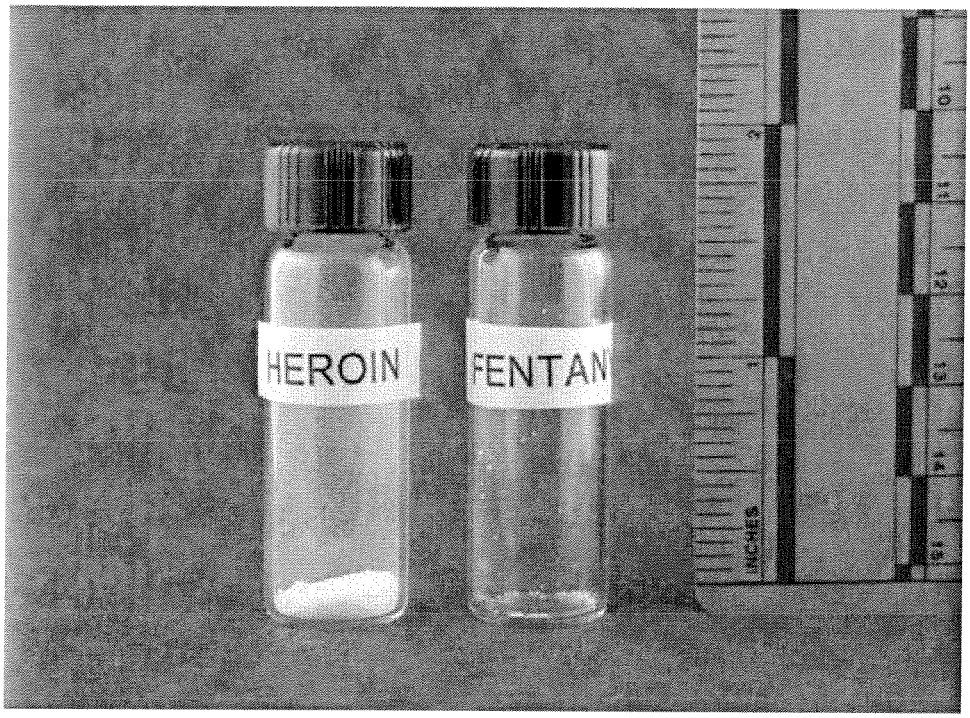
## Lee, Chris

**From:** Peterson, Brian <Brian.Peterson@milwaukeecountywi.gov>
**Sent:** Tuesday, May 23, 2017 7:28 AM
**To:** Lee, Chris
**Subject:** Lethal dose of heroin vs lethal dose of Fentanyl




https://www.nist.gov/news-events/news/2017/05/fentanyl-can-sicken-first-responders-heres-possible-solution

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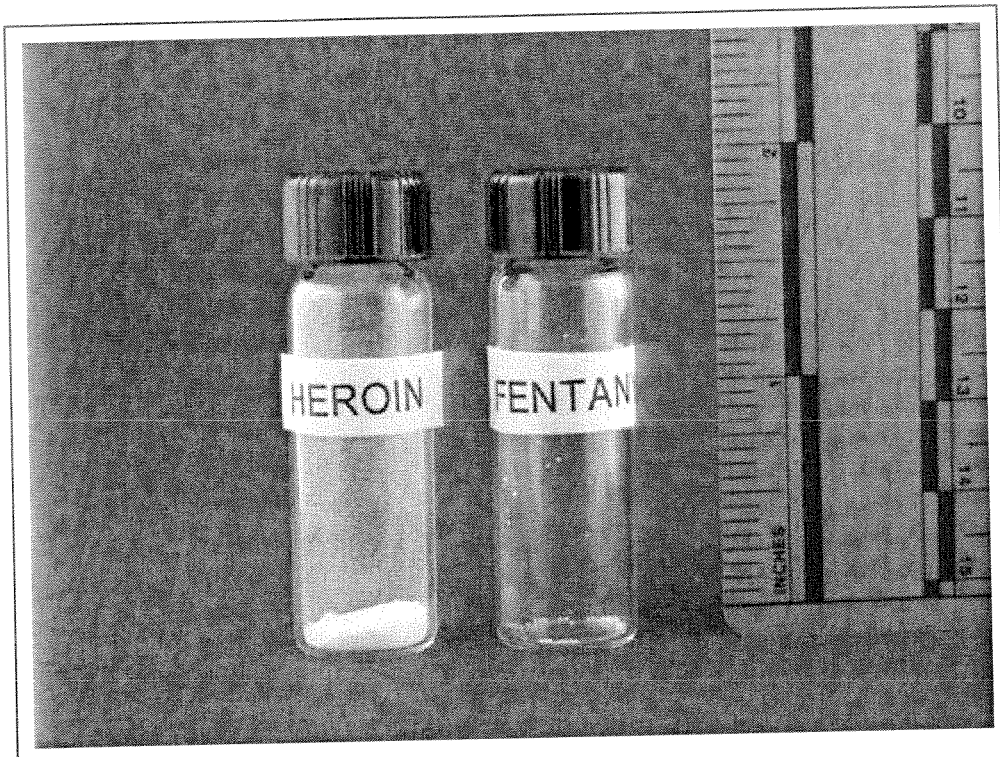
National Institute of Standards and Technology
U.S. Department of Commerce

# Fentanyl Can Sicken First Responders. Here's a Possible Solution.

## NIST researchers demonstrate screening techniques that can help prevent accidental exposure to synthetic opioids.

May 09, 2017




A lethal dose of heroin compared to a lethal dose of fentanyl. This is just an illustration—the substance actually shown in this photo is an artificial sweetener.

Credit: Bruce A. Taylor/NH State Police Forensic Lab

Dan Kallen, a detective in southern New Jersey, was searching a home with fellow officers in August 2015, when they found a bag of white powder. Kallen removed a scoop of powder for testing. When he was done, he closed the bag, and a bit of air escaped, carrying a puff of powder with it. It was enough to send Kallen and a fellow officer to the emergency room.

The drugs in the bag had been spiked with fentanyl, a synthetic drug that, like heroin, is an opioid. But it is 50 times more potent than heroin—even a tiny amount inhaled or absorbed through the skin can be extremely dangerous or deadly. Kallen described his experience in a Drug Enforcement Agency video (https://www.dea.gov/video_clips/Fentanyl%20Roll%20Call%20Video.mp4) that warns first responders of the dangers of handling unknown powders.

Scientists from the National Institute of Standards and Technology (NIST) are working to address this hazard. In a paper published in *Forensic Chemistry* (http://dx.doi.org/10.1016/j.forc.2017.04.001), they report that two technologies, Ion Mobility Spectrometry (IMS) and Direct Analysis in Real Time Mass Spectrometry (DART-MS), can detect trace amounts of fentanyl even when mixed with heroin and other substances.

This research is the first to identify the lowest concentrations at which fentanyl mixtures can be detected using these techniques, and it suggests new ways to protect law enforcement officers, evidence examiners, and drug-sniffing dogs (http://www.wbaltv.com/article/potent-fentanyl-has-k-9-units-taking-extra-precaution/7101351).

IMS instruments are commonly used at airports. In that setting, a security officer might swab a piece of luggage or a passenger's hands, then insert the swab into the instrument to check for traces of explosive residue. Similarly, a police officer might test a bag of powder for fentanyl before opening it.

"Currently, police officers have to handle drugs to test them," said Ed Sisco, a research chemist at NIST and the lead author of the study. "But with these technologies, they can just swab the outside of a bag to test for fentanyl." If the test comes back positive, they can take extra precautions.

Amber Burns, chief of the Controlled and Dangerous Substances Unit at the Maryland State Police Crime lab, agreed that screening with IMS or DART-MS would be useful. "Several law enforcement agencies have reached out to us about how to better handle suspected drugs," Burns said. "Because IMS is portable, it would be pretty user friendly for them to bring to a scene and screen a sample quickly."

IMS instruments cost around $35,000 and are the size of a microwave oven. Burns said the DART-MS instruments, which are more sensitive but larger and more expensive, might be ideal for screening incoming material at a forensic lab before it's handled by evidence examiners.

In addition, these technologies might be used to screen packages at the border or at postal service inspection facilities.

The authors have also reached out to medical researchers about investigating whether fentanyl screening might be useful when treating overdose victims. Because fentanyl is so potent, reviving an individual after a fentanyl-related overdose often requires multiple doses of the opioid antidote naloxone (https://emergency.cdc.gov/han/han00384.asp). Swabbing the victim's hands might reveal if fentanyl is involved, and that information might be useful in determining a course of treatment.

## An Epidemic of Drug Overdoses

According to a recent report from the Centers for Disease Control and Prevention (https://www.cdc.gov/mmwr/volumes/65/wr/mm655051e1.htm), more than 52,000 people died of drug overdoses in the United States in 2015, more than triple the number from 1999. That rapid increase is being driven by heroin and synthetic opioids, mainly fentanyl. In just a single year, from 2014 to 2015, the death rate from synthetic opioids (excluding methadone) increased by 72 percent.

Pharmaceutical fentanyl is used as a painkiller. But according to the Drug Enforcement Agency, most illicit fentanyl is smuggled into the United States. The manufacturers constantly create new forms of fentanyl, each with a slightly different chemical structure. They do this to stay one step ahead of the authorities, who must individually ban each new fentanyl analog as it emerges.

Drug dealers often lace their supply with fentanyl or an analog to boost its potency. Users may not know the strength of the drugs they're buying, or how the different substances in it interact.

A particularly dangerous fentanyl analog, carfentanil, is increasingly turning up in the U.S. drug supply. Carfentanil is used as a large animal tranquilizer, and it is 100 times more potent than fentanyl—5,000 times more potent than heroin.

"A small amount, just the size of a poppy seed, can kill you," Burns said.

## Research Based on a Realistic Scenario

For their research, Sisco and colleagues used IMS and DART-MS instruments to detect 16 different fentanyl analogs, including carfentanil. Both technologies work by ionizing the molecules in question, which gives them an electric charge. An electrical field then draws the ions toward a detector, and you can measure how long it takes for them to arrive. That time delay is like a signature that identifies the molecule.

Detecting the synthetic drugs in their pure form is easy. In this case, the researchers mixed small amounts of fentanyl and fentanyl analogs with heroin and with common cutting agents such as caffeine.

"We wanted to mimic what first responders and evidence examiners are likely to see in the field," said Sisco. "Would the large amounts of cutting agents mask the fentanyl signatures? That's what we wanted to find out."

They found that, using IMS, they could detect fentanyl in mixtures that contain as little as 0.2 percent fentanyl. With DART-MS, they could easily detect mixtures down to 0.1 percent. Both types of instruments were able to detect traces of the compounds that inevitably land on the outside of plastic bags through handling.

In addition, both techniques distinguished between most of the different analogs of fentanyl. This is important because some analogs are far more potent than others. In addition, identifying specific analogs will help law enforcement and public health officials keep track of new analogs as they emerge.

This research paper is the first to publish the IMS and DART-MS signatures for the 16 fentanyl analogs tested. Sisco and his co-authors are speaking with IMS manufacturers about adding the newly identified signatures to their product software. That way, agencies that

already own the instruments would be able to identify the fentanyl analogs after their next software update. NIST publishes a widely used DART-MS library, and the authors are working on getting the signatures added to that library as well.

"We hope this makes a real difference to the safety of people who come into contact with synthetic opioids," Sisco said. "The opioid epidemic is a huge problem. This might be one small way to try to get a handle on it."

Paper: E. Sisco, J. Verkouteren, J. Staymates, J. Lawrence, Rapid Detection of Fentanyl, Fentanyl Analogues, and Opioids for on-Site or Laboratory Based Drug Seizure Screening using Thermal Desorption DART-MS and Ion Mobility Spectrometry. Published online 27 April 2017. *Forensic Chemistry*. DOI: 10.1016/j.forc.2017.04.001 (http://dx.doi.org/10.1016/j.forc.2017.04.001)

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