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Adam Liebendorfer

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Graphene-based sensor rapidly detects HIV drug in nanoscale concentrations

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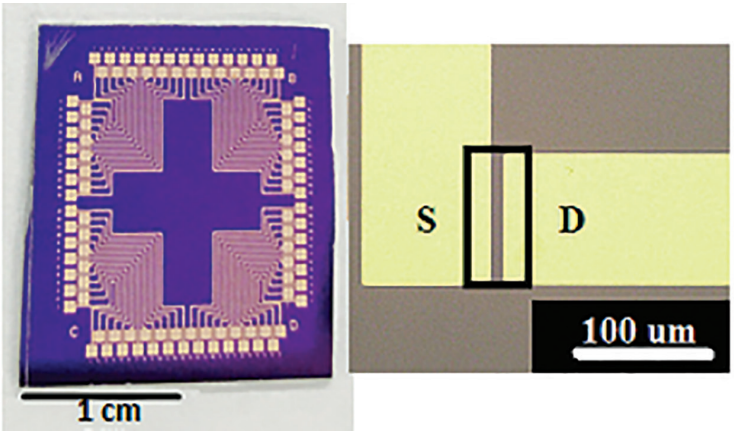
A new nanosensor based on graphene field-effect transistors boasts the ability to detect a target HIV drug comparable to liquid chromatography-mass spectrometry in a fraction of the time and cost.



Many medical tests for biomarkers and drugs rely on liquid chromatography-mass spectrometry (LC-MS), a decades-old combination of techniques that often require external lab analysis. This can be expensive and yield slow results not suitable for point-of-care use. Novel uses of graphene field-effect transistors (GEFTs), however, are paving the way for new methods of measuring these markers through inexpensive, rapid techniques.

By affixing aptamers, sequences of nucleotides that bind to specific targets, to a graphene base, University of Pennsylvania researchers created a nanosensor for monitoring concentrations of a prominent HIV drug in test conditions. As reported in *AIP Advances,* these aptamers induce a shift in the GFET's Dirac voltage, or the minimum point of conductance, when binding with the market drug tenofovir. This shift corresponds to the concentration and charge of the tenofovir.

The GEFTs were able to detect concentrations of tenofovir as little as 1 ng/mL, a sensitivity on par with many LC-MS systems and acceptable for point-of-care scenarios, which often rely on drug concentrations 1,000 times that amount or more. Researchers demonstrated the device's high specificity for tenofovir by testing the aptasensor against other HIV drugs it wasn't configured for, which produced no significant signals.

The study aimed to take initial steps toward eventually analyzing HIV patients' urine in outpatient settings so that physicians can quickly gauge whether patients are compliant on their medications. In addition to this, aptasensor technology can potentially extend into other forms of quantification such as biomarker-based cancer diagnostics.

Source: "Scalable graphene aptasensors for drug quantification," by Ramya Vishnubhotla, Jinglei Ping, Zhaoli Gao, Abigail Lee, Olivia Saouaf, Amey Vrudhula, and A. T. Charlie Johnson, *AIP Advances* (2017). The article can be accessed at https://doi.org/10.1063/1.4990798.