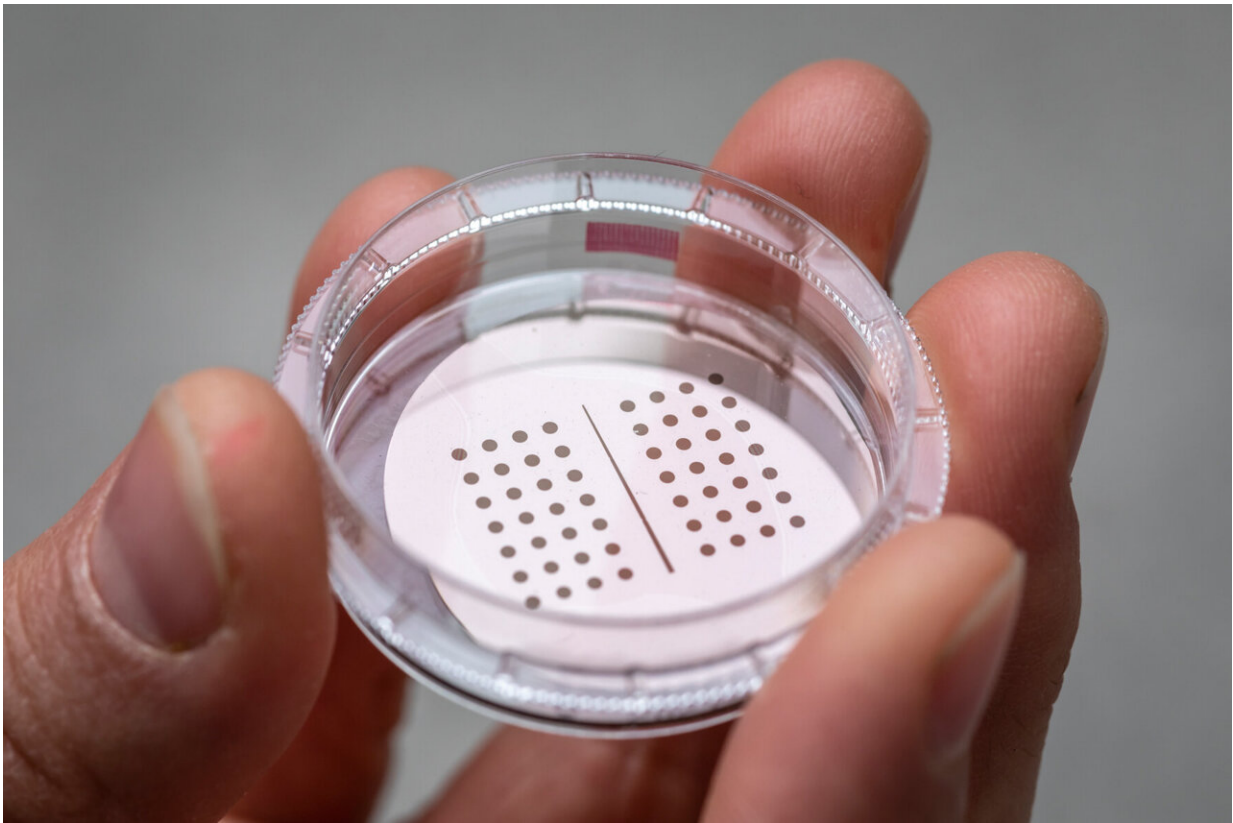


Nerve stimulation with the help of implantable mini solar cells

April 7 2022



A completely new type of implant: a wafer-thin and light-sensitive pigment film, for example to stimulate nerve cells. Credit: Lunghammer - TU Graz

An international research team has successfully developed and tested a concept in which nerves are stimulated with light pulses. The method

provides considerable advantages for medicine and opens up a wide range of possible applications.

The technology enables completely new types of implants that can be used to stimulate nerve cells and was developed in a joint effort by researchers from Graz University of Technology (TU Graz), the Medical University of Graz (Med Uni Graz), the University of Zagreb and the Czech CEITEC. The basis of this technology involves color pigments from the food industry, such as those used in organic solar cells. The pigments are vapor-deposited to form a layer only a few nanometers thick, where they convert light into [electrical charge](#)—just as in [organic solar cells](#). Nerve cells that adhere to the film (note: they are first pipetted onto the film and grow there) react to this charge and in turn fire [electrical impulses](#) with which they stimulate other nerve cells.

The researchers have now been able to demonstrate this process for the first time in cell biological experiments. Cultivated nerve cells that were grown directly on the film were stimulated by several light flashes each lasting a few milliseconds at a wavelength of 660 nanometers (red light) and reacted as hoped. They generated so-called [action potentials](#), which are essential for communication between nerve cells. The researchers have published the results of their electrophysiological measurements and [computer simulations](#) in the scientific journal *Advanced Materials Technologies*.

Paradigm shift from metal electrodes to flexible films

Corresponding author Theresa Rienmüller from the Institute of Health Care Engineering at TU Graz speaks of a paradigm shift: "In contrast to the current usual electrostimulation via metal electrodes, our pigment films represent a completely new way of stimulating nerve cells." The films are so thin that they can be implanted easily. During the treatment, the nerve cells are then irradiated with red light, which can penetrate

deep into the body without causing damage. "We think that short-term treatments can lead to long-term therapeutic effects. These experiments are currently being researched," says Rainer Schindl, electrophysiologist at the Division of Biophysics at Med Uni Graz and supervisor in the project.

In the future, there would therefore no longer be a need for complex wiring, which in turn reduces the risk of infection after invasive procedures, because no more tubes or cables would have to lead out of the body to the outside. Thanks to their organic nature, the pigment films are extremely well tolerated by both human and animal cells.

Multifaceted areas of application

The researchers see possible applications in severe brain injuries. Here, the stimulation of nerve cells can accelerate the [healing process](#) and prevent complications by "preventing the [nerve cells](#) from dying off," says first author Tony Schmidt from the Division of Biophysics at Med Uni Graz. The researchers also see potential in other neurological injuries or in pain therapy. In addition, the technology could be used to create new types of retinal implants. More research is needed before the pigment film finds its way into [clinical use](#).

More information: Tony Schmidt et al, Light Stimulation of Neurons on Organic Photocapacitors Induces Action Potentials with Millisecond Precision, *Advanced Materials Technologies* (2022). [DOI: 10.1002/admt.202101159](#)

Provided by Graz University of Technology

Citation: Nerve stimulation with the help of implantable mini solar cells (2022, April 7) retrieved

4 July 2023 from

<https://medicalxpress.com/news/2022-04-nerve-implantable-mini-solar-cells.html>

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