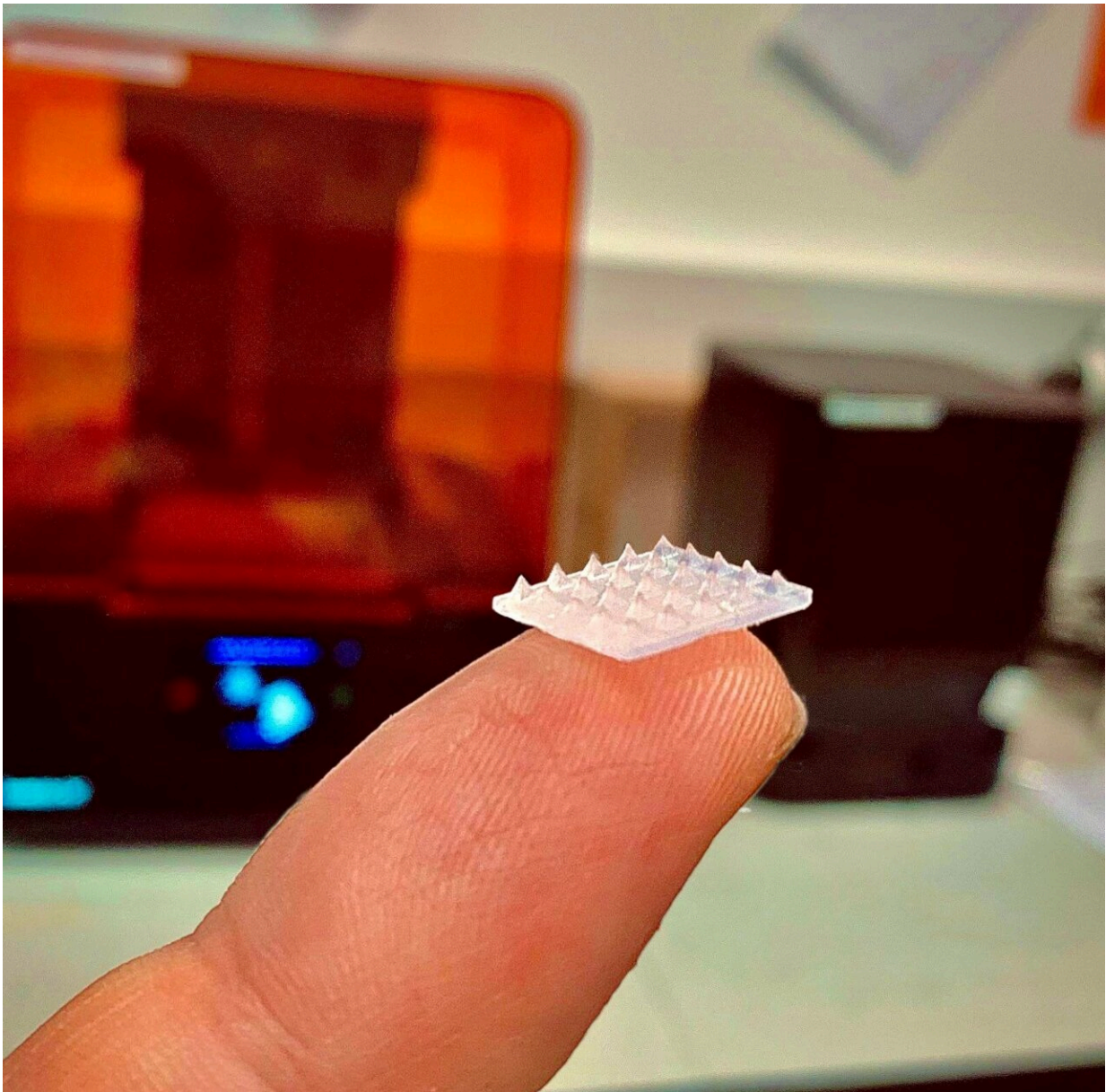


Scientists develop a skin patch that painlessly delivers drugs into the body

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Credit: University of Bath

An affordable microneedle skin patch that delivers a controlled dosage of medicine directly into the body, eliminating the need for injections or oral medication, has been developed by a team led by scientists at the University of Bath.

It is hoped that the [patches](#), which are [described in the journal *Biomaterials Advances*](#), will be ready for use within the next five to 10 years.

What makes the microneedle patches unique is that they are made from a hydrogel (a gel-like substance in which water forms the liquid component), with the [active ingredient](#) encapsulated inside the hydrogel microneedle structure rather than in a separate reservoir.

They are also more affordable than other commercially available microneedle patches, as they are produced from 3D printed molds. Molds produced this way are easy to customize, which keeps the costs down.

Painless delivery

The patch is smaller than a pound coin. Barely visible microneedles painlessly pierce the first few layers of [skin](#). Contact with fluid beneath the skin barrier causes the 'hydrophilic' (water-loving) needles to swell, prompting a specific dosage of the drug to be delivered into the body.

In experiments carried out at Bath, upon swelling, the patches delivered doses of antibiotics that elicited a strong response against two bacteria known to cause serious infections—Escherichia coli (E. coli) and

Staphylococcus aureus.

The patch also works in reverse, extracting small quantities of fluid from beneath the skin for medical analysis. This may be helpful, for instance, for monitoring the levels of lactate (a component of lactic acid) and other chemicals in patients with an infection.

Clear benefits

Bath Chemical Engineer Dr. Hannah Leese—who continues to refine the skin patch design along with fellow engineers Ph.D. student Joseph Turner and Professor Pedro Estrela, and biologist Dr. Maisem Laabei—says microneedle-based skin patches are an ideal system for delivering drugs and have clear benefits over traditional delivery approaches.

She said, "Injections are invasive and expensive, and they don't suit everyone. A lot of people are needle-phobic and are understandably reluctant to receive medicine by injection even when treatment is really needed. Others are ill-suited to injections—for instance, elderly patients with thin skin.

"Also, sometimes the use of needles can introduce pathogens, such as bacteria, that may cause infections, especially in people with low immunity."

She added that people generally have fewer objections to taking drugs by mouth, but there are downsides to [oral medication](#) too.

She said, "You can experience gastrointestinal side-effects; there is a delay between taking the medication and the drug getting to where it's needed in the body; doses need to be higher because a lot of the formulation is broken down in the gut, and if the patient is taking

antibiotics, this can also contribute to antimicrobial drug-resistance."

Toward clinical trials

"Our next step is to continue to refine the [microneedle](#) platform and run animal studies before moving to human [clinical trials](#)," said Dr. Leese, adding, "I'm hopeful these patches will be ready for patient use within the next five to 10 years."

Dr. Leese anticipates that the patches will be able to deliver both drugs that circulate the entire body and drugs that need to remain more localized—for instance, when there is an infection in a discrete section of skin. There is also scope for the patches to deliver vaccines and to monitor hormone levels.

"We can also see there being a role for these patches in the health and wellness fields," she said. "I can picture the day people have microneedles under their smartwatches to detect fluctuations in the stress hormone, cortisol."

More information: Joseph G. Turner et al, Antimicrobial releasing hydrogel forming microneedles, *Biomaterials Advances* (2023). [DOI: 10.1016/j.bioadv.2023.213467](https://doi.org/10.1016/j.bioadv.2023.213467)

Provided by University of Bath

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