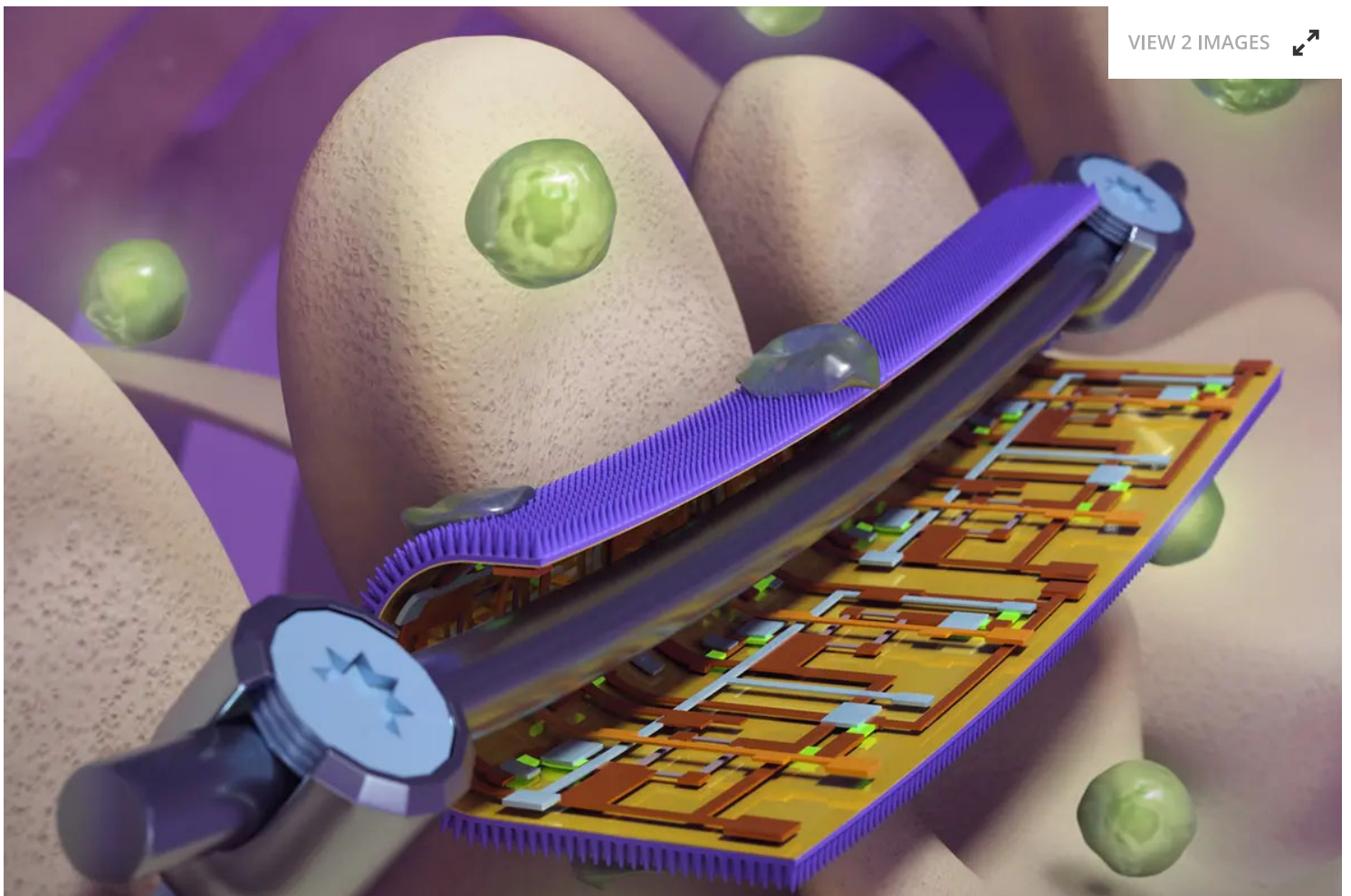


## MEDICAL

# Bug-inspired coating could make for better bone and joint implants

By Michael Franco  
May 09, 2023



*In this computer illustration of the coating, the purple area represents the bacteria-popping pillars, while the circuits represent the stress-sensing components* **Beckman Imaging Technology Group**

Inspired by the wings of dragonflies and cicadas, researchers have developed a new coating for orthopedic implants. It not only shreds harmful bacteria, but also monitors stress on the system, meaning it could warn of impending implant failure.



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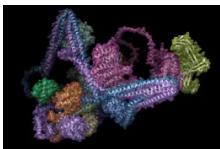
Biomimicry, the practice of creating man-made items based on observations of the natural world, has been a powerful driver of innovations in the medical community for years. We've seen [a material that could make for better bone implants](#) inspired by the different types of pores found in wood and animal horns; [a cactus-inspired sensor](#) that can collect sweat for analysis; and [a coating for brain implants](#) based on the leaves of the carnivorous pitcher plant.

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Turning to nature once again for a coating solution, researchers at University of Illinois Urbana-Champaign (UI) looked to the bacteria-fighting wings of dragonflies and cicadas to solve a persistent problem that arises from orthopedic implants: infection.

According to study leader Qing Cao, a UI professor of materials science and engineering, there hasn't been an adequate way to deal with the infections that afflict up to 10% of implant patients at the implant level. Current efforts at using heavy metal ions to fight bacteria can also cause damage to nearby tissue, he says, and implants coated with antibiotic drugs eventually fail when the chemicals run out. They're also not effective at fighting [antibiotic resistant bacteria](#), a [growing problem](#) in the medical world.



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So Cao and his team created a thin foil coating for implants which, on one side, consists of nanopillars such as those found in the insects' wings. When bacterial cells come in contact with the pillars, they are punctured and die.

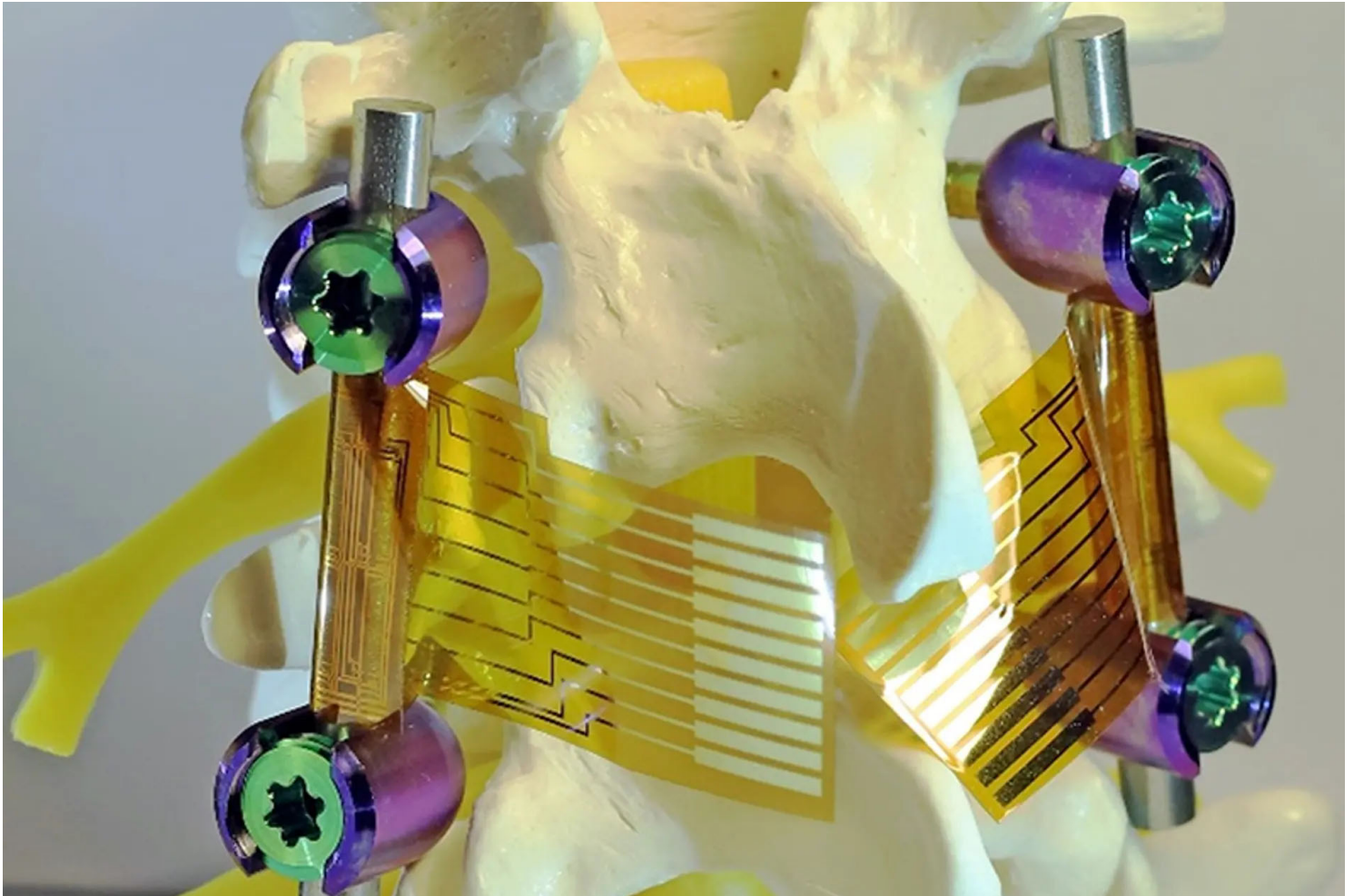
“Using a mechanical approach to killing bacteria allowed us to bypass a lot of the problems with chemical approaches, while still giving us the flexibility needed to apply the coating to implant surfaces,” said pathobiology professor Gee Lau, a co-author of the study.

## **Two-for-one**

Not satisfied with solving just one of the problems with orthopedic implants, the researchers realized their coating could solve another: device failure. Cao says this issue, too, affects about 10% of all patients who get implants.

So, on the other side of the film, the researchers embedded flexible microsensors that were able to measure the mechanical stress on the implants to which the coating was applied. This could not only let physicians know how the body is healing around an implant, say the researchers, but it could send alerts if the strain on an artificial joint gets to be too much.

In animal tests, the coatings performed well, warding off bacteria in mice and sending stress signals back from spinal implants in sheep. While the current coating needs an external power supply, the researchers say they are now working on a wireless solution.



*The coating was applied to a standard spinal implant in sheep where it successfully measured mechanical stress* **Beckman Imaging Technology Group**

“These types of antibacterial coatings have a lot of potential applications, and since ours uses a mechanical mechanism, it has potential for places where chemicals or heavy metal ions – as are used in commercial antimicrobial coatings now – would be detrimental,” Cao said.

The study has been published in the journal [\*Science\*](#).

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### Michael Franco

Michael Franco has been writing about the serious and silly sides of science and technology for years for publications including Discovery Channel Magazine, Discover Magazine and CNET. By far his favorite home so far is at New Atlas where he's allowed all the beakers and Bunsen burners he needs in which to mix his

words. The mountains of North Carolina, where he now lives with his wife and two giant poodles, offer the perfect foil to way too much screen time.

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