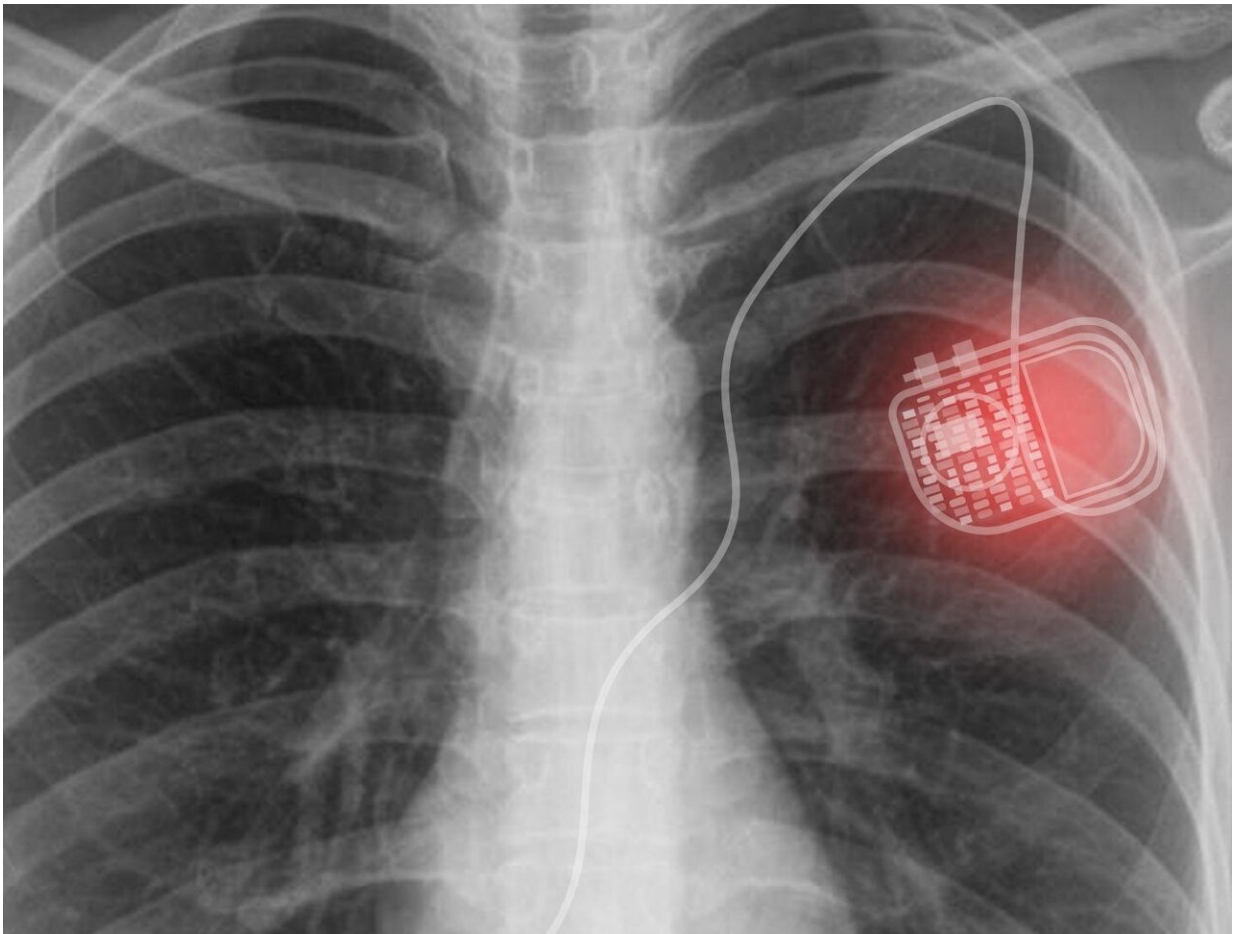


A novel active photonic wireless system to power medical implants

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The use of medical implants in human bodies generates the need for invasive surgery to replace exhausted batteries, leading to a higher risk of surgical complications in patients Credit: Gwangju Institute of Science and Technology

Over the past few decades, medical technology has seen various advances in terms of the scope and efficiency of implantable devices. For example, developments in medical research have led to the emergence of electronic implants, such as pacemakers, to regulate the heart rate; and cerebral spinal shunts to control the flow of spinal fluid. Most of these medical devices, including the pacemaker, require a constant source of energy to operate. Naturally, this causes some limitations: batteries, which provide an energy source for the implants, have a finite lifespan. Once the battery power gets exhausted, there is no other option but to perform invasive surgery to replace the battery, which poses a risk of surgical complications, such as bruising, infections, and other adverse events.

In a new study published in *PNAS*, a research group from South Korea, led by Professor Jongho Lee at GIST, dug deeper to find a solution: they attempted to develop a strategy to recharge the internal battery of devices without invasive surgery or risky penetrative procedures. Prof Lee explains, "One of the greatest demands in biomedical electronic implants is to provide sustainable [electrical power](#) for extended healthy life without battery replacement surgeries." Although this is a tricky concept, Prof Lee believes that the answer lies in the 'translucency' of living tissue.

This can be explained by an interesting phenomenon. When you hold your hand up to a powerful light, you can see that the edges of your hand glow as the light passes through your skin. Taking inspiration from this, Prof Lee and his team developed an 'active photonic power transfer' method, which can generate electrical power in the body. This novel system consisted of two parts: a skin-attachable micro-LED source patch—which can generate photons that would penetrate through the tissues—and a photovoltaic device integrated into a medical implant—which can capture the photons and generate electrical energy. This system provides a sustainable way of supplying the medical implant

device with enough power to avoid any high-risk replacement methods. Prof Lee says, "Currently, a lack of a reliable source of power limits the functionality and performance of implant devices. If we can secure enough electrical power in our body, new types of medical implants with diverse functions and high performance can be developed."

When the scientists tested this power system in mice, they found that this wireless power transfer system is easy to use, regardless of weather, clothes, indoor or outdoor conditions, etc. The light photons emitted from the source patch successfully penetrated live tissues in mice and recharged the device in a wireless and convenient manner. "These results enable the long-term use of currently available implants, in addition to accelerating emerging types of electrical implants that require higher power to provide diverse, convenient diagnostic and therapeutic functions in [human bodies](#)," says Prof Lee, pleased with the efforts of his team and already looking forward to furthering their experiments. He concludes, "Our device would probably not work for 'Iron Man,' but it can provide enough power for medical implants."

More information: Juho Kim et al, Active photonic wireless power transfer into live tissues, *Proceedings of the National Academy of Sciences* (2020). [DOI: 10.1073/pnas.2002201117](https://doi.org/10.1073/pnas.2002201117)

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