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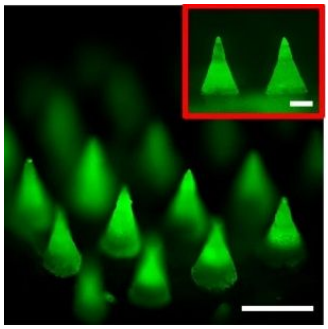
Microneedle Patches for Diagnostics and Monitoring



Researchers at Washington University in St. Louis (USA) have developed a microneedle patch for the collection and analysis of biomarkers in interstitial fluid as a minimally invasive alternative to blood tests.

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The patch can be applied to skin and capture the needed biomarker directly from dermal interstitial fluid (ISF), without the need to use a solution as with the blood testing. The rest of the procedure is similar to the one used with blood samples where the presence and quantity of biomarkers is detected using fluorescence.

While IFS is a particularly rich source of soluble bioanalytes, application of conventional methods to analyse biomarkers is difficult due to insufficient amounts of material, either IFS or biomarkers, extracted. The researchers addressed these problems using specifically designed microneedles that allow the biomarkers to easily ‘adhere’ to them, and applying an ultrabright fluorescence nanolabel, termed plasmonic fluor, which improved detection of target protein biomarkers’ signal by nearly 800-fold compared with conventional fluorophores and allowed for easier detection, even at low concentrations.

In a series of mouse models, the researchers demonstrated how simply sticking and peeling a microneedle patch would allow for ultrasensitive and quantitative monitoring of various protein biomarkers.

It is noted that the polystyrene-based patch is low cost, and easy and practically painless to use, which makes it an promising technology to be applied by clinicians and even patients without the need of a blood draw. According to the researchers, the patches could also be used for longitudinal monitoring of biomarkers, e.g. to study immunity patterns in a new disease, such as COVID-19. Another possible application is in emergency settings, for example in an ambulance taking a patient to the hospital, or in patients with chronic diseases that require continuous monitoring. “Simple and effective methods that enable comprehensive analysis of ISF can lead to transformative advances in biodiagnostic technologies that are not only minimally invasive and pain free, but also ideally suited for point-of-care and resource-limited settings,” the authors note.

Source: Washington University in St. Louis

Image credit: Wang Z et al. (2021)

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