MEDICAL

Hydrogel injected into fat stores fights obesity from within

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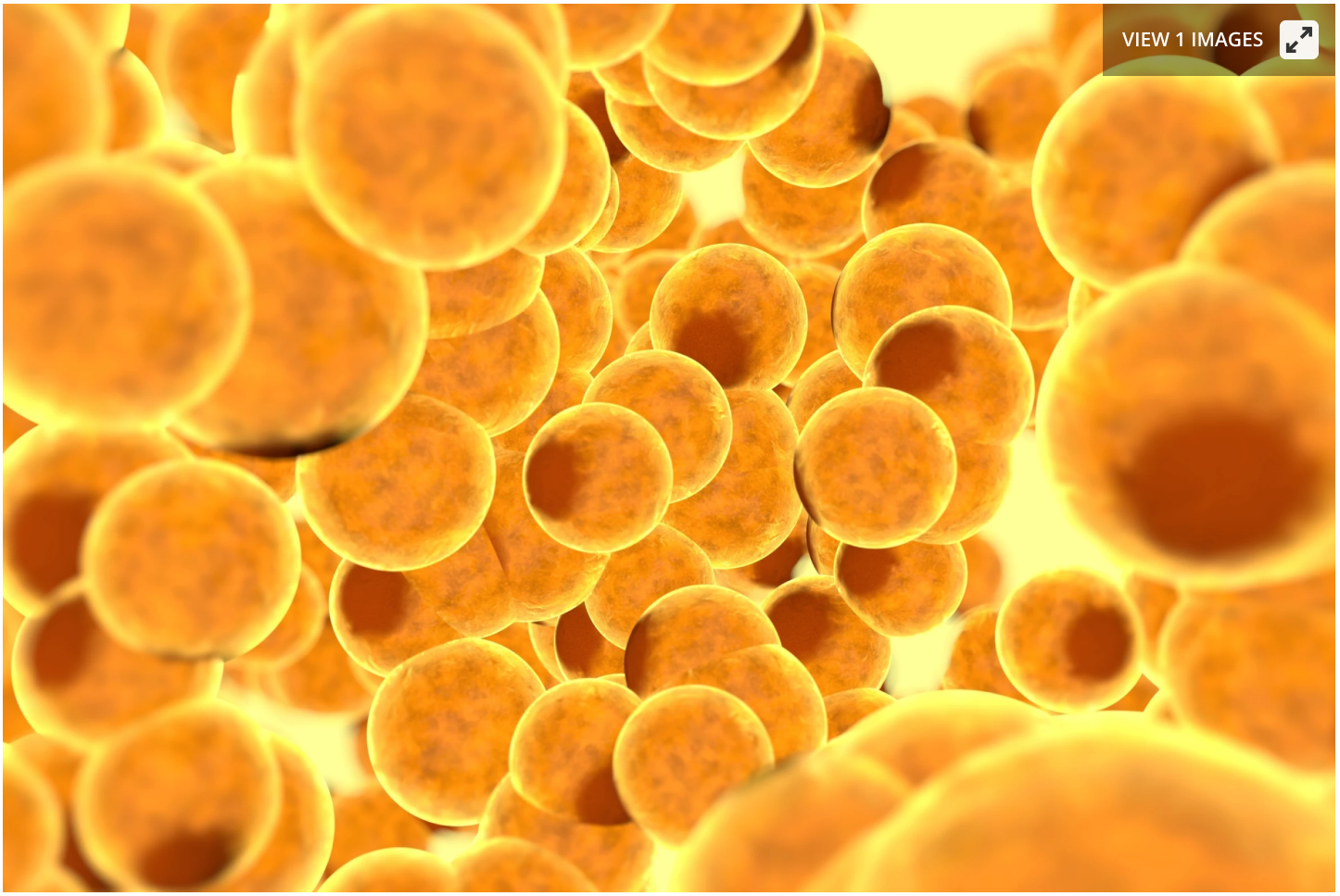


Scientists have developed an injectable hydrogel that converts white fat into a more favorable brown, inducing weight loss in obese mice Depositphotos

Next-generation therapies that fight obesity could come in many forms, but one example from Nanyang Technological University that uses a unique combination of light and metabolic function to break down fat has some unique advantages. The team's solution consists of a hydrogel that can be injected into fat deposits and subjected to near-infrared light, with obese mice showing up to a 54-percent fat reduction following treatment.

The function of this new technology hinges on a protein called TRPV1, which plays an important role in our metabolism. This protein can trigger the conversion of white fat, the type that stores excess calories in beer bellies and love handles, into brown fat. This is the type of fat that the body readily burns for energy and warmth, and as such a lot of anti-obesity research focuses on therapies that can initiate this conversion.

TRPV1 activity also promotes the breaking down of fat droplets into fatty acids that can be used by the converted brown fat to burn calories, or be broken down in the bloodstream through a process called lipolysis. Further, the protein stimulates the secretion of a hormone that improves metabolism of glucose and lipids in the liver and muscles, while also improving insulin sensitivity.

Setting out to develop a therapy that targets TRPV1, the researchers created a hydrogel containing copper sulphide nanoparticles that activates the protein in response to light, and a drug approved by the FDA that can stimulate browning of fat tissues. A biocompatible polymer was also added to keep the hydrogel in a gel-like state after injection, slowly releasing its contents over several days.

Obese mice with hallmarks of metabolic disease had the hydrogel injected into their subcutaneous fat, with near-infrared light then shone onto the site of the injection for ve minutes. This took place each day for three days, followed by four days of rest, for a two-week period, leading to a 5.5-percent reduction in the animals' body weight, compared to a 9.5-percent increase seen among a control group. The treated mice also showed a 40-percent reduction in subcutaneous fat, a 54-percent drop in visceral fat, a 54-percent reduction in cholesterol and 65-percent drop in insulin resistance.

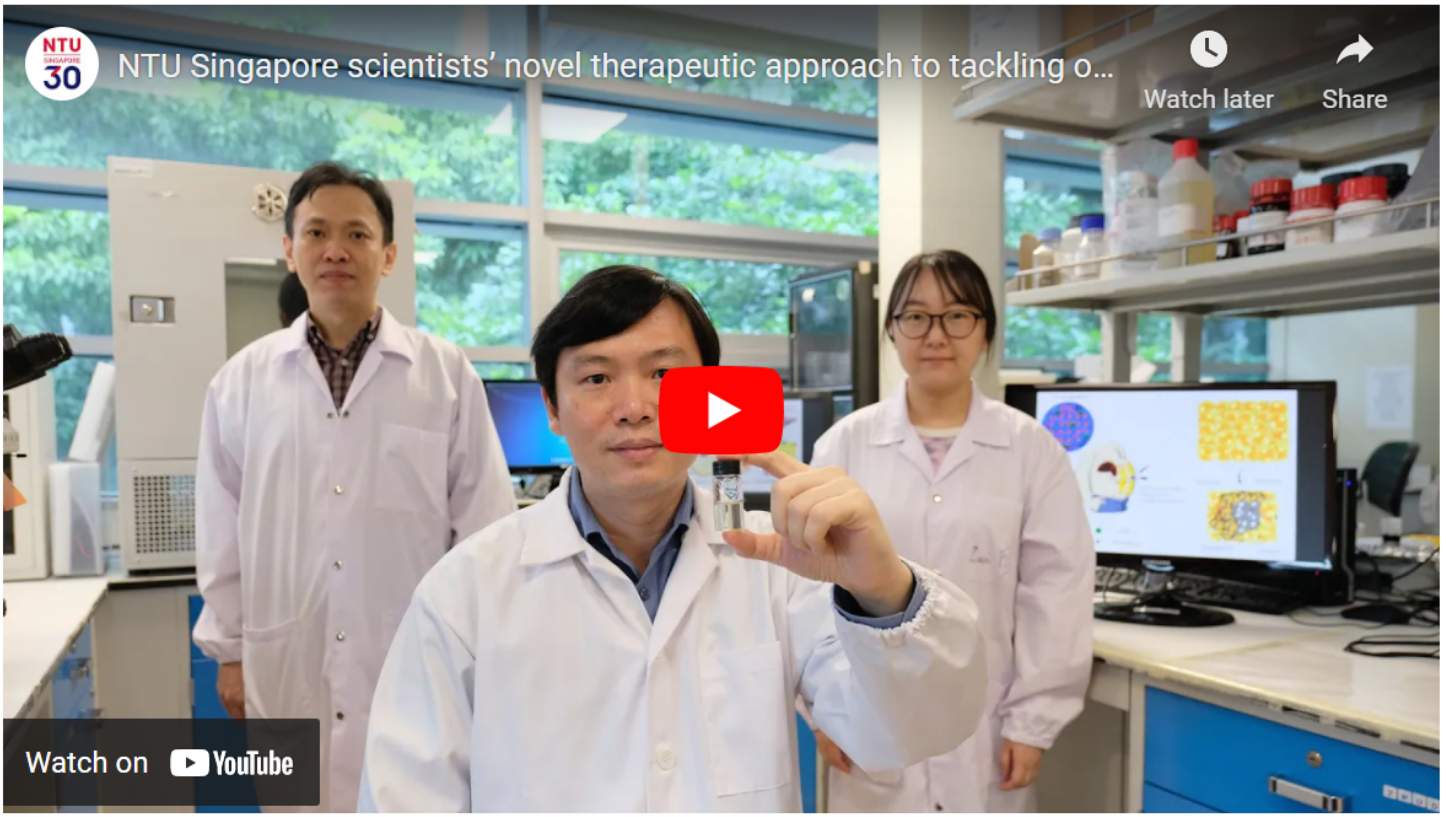
"Through lab experiments, we found that this approach not only resulted in 40 to 54 per cent fat reduction in obese mice, but also signi cantly improved their metabolism, which is key to reducing the risk of metabolic conditions such as heart disease, stroke and type 2 diabetes," said study author Chen Peng. "Though this method makes use of heat converted from near infrared light to burn subcutaneous fat, we found no thermal injury to the skin."

The scientists still have much to do to convert these promising results into therapies to tackle obesity and metabolic dysfunction in humans. However, the early signs indicate that it could come to ll a gap in existing treatments for these conditions that carry a risk of side effects or are prohibitively expensive.

"All FDA-approved medications for obesity indirectly act on the brain to suppress appetite or on the digestive system to reduce fat absorption," said Peng. "Most of them have been withdrawn from the market due to their serious side effects. Procedures performed in clinics to remove fat in targeted areas have shown to be effective, but they come with risks and high cost, and do not improve body metabolism. In contrast, our therapeutic approach focuses on remodeling white fat tissue, which is the root of the evil."

As for what the treatment could look like, the scientists imagine that obese patients could self-administer the hydrogel at home, and shine a handheld laser onto the site to activate the copper sulphide particles and, in turn, the TRPV1 protein. The team has filed a patent for the technology, and is now searching for partners to conduct clinical trials on human patients.

The study was published in the journal *ACS Nano*, while the video below provides an overview of the research.



NTU Singapore scientists' novel therapeutic approach to tackling obesity

Source: Nanyang Technological University