Fluorescence detection method predicts wound scar formation

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A team of scientists at Nanyang Technological University (NTU; Singapore) and Northwestern University (Evanston, IL) has developed a fluorescence detection method to predict how scars will develop following surgery or after a burn wound. Using new nanoparticles and a fluorescence microscope, the joint research team has shown in animals and human skin samples the potential to quickly and accurately predict whether a wound is likely to lead to excessive scarring as occurs in keloids and skin contractures.

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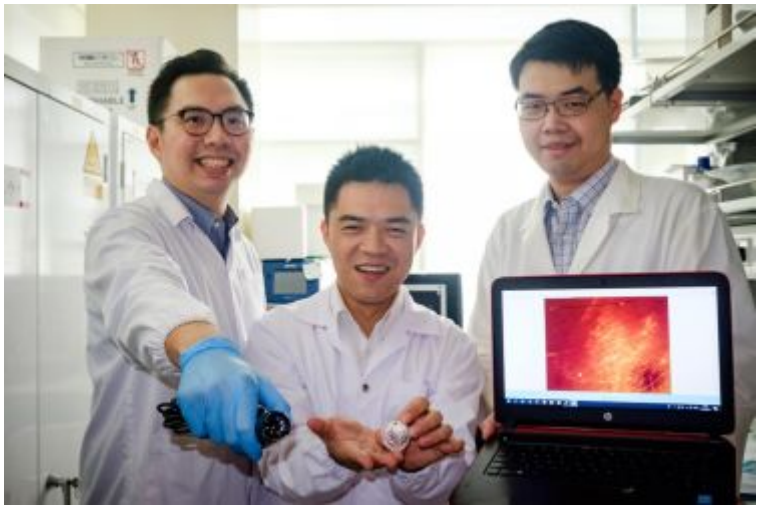
Currently, apart from the visual examination of mature scars, the only other tool to detect skin diseases accurately is to perform a biopsy, where a skin tissue sample is extracted and sent for laboratory testing. These biopsies may be painful and inconvenient for patients, as an open wound also risks infections and needs sutures that must be removed later.

The new detection method uses thousands of nanoparticles called NanoFlares, which have DNA strands attached to their surfaces like a ball of spikes and are applied to closed wounds using a cream. After the nanoparticles have penetrated the skin cells for 24 hours, a handheld fluorescence microscope is used to look for signals given out by the nanoparticles' interaction with target biomarkers inside the skin cells. If fluorescence signals are detected, they indicate abnormal scarring activity and preventive action can be taken to hopefully avoid heavier scarring.

"When our bioengineered nanoparticles are applied on the skin, they will penetrate up to 2 mm below the skin surface and enter scar cells," explains Xu Chenjie, an assistant professor at NTU's School of Chemical and Biomedical Engineering, who led the work. "Upon binding with a specific tell-tale gene released by the scar cells, smaller DNA spikes are knocked loose and light up under the microscope like little light flares. The more flares we see, the more scarring activity there is."



(L-R) NTU's Dr. David Yeo, assistant professor Xu Chenjie, and Dr. Christian Wiraja; Prof. Xu is holding

the cream containing the new NanoFlares that can detect scarring. (*Image credit: NTU Singapore*)

The NanoFlares are made by coating the gold nanoparticles with tiny DNA strands targeting particular genes. It has shown negligible toxicity or side effects when tested on mice, rabbits, and on human skin samples.

The team has filed a patent application based on this technology through NTU's innovation and commercialization arm, NTUitive, and plan to license out the technology for commercialization.

Full details of the work appear in the journal *Nature Biomedical Engineering*.