# Bioengineers develop quick, saliva-based detection test for marijuana

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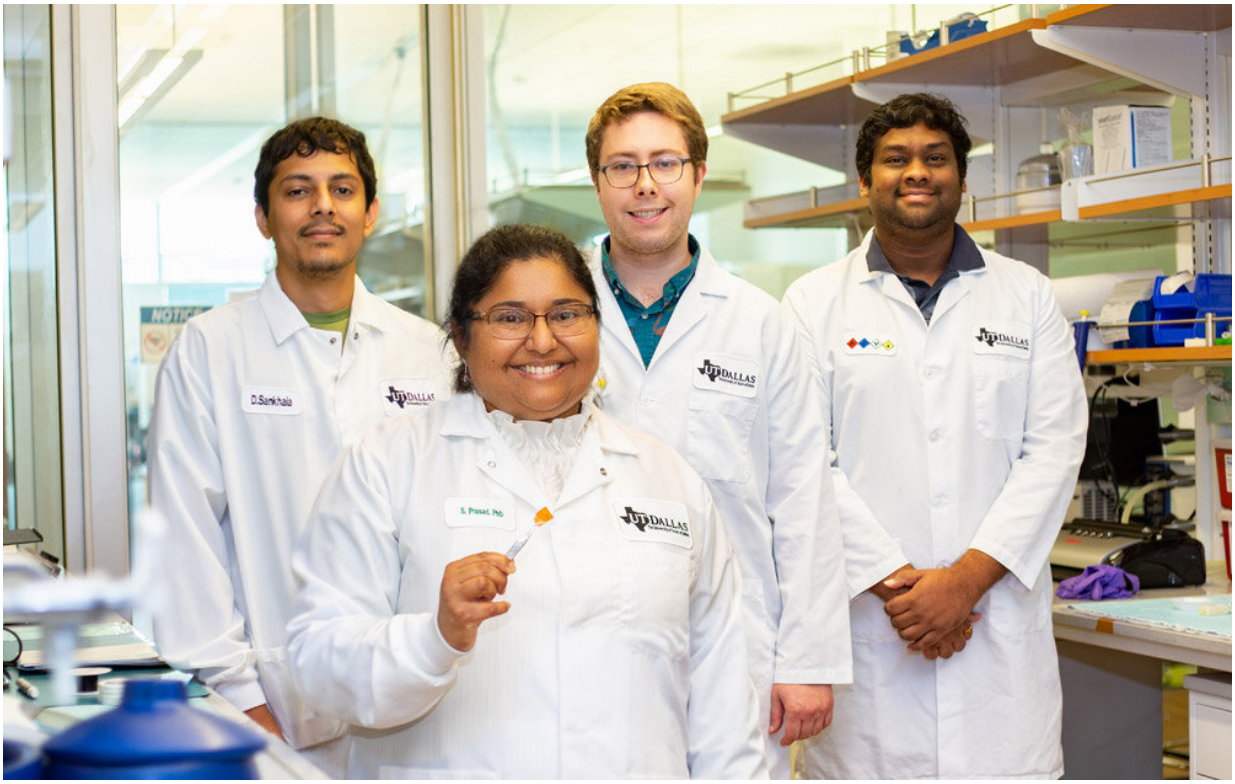

Credit: University of Texas at Dallas

Dr. Shalini Prasad (front), interim department head of bioengineering in the Erik Jonsson School of Engineering and Computer Science, holds the THC biosensor her team developed. In back, from left, are electrical engineering Ph.D. student Devangsingh Sankhala, research engineer Paul

Rice and biomedical engineering Ph.D. student Vikram Narayanan Dhamu.

Marijuana is the most commonly used illicit drug in the U.S. As states grapple with marijuana laws, public safety agencies face challenges in identifying those driving under its influence.

Researchers at The University of Texas at Dallas have created a sensor that uses saliva to rapidly report—within one minute—a subject's level of THC, the psychoactive component in marijuana.

Their proof-of-concept study, published in September in *Nature Scientific Reports*, could clear the way for a new roadside DUI assessment for THC that works in much the same way as testing for alcohol impairment.

"Even here in Texas, where marijuana is not yet legal, the conversation has already started," said Dr. Shalini Prasad, corresponding author of the study and interim department head of bioengineering in the Erik Jonsson School of Engineering and Computer Science. "Do we have technologies that, if you do a rapid screen at a roadside stop, can determine THC levels accurately?"

Marijuana's active component, tetrahydrocannabinol (THC), can affect a user's memory, movements, decision-making, concentration, coordination, and sensory and time perception.

"The effects of marijuana vary so much from person to person," said Prasad, the Cecil H. and Ida Green Professor in Systems Biology Science. "There's significant research on how its metabolism works. But determining how it works on the general population across various demographics is difficult—much more so than for alcohol."

Prasad's team previously developed biosensors that analyze sweat to detect levels of certain chemicals, such as glucose, in the body. But the timeline from when marijuana enters the body to when it leaves via sweat is too long for public safety purposes. Blood draws, while accurate, are also time-consuming, invasive and involve medical skills not all law enforcement personnel possess.

"For a public-safety assessment, time is critical," Prasad said. "After reviewing existing technologies, we set out to produce faster readings, to make a device that's easy to use and to ensure the interpretation of the data is extremely robust."

Prasad explained that the usefulness of a faster test would go beyond public safety concerns.

"In places where it's legal, marijuana is also being administered in a medical space," she said. "So they must also understand the scale of the therapeutic impact."

## Sticking to Saliva

Saliva offers an alternative to blood and sweat that solves the time issue while retaining accuracy. It also can be obtained easily via a swab of the cheek.

"At-home kits for this purpose already exist, but they require a great deal of handling precision and still take more time than someone would have at a roadside stop," Prasad said.

Prasad's method relies on the electrochemical activity of molecules, or how they respond to an electric field. After marijuana use, THC in the body breaks down into molecules called metabolites. Prasad's device picks up the distinct electrochemical signal of one metabolite, and the

strength of the signal indicates the THC concentration.

Despite being the best choice, saliva still comes with complications.

"There are a lot more interfering molecules in saliva," she said. "Many of these other compounds are much more electroactive than the THC metabolite, which makes it difficult to detect via the electrochemistry we used in our glucose sensors. That's the engineering challenge."

Saliva can also be rather acidic, adding another hurdle to the detection process.

"Acids tend to camouflage other electrochemical signals," Prasad said. "So we had to figure out a way to filter that noise out."

Prasad's team overcame the signal-to-noise issue by designing a coating for the sensor that acts as a lubricant, spreading in response to the target metabolite to amplify the signal.

"We're tuning the dial on a metaphorical radio," she said. "We know the frequency of the 'station' we want, that is, where the THC metabolite binds to our coating. Our dial tunes out the other frequencies, increasing the sensitivity of our sensor."

Prasad's team worked for about three years, off and on, on the salivary-sensing method. Her results show saliva can work as a marijuana-sensing alternative to blood testing.

"We've shown with 95% accuracy the correlation between salivary concentration and blood concentration of THC," she said.

With an accurate prototype test in hand, Prasad hopes to partner with researchers who work closely with marijuana metabolism.

"Many research centers and government labs conduct research on marijuana metabolism, and they have been waiting for a tool such as ours to come along," she said.

## Public Health and Safety

Going forward, Prasad envisions addressing needs related to both public health and safety.

"The impairment-level issue is challenging because there is no existing numeric threshold for THC, as there is with blood alcohol levels," she said. "Legislators and public safety bodies need the context that such readings provide to determine a standard concentration limit.

"At the same time, as with any other medicine, where marijuana is being used for pain relief, we want to better understand the efficacy of the treatment. For example, how long is the effective period per dose? What dosage is sufficient? Our sensor should be able to help answer these questions."

**More information:** Hunter Stevenson et al. A Rapid Response Electrochemical Biosensor for Detecting Thc In Saliva, *Scientific Reports* (2019). DOI: 10.1038/s41598-019-49185-y

Provided by University of Texas at Dallas