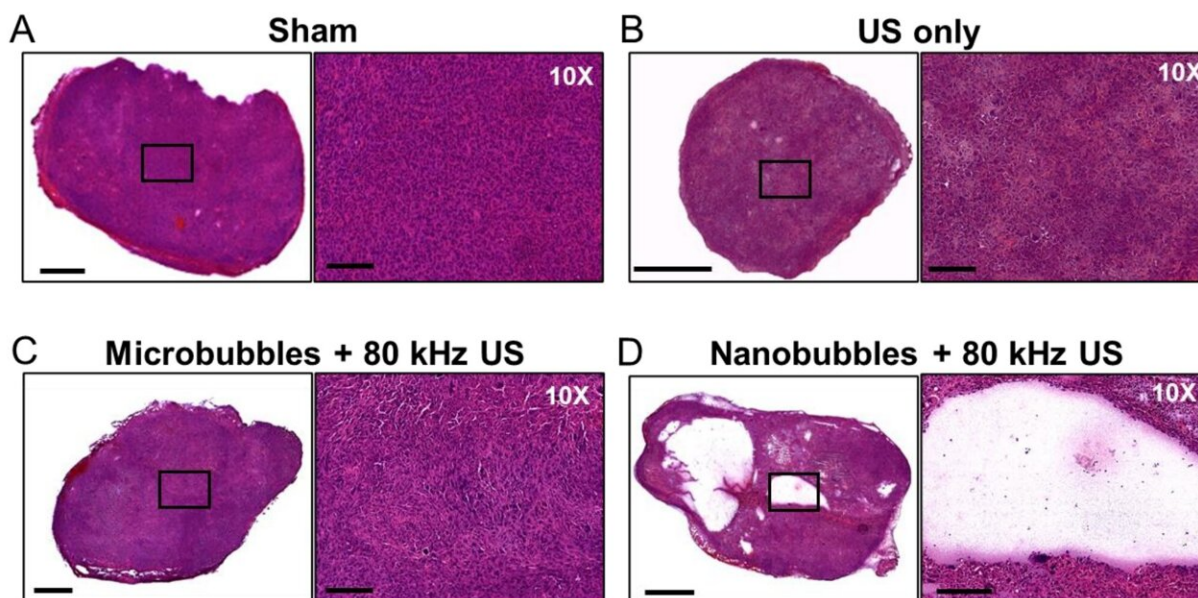


A combination of ultrasound and nanobubbles allows cancerous tumors to be destroyed without invasive treatments

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Histological photomicrographs of control and treated groups. (A) Sham tumor, (B) Tumor treated with low frequency ultrasound (US) only, (C) Tumor treated with low frequency US 10 min after systemic injection of microbubbles and (D) Tumor treated with low frequency US 10 min after systemic injection of nanobubbles. Scale bars are 1 mm for tumor cross- sections and 200 μm for 10x magnified images. Credit: *Nanoscale* (2022). DOI: 10.1039/D2NR01367C

A new technology developed at Tel Aviv University makes it possible to

destroy cancerous tumors in a targeted manner, via a combination of ultrasound and the injection of nanobubbles into the bloodstream. According to the research team, unlike invasive treatment methods or the injection of microbubbles into the tumor itself, this latest technology enables the destruction of the tumor in a non-invasive manner.

The study was conducted under the leadership of doctoral student Mike Bismuth from the lab of Dr. Tali Ilovitsh at Tel Aviv University's Department of Biomedical Engineering, in collaboration with Dr. Dov HersHKovitz of the Department of Pathology. Prof. Agata Exner from Case Western Reserve University in Cleveland also participated in the study. The study was published in the journal *Nanoscale*.

Dr. Tali Ilovitsh says that their "new technology makes it possible, in a relatively simple way, to inject nanobubbles into the bloodstream, which then congregate in the area of the cancerous [tumor](#). After that, using a low-frequency ultrasound, we explode the nanobubbles, and thereby the tumor."

The researchers explain that the prevalent method of cancer treatment today is surgical removal of the tumor in combination with complementary treatments such as chemotherapy and immunotherapy. Therapeutic ultrasound to destroy the [cancerous tumor](#) is a non-invasive alternative to surgery.

This method has both advantages and disadvantages. On the one hand, it allows for localized and focused treatment; the use of high-intensity ultrasound can produce thermal or mechanical effects by delivering powerful acoustic energy to a focal point with high spatial-temporal precision. This method has been used to effectively treat solid tumors deep within in the body. Moreover, it makes it possible to treat patients who are unfit for tumor resection surgery. The disadvantage, however, is that the heat and high intensity of the ultrasound waves may damage the

tissues near the tumor.

In the current study, Dr. Ilovitsh and her team sought to overcome this problem. In the experiment, which used an [animal model](#), the researchers were able to destroy the tumor by injecting nanobubbles into the bloodstream (as opposed to what has been until now, which is the local injection of microbubbles into the tumor itself), in combination with low-frequency ultrasound waves, with minimal off-target effects.

Dr. Ilovitsh says that "The combination of nanobubbles and low frequency ultrasound waves provides a more specific targeting of the area of the tumor, and reduces off-target toxicity. Applying the low frequency to the nanobubbles causes their extreme swelling and explosion, even at low pressures. This makes it possible to perform the mechanical destruction of the tumors at low-pressure thresholds. Our method has the advantages of ultrasound, in that it is safe, cost-effective, and clinically available, and in addition, the use of nanobubbles facilitates the targeting of tumors because they can be observed with the help of ultrasound imaging."

Dr. Ilovitsh adds that the use of low-frequency [ultrasound](#) also increases the depth of penetration, minimizes distortion and attenuation, and enlarges the focal point. "This can help in the treatment of tumors that are located deep with the body, and in addition facilitate the treatment of larger tumor volumes. The experiment was conducted in a breast cancer tumor mouse model, but it is likely that the treatment will also be effective with other types of tumors, and in the future, also in humans."

Keren Primor Cohen, CEO of Ramot, adds that "Ramot—Tel Aviv University Tech Transfer Company, applied for several patents to protect this technology and its application. We believe in the commercial potential of this breakthrough technology in cancer treatment, and we are in contact with several leading companies in Israel and abroad to

promote it."

More information: Mike Bismuth et al, Low frequency nanobubble-enhanced ultrasound mechanotherapy for noninvasive cancer surgery, *Nanoscale* (2022). [DOI: 10.1039/D2NR01367C](https://doi.org/10.1039/D2NR01367C)

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