friends of the Earth, remains unconvinced. In an email, quoted in a San Francisco Chronicle article, she says the company's plan to use numerous DNA sequences, instead of just one, "makes it that much more difficult to assess the predictable and unforeseen consequences."

> I am not clear that mixing the sequence with a substance that has been tested as safe necessarily means that any risks of the new DNA sequences would be rendered safe as well. It doesn't seem like one would cancel the other out. These sequences are also designed to last. What is the impact of the new particles over time?

For the technology to be widely accepted, DNATrek will have to confirm its safety and effectiveness during its upcoming pilot tests, which will be done in cooperation with growers and producers on five to six types of produce. Then, to succeed, it will have to address educate the public and persuade industry members to get on board.

Whatever the benefits to the both human health and the food industry, the new technology could easily become a target for advocates. DNA isn't being inserted into the produce itself, so the foods shouldn't be called Frankenfoods — but being coated in DNA, however harmless, could draw cries of "Frankenpackaging" from critics of all genetic technology.

At the moment the DNA is synthetic but to allay consumer fears, DNATrek intends to use DNA extracted from natural substances like sea weed that are universally perceived as safe. So in reality, if the technology takes off, we could think of our food being shrink-wrapped in invisible Nori – really no different to a sushi roll.

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Additional Resources

- USDA: U.S. Foodborne Illnesses Cost More Than $15.6 Billion Annually, Food Safety News
- Whole genome sequencing for foodborne outbreak tracking, Examining Food