Researchers develop sensor to detect brain disorders in seconds

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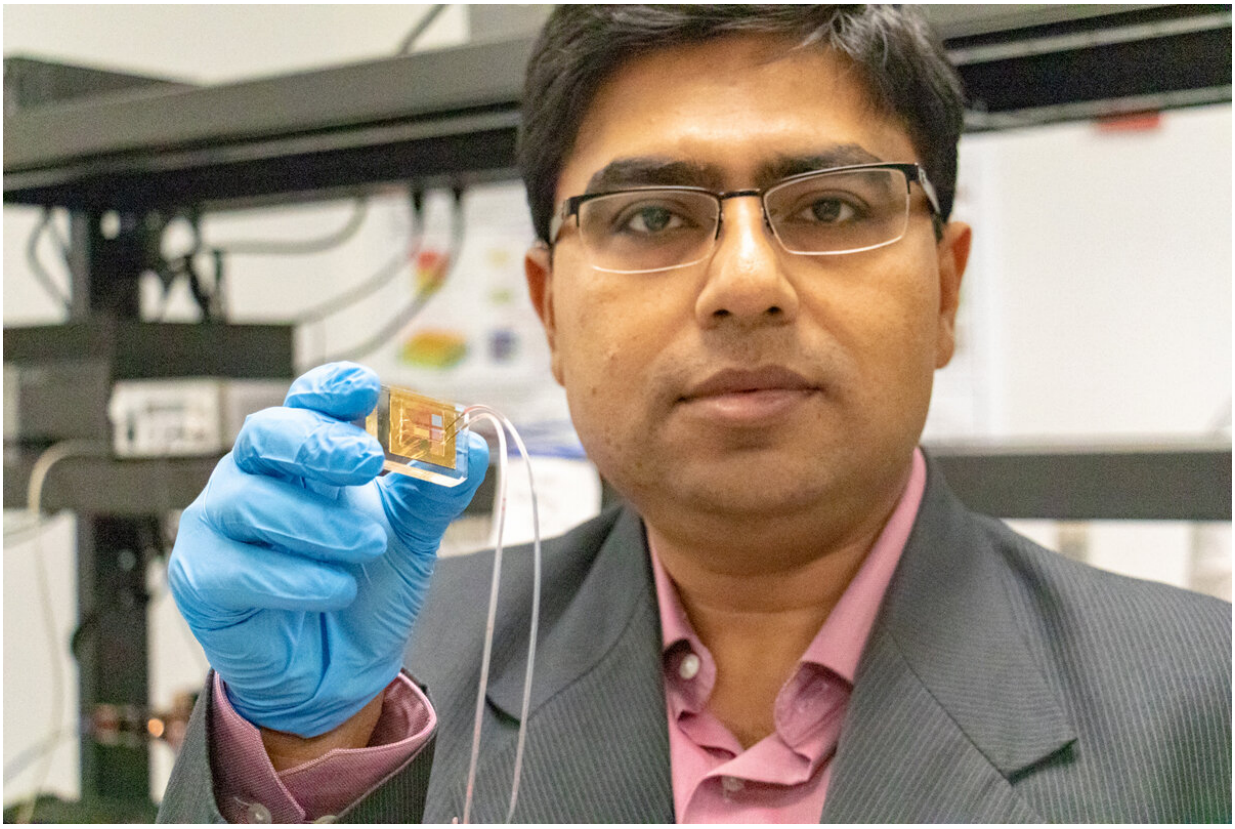

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detector for dopamine, a chemical that is believed to play a role in various diseases such as Parkinson's, depression and some cancers.

Studies show too much dopamine could be associated with some cancers, while low dopamine could be associated with Parkinson's disease and depression. The new technique developed at UCF requires only a few drops of blood, and results are available in minutes instead of hours because no separate lab is necessary to process the sample.

The new technology was described in a recent study in the journal *Nano Letters*.

More than half a million people in the United States have Parkinson's and major episodes of depression affect about 16 million adults a year.

Current methods to detect dopamine are time consuming, require rigorous sample preparation, including blood-plasma separation, as well as specialized laboratory equipment. With this device, however, a few drops of blood on a palm-sized, rectangular chip is all that is needed.

"A neurotransmitter like dopamine is an important chemical to monitor for our overall well-being so we can help screen out neural disorders like Parkinson's disease, various brain cancers, and monitor mental health," said Debashis Chanda, an associate professor in UCF's NanoScience Technology Center and the study's principle investigator. "We need to monitor dopamine so that we can adjust our medical doses to help address those problems."

Plasma is separated from the blood within the chip. Cerium oxide nanoparticles, which coat the sensor surface, selectively capture dopamine at microscopic levels from the plasma. The capture of dopamine molecules subsequently changes how light is reflected from the sensor and creates an optical readout indicating the level of

dopamine.

Sudipta Seal, an engineering professor and chair of UCF's Department of Materials Science and Engineering, said the use of cerium oxide nanoparticles was an important part of the sensor's success.

"Getting the sensor to be sensitive to dopamine had been quite the challenge for researchers for a while, but using altered cerium oxide nanostructures on the sensing platform was key in making the sensor work," Seal said.

Chanda co-developed the sensor with Abraham Vázquez-Guardado, a graduate of UCF's College of Optics and Photonics and now a postdoctoral fellow at Northwestern University.

Vázquez-Guardado said reduced steps and processing make the test cost effective, and it can also be performed at the patient's side rather than in a separate lab.

"There is no preprocessing needed," he said. "Our plan was to make a much quicker, enzyme-free kind of detection."

More information: Abraham Vázquez-Guardado et al, Enzyme-Free Plasmonic Biosensor for Direct Detection of Neurotransmitter Dopamine from Whole Blood, *Nano Letters* (2018). DOI: 10.1021/acs.nanolett.8b04253

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