Opioid drugs like fentanyl are very strong and widely abused, so it's important to have a quick way to detect them in body fluids. This summary describes a new device that uses tiny needle-like sensors to detect fentanyl in blood serum. These sensors are made with platinum and silver wires and coated with special materials to improve detection. They can identify fentanyl at very low levels quickly and accurately, without interference from other substances. This technology could be very useful in emergencies to detect drug use.

The device uses microneedles, which are small and less painful than regular needles. These microneedles can be made from materials like glass, silicon, stainless steel, and polymers. In this study, they used a biocompatible material called E-Shell 200. These microneedles were able to penetrate the skin effectively and are made from safe elements like carbon, titanium, and oxygen. This innovation shows promise for medical uses, including drug detection and delivery.

The microneedle sensors were tested with fentanyl concentrations and showed good results in detecting the drug in both buffer solutions and diluted serum samples. This microneedle-based sensing platform could be an effective tool for rapid fentanyl screening in real biological fluids. To create the test samples, they diluted a strong fentanyl solution into weaker solutions and applied it to the sensors. By gradually adding fentanyl, they observed a clear reaction at a specific voltage, indicating the presence of fentanyl. This response was consistent and linear across different concentrations, meaning the sensors reliably measured varying amounts of fentanyl. The researchers used graphene ink on the sensors, which helped provide a good surface for detecting fentanyl. An ionic liquid was also used to enhance the detection signal. Their tests showed that the sensors could accurately detect fentanyl in liquid samples and could be useful for real-world applications. The sensors showed good sensitivity and consistent results across multiple tests.

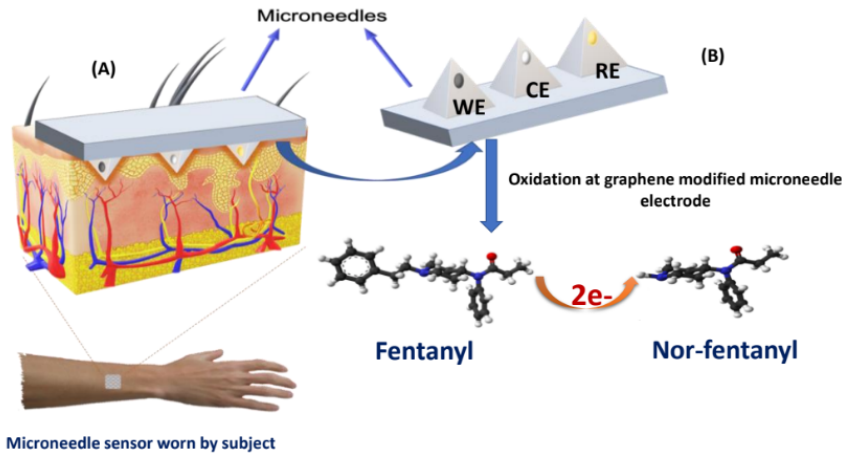

Figure 1. Schematic illustration of fentanyl detection on graphene-modified microneedle working sensor and sensor detection mechanism for future on-body applications. (A) Microneedle array placed on the skin for fentanyl sensing and (B) fentanyl oxidation at graphene-modified microneedle sensor