

## World's Tiniest, Injectable Chip Uses Ultrasound to Monitor Body Processes



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**Once a thing of science fiction, implantable medical devices are transforming healthcare and improving the quality of life for millions of people.**

Columbia Engineers have taken the science further — developing what they say is the world's smallest single-chip system with a complete functioning electronic circuit. The system, at less than 0.1 cubic millimeters, is the size of a dust mite and is visible only under a microscope. These devices can be implanted via a hypodermic needle and are used in both diagnostic and therapeutic procedures, to monitor physiological conditions, such as temperature, blood pressure, glucose, and respiration.

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The research team used ultrasound to wirelessly power and communicate with the device. Typically, radio frequency (RF) modules are used for transmitting and receiving electromagnetic signals, but are too large to be used with such a small device. Ultrasonic wavelengths are much smaller at a given frequency. “*Ultrasound is continuing to grow in clinical importance as new tools and techniques become available. This work continues this trend,*” said Elisa Konofagou, a member of the Columbia research team.

First author of the [paper](#) detailing the study, Chen Shi, was also responsible for the novel design, which is unique in its volumetric efficiency, or the amount of function that is contained in a given amount of volume.

The device was trialled on live mice, wherein they implanted up to seven mice at once with intramuscular injection via syringe.

The next step for the team is to develop chips that can be injected into the human body with a hypodermic needle and then communicate back out of the body using ultrasound, providing information measured locally, such as body temperature.

Source: [Columbia University](#)

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