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Hong Kong develops externally readable, battery-free, bioresorbable implant

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Allows researchers to optically observe its condition from outside the body



Implantable bioelectronics enable healthcare professionals to continuously monitor patients' physiological conditions, deliver targeted treatments and support recovery. However, once implanted, these devices are difficult to inspect directly, and damage or degradation may go undetected until complications occur. Limited battery lifetimes and leakage risks also raise safety concerns.

To address this "black box" problem, a research team led by Prof. Raymond Wai-Yeung WONG, Dean of the Faculty of Science, Clarea Au Professor in Energy and Chair Professor of Chemical Technology at The Hong Kong Polytechnic University (PolyU), in collaboration with researchers at Yonsei University in South Korea, has developed an externally readable, battery-free, bioresorbable implant.

The device harvests energy through ultrasound-driven triboelectric energy-harvesting (TEH) and allows researchers to optically observe its condition from outside the body, enhancing clinical monitoring and patient management.

This innovation advances a new generation of bioelectronics. Potential applications include temporary biosensors for post-surgical monitoring, on-demand drug-delivery systems and neurostimulators for pain management or tissue regeneration.

The key innovation is the embedding of nanoscale iridium(III) phosphors, which are light-emitting complexes, into a biodegradable polymer matrix, giving the implant the dual functions of revealing its outline and enhancing power generation.

First, when healthcare professionals illuminate the implant site with a handheld UV lamp, the phosphors glow, outlining the device beneath the skin so clinicians can locate it and assess its shape and integrity. A clear and complete outline indicates the device is intact, while a fragmented outline may signal damage or degradation.

Second, the phosphors enhance ultrasound-driven triboelectric output, enabling the device to generate electricity without an internal battery, thereby avoiding the need for surgical battery removal due to limited battery lifetimes or leakage.