Development of nanoengineered bacteria for cancer optotheranostics

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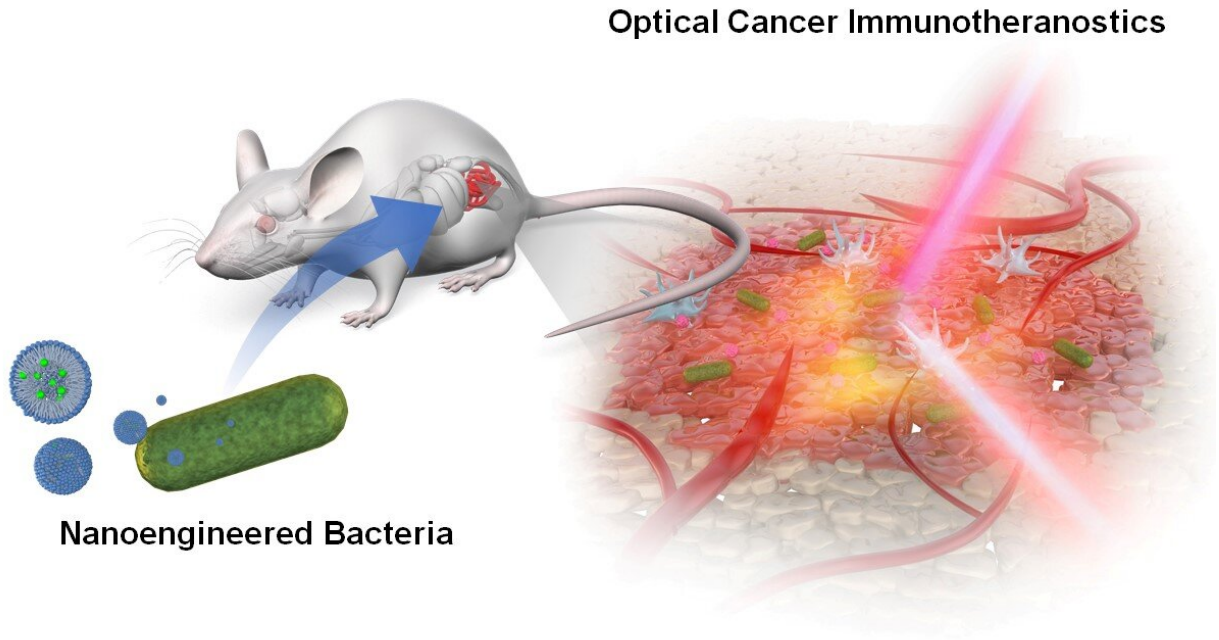

Schematic illustration of nanoengineered bacteria-based optical cancer immunotheranostics. Credit: Eijiro Miyako from JAIST

There is substantial interest in understanding and designing of nanoengineered bacteria to combat various fatal cancerous diseases. However, conventional nanotechnological approaches adopt genetic manipulation for attenuating and improving the efficacy of bacteria. In addition, complicated chemical reactions were essential in the previous

approaches.

Scientists at Japan Advanced Institute of Science and Technology (JAIST) have created a convenient method for development of nanoengineered bacteria for photothermal cancer immunotheranostics.

Discovered by Associate Professor Eijiro Miyako and his student Ms. Sheethal Reghu from JAIST, the synthesized ICG encapsulating Cremophor EL (CRE) nanoparticles could be applied to non-pathogenic natural Bifidobacterium bacteria for its effective nanoconjugation for cancer optotheranostics using a biologically penetrable near-infrared (NIR) laser. Notably, nanoengineered bacteria can be easily prepared in only two steps, namely incubation and washing processes.

The optically activated functional nanoengineered bacteria exhibited unique optical absorbance and fluorescent properties, powerful photothermal conversion, high biocompatibility, excellent tumor selectivity, and strong anticancer efficacy. The NIR fluorescence from light-induced functional nanoengineered bacteria facilitated clear fluorescent tumor visualization, in association with bacterial tumor-targeting effect. Moreover, the powerful photothermal conversion of the functional bacteria could be spatiotemporally evoked by biologically penetrable NIR laser for effective tumor regression in mice, with the help of immunological responses. The present study demonstrates that an optical nanoengineering approach can provide the strong physicochemical traits and attenuation of living bacterial cells for cancer immunotheranostics.

The current experiments warrant further consideration of this novel theranostic approach for the treatment of refractory cancers. The team believes that the developed technology would advance cancer treatment for creating more effective medicine.

"Nanoengineered Bifidobacterium bifidum with Optical Activity for Photothermal Cancer Immunotheranostics" is published in *Nano Letters*.

More information: Sheethal Reghu et al, Nanoengineered Bifidobacterium bifidum with Optical Activity for Photothermal Cancer Immunotheranostics, *Nano Letters* (2022). DOI: 10.1021/acs.nanolett.1c04037

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