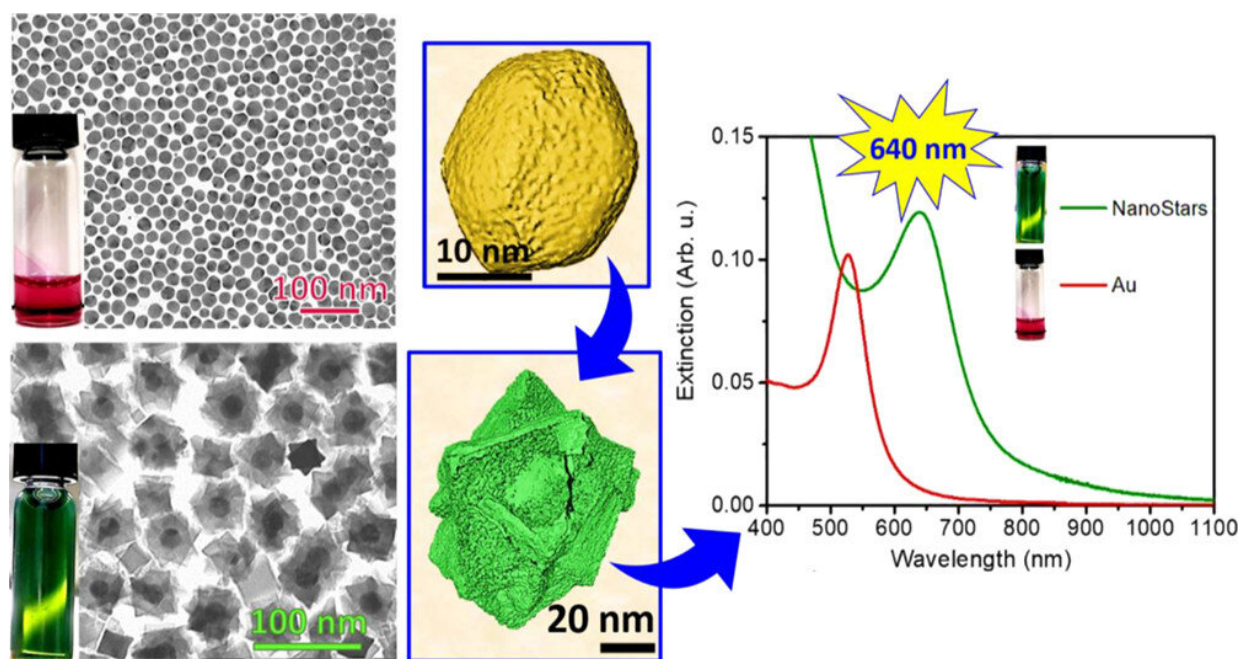


# Star-shaped nanoparticles may help to fight cancer

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Graphical abstract. Credit: *ACS Applied Materials & Interfaces* (2022). DOI: 10.1021/acscami.2c04865

Together with colleagues, a group of scientists from Immanuel Kant Baltic Federal University synthesized nanostructures of gold and iron oxides that have improved magnetic and optical properties because of their unique star shape. The particles obtained are safe for healthy human cells and can be used in tumor therapy. The results of the study are published in the journal *ACS Applied Materials & Interfaces*.

Nanoheterostructures are nanoscale objects containing several functional compounds with different physical and [chemical properties](#), for instance, of metal and metal oxide. The mutual location of the components of such a structure determines its magnetic and optical properties. Magnetic properties help to control the nanostructures' activity in the body by using an [external magnetic field](#). Applying a low-frequency [magnetic field](#) in this process can induce the destruction of cancerous cells.

The optical properties help to visualize, that is, to track particles in the human body. It can be used for photothermal therapy, during which the cells are heated and destroyed by the light of a certain wavelength. These features can be used together to provide more effective destruction of cancer cells.

Together with international colleagues, scientists from the Scientific and Educational Center "Smart Materials and Biomedical Applications" (based on Immanuel Kant Baltic Federal University, Kaliningrad), synthesized nanostructures containing gold and [iron oxides](#), which can be used in photothermal and magneto-mechanical [cancer therapy](#).

Researchers studied the structure of the resulting particles. The latter were star-shaped and had a core of gold, surrounded by an iron oxide sheath. The scientists proved that the shape and optical response of the particles were excellent for combined cancer therapy.

Moreover, the scientists tested how the particles affect breast cancer cells and cell culture, blood vessel walls are normally formed. The cells were pre-incubated in a culture medium with predetermined concentrations of nanoparticles.

It turned out that the nanoparticles had good biocompatibility—they had low toxicity and did not affect the viability of healthy cells. At the same time, the viability of cancer cells with nanostructures was reduced by

65% after the influence of a variable magnetic field of low frequency. When exposed to light, the viability of cancer cells was reduced by 45% due to the local heating of the nanoparticles. The effectiveness of the approach was also confirmed by morphological changes in cancer cells, including their "shrinkage" after alternating magnetic field or light therapy.

"The purpose of this study was to develop and test multifunctional nanoparticles with special magnetic and optical properties. In biomedicine, such nanoparticles are a promising material for cancer treatment. That's why in this article we showed not only the detailed characterization of the physicochemical properties of the obtained samples. We also added the results of cytotoxicity upon application of various external stimuli (optical radiation and magnetic field), and showed the effectiveness of both approaches," says Alexander Omelyanchik, a researcher at the Scientific and Educational Center "Smart Materials and Biomedical Applications" (based on Immanuel Kant Baltic Federal University, Kaliningrad).

**More information:** Beatrice Muzzi et al, Star-Shaped Magnetic-Plasmonic Au@Fe<sub>3</sub>O<sub>4</sub> Nano-Heterostructures for Photothermal Therapy, *ACS Applied Materials & Interfaces* (2022). [DOI: 10.1021/acsami.2c04865](https://doi.org/10.1021/acsami.2c04865)

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