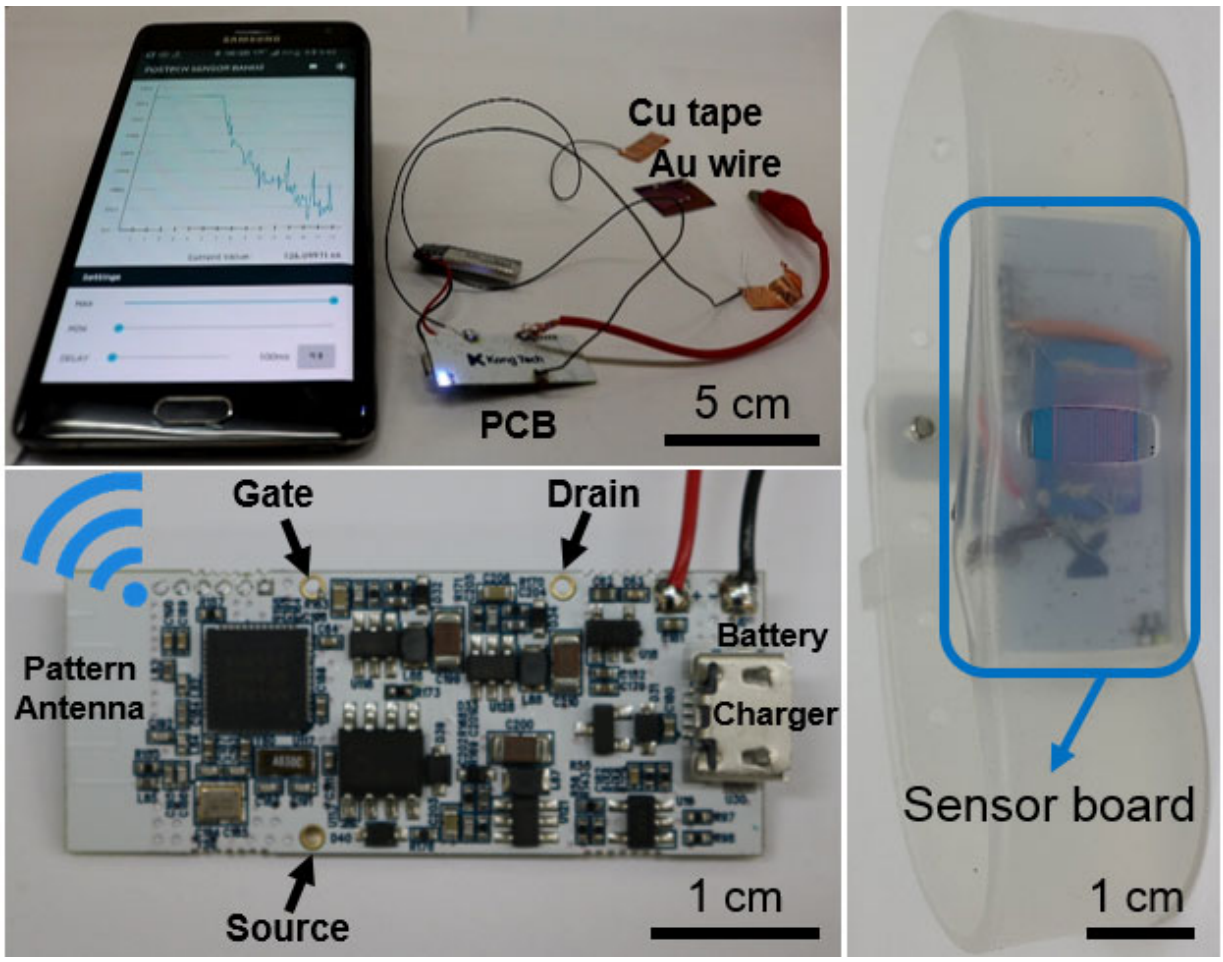
Speedy urine test for amphetamines sends results via app

September 28 2017



This figure represents the newly developed amphetamine sensor with a wireless communication system. The drug sensor consists of a highly sensitive organic transistor platform functionalized with drug-specific host molecules. Credit: Jang et al.

Researchers in Korea have developed a wireless sensor and a smartphone app that can detect the presence of speed in a drop of human urine in seconds. The prototype device is also portable enough to be worn as a bracelet, has unprecedented sensitivity for amphetamines with low risk for false-positive results, and costs about $50 to produce. They present their proof-of-concept design September 28 in the journal *Chem*.

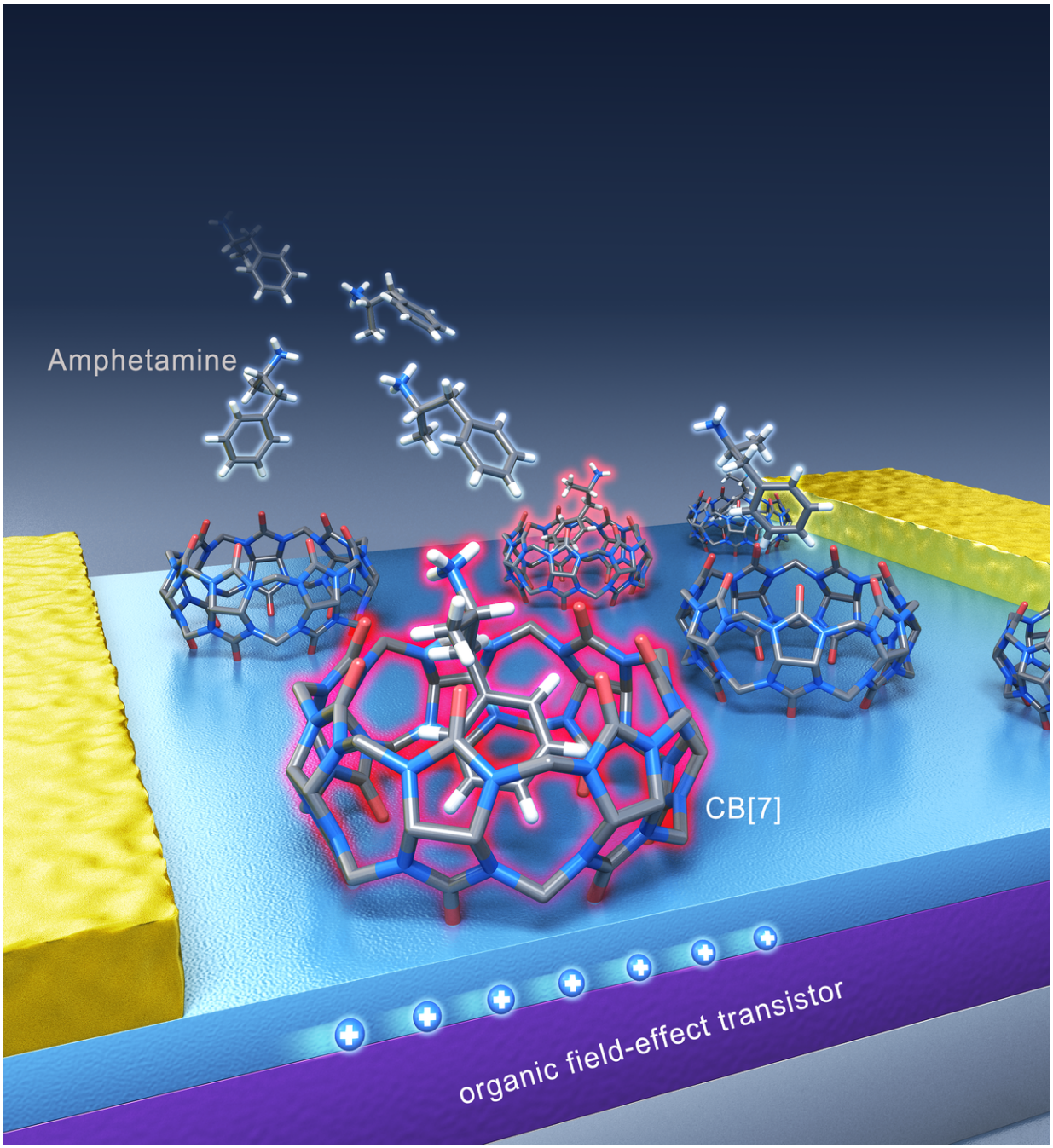
"Conventional drug detection generally use techniques that require long operation time, sophisticated experimental procedures, and expensive equipment with well-trained professional operators; moreover, they are not usually portable," says co-senior author Joon Hak Oh, who heads an organic electronics laboratory at Pohang University of Science and Technology (POSTECH). "Our method is a new type of drug sensor that can solve all these problems at once."

The Oh lab, which has expertise in sensor technology, worked on the project in collaboration with the lab of the paper's other senior author, Kimoon Kim, who studies molecular recognition at POSTECH and the Institute for Basic Science (IBS) by using a family of hollowed-out pumpkin-shaped molecules called cucurbiturils. This partnership was inspired when Ilha Hwang, a senior scientist in the Kim lab, had the hypothesis that amphetamines—which he saw on news reports are being widely abused—would tightly bind to cucurbituril molecules and thus help in drug detection.

The researchers tested their sensor by adding amphetamines to urine and then evaluating results sent via Bluetooth from the sensor to an Android app. False-positive results were not detected in human urine, but it's impossible to rule out the possibility that they could occur. Further testing in clinical settings will need to be conducted before the product can be commercialized, but the ultimate goal would be to provide a mechanism for on-site drug testing. For this purpose, the researchers miniaturized the sensor so that it can fit and analyze samples on a

bracelet.

"On-site amphetamine testing could potentially prevent additional crimes or accidents that may be caused by drug abuse," says Hwang. "For example, breathalyzers are effective at catching drunk drivers on the spot, thereby preventing accidents; we hope that our sensor may have a similar effect with people who abuse amphetamines."



Binding of drug molecules to the hollow cucurbit[7]uril (CB[7])'s cavity changes the current signal flowing in the transistor and therefore can be used as a detection system. The molecular structure of amphetamine and methamphetamine bound to cucurbit[7]uril (CB[7]) was confirmed with X-ray crystallography. Each color indicates a different atom (blue: nitrogen, red: oxygen, gray: carbon, and white: hydrogen). CB[7]'s hydrogen atoms have been

omitted for clarity. Credit: IBS

"We believe that the combination of molecular recognition and organic electronics is very powerful and will greatly contribute to the development of accurate, sensitive, and inexpensive sensors beyond the limits of existing methods," adds Kim. "There are many important, real-world areas where sensors are required, such as environmental monitoring, healthcare, detection of dangerous substances, safety issues, and so on. We are currently conducting further research in this direction."

More information: *Chem*, Jang, Y., and Jang, M. et al.: "Point-of-Use Detection of Amphetamine-Type Stimulants with Host-Molecule-Functionalized Organic Transistors" www.cell.com/chem/fulltext/S2451-9294(17)30362-5 , DOI: 10.1016/j.chempr.2017.08.015

Provided by Cell Press