Bio-inspired surgical coatings fight infections and monitor strain

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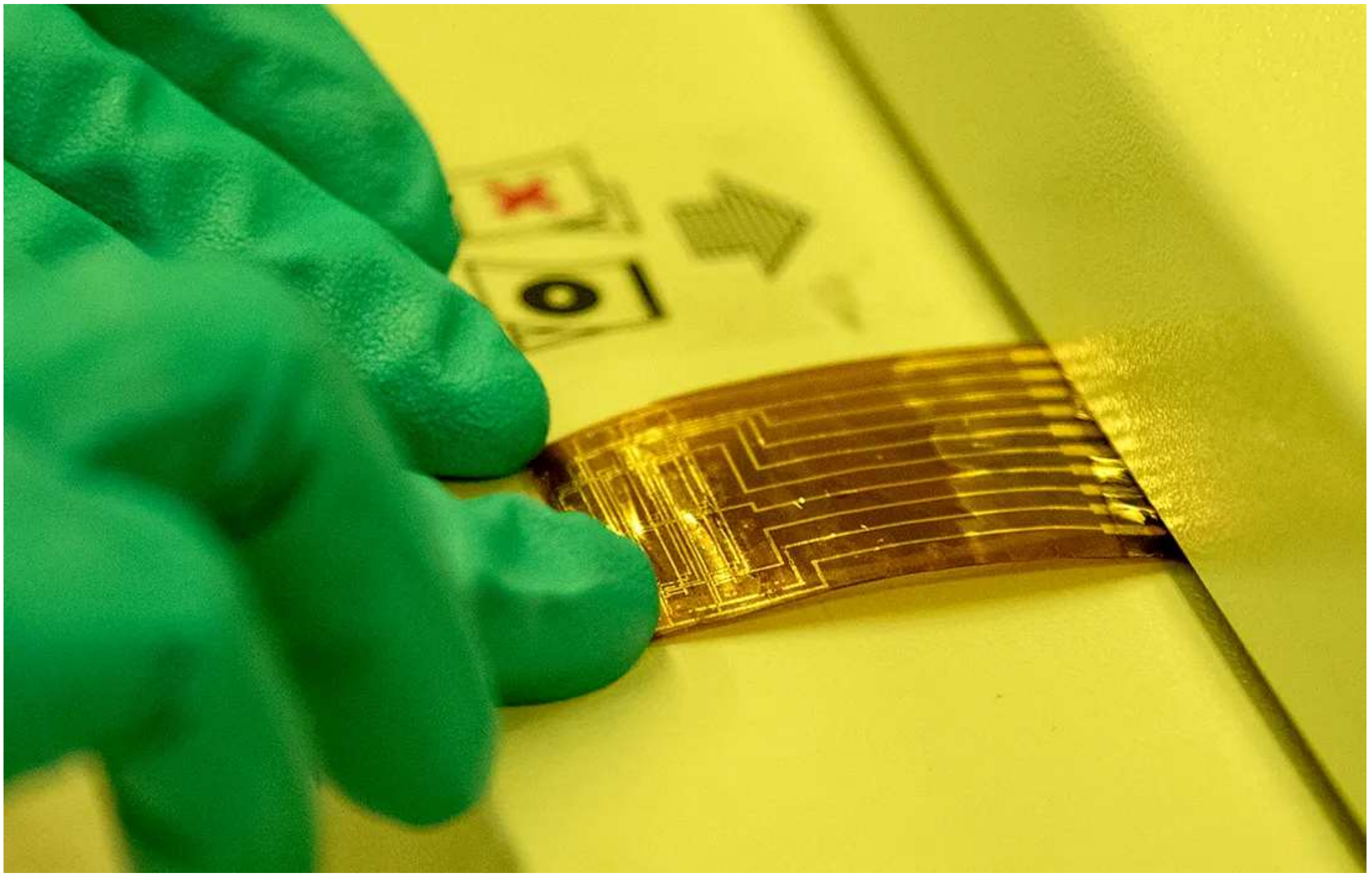
Researchers have designed a surgical coating inspired by the structure of cicada wings that has both antimicrobial and strain mapping properties

By: Eva Cornman



The strain mapping layer of the smart coating. Qing Cao/UIUC

While spinal plates and knee screws may help save lives and limbs, these surgical implants still face some pressing problems; notably, infection risk and device failure. To combat these issues, researchers at the University of Illinois at Urbana-Champaign have developed a coating for orthopedic implants that can both kill invading bacteria and monitor strain on the device.

This research, published in May in *Science Advances*, began with a bio-inspired approach. The wings of cicadas and dragonflies have a unique mode of natural antimicrobial resistance. Rather than fighting infections with medicine or immune cells, they fight with weapons: tiny, microscopic pillars that stab and destroy invading bacteria. Along with his research team, Dr. Qing Cao, a researcher who works on electronic and optoelectronic devices at the University of Illinois, decided to replicate those pillars in the lab and spread them across the outer layer of the coating.

Cao's team then placed extremely thin layers of silicon crystals on the inner side of the coating. When the surgical device moves or bends, it simultaneously moves the atoms in the crystals. The motion of the atoms changes the resistance, which can be detected by using external wires to flow charge through the atoms.

But this is where the challenge lies. The team was able to test their coating in live mice and on an extracted sheep spine. While both animal models showed promising results, it will take some time before the coating is ready for clinical use. The reason? The strain mapping still isn't wireless, and it might be tricky to go about your day with wires sticking out of your back. Since publishing their results in May, Cao's team has been working on that very problem. They're currently exploring both Bluetooth and near-field communication as potential solutions. But even then, the coating would still need to be tested in large animal models before it could reach the clinical trial stage.

It's a long process, but an exciting application has emerged. Cao's team has been working on a way to scale up the antimicrobial nanopillars for potential commercial use. Things like food packaging and surfaces in hospitals or even public transportation could benefit from this simple antimicrobial mechanism. The problem, Cao says, is figuring out how to scale up "not as centimeter-by-centimeter scales as what we're doing now, but meter-by-meter scales."

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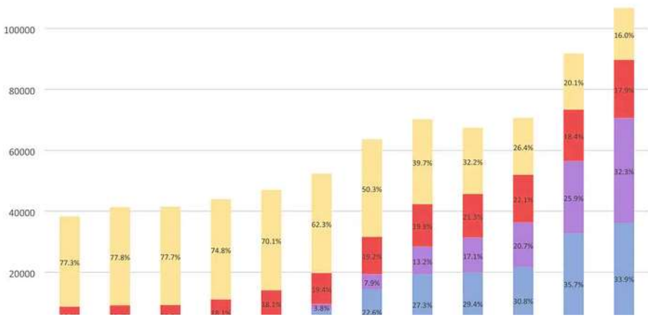

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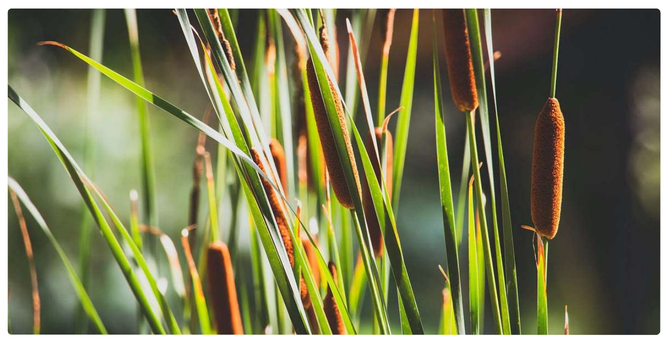

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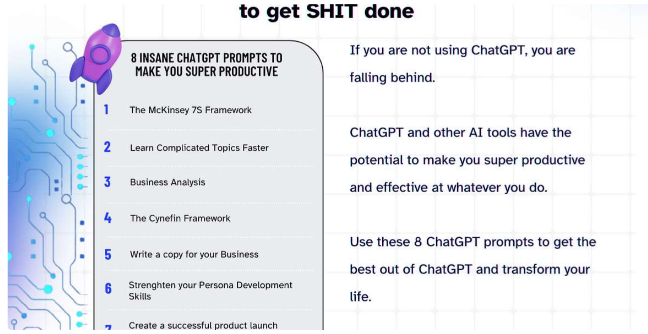

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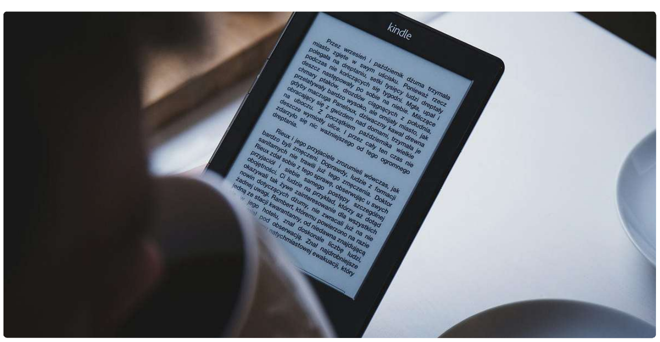

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