Nanoparticle system that can release fluorescent dyes in pancreatic cancer tumor cell samples

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Theranostics have the potential to both diagnose cancers and treat them, all in one package. But it's challenging to tell when—or even if—the package has reached and penetrated a tumor. Now, researchers reporting in *JACS Au* have designed a nanoparticle system that can get through

tough pancreatic cancer tumors, releasing fluorescent dyes in human cell samples and 3D lab-made tumor masses for diagnostics and therapy.

The most common type of pancreatic cancer, called pancreatic ductal carcinoma, is also one of the most difficult cancers to diagnose and treat. Studies have shown that 5-year survival rates of people with the disease are very low. The tumors are often dense, and it is challenging for imaging dyes and medicines to reach cells deep within the mass. Researchers have been developing theranostics that specifically enter tumor cells, but few systems allow scientists to track this uptake or to see how deeply the compounds penetrate. So, Hui Li, Zhiqian Guo and colleagues wanted to solve this problem by designing a new delivery system that includes dyes that only fluoresce under certain conditions.

The team prepared a nanoparticle that remained intact until it encountered the acidic environment of pancreatic tumor tissue. The particle carried two dyes that would only fluoresce once the nanoparticle broke apart. After an initial characterization of the nanoparticle-dye system, the researchers added it to a 3D spheroid of pancreatic cancer cells. They found that the dyes reached the interior of the cellular structure when delivered via the nanoparticle. The team also created high-resolution images of dense tumor structures in human pancreatic tumor tissues using the new system. Detailed images like these could help surgeons fully remove tumor tissues from cancer patients. This nanoparticle delivery system could eventually be used to deliver targeted chemotherapies within tough-to-penetrate pancreatic cancer tumors, the researchers say.

More information: Yining Tao et al, Sequence-Activated Fluorescent Nanotheranostics for Real-Time Profiling Pancreatic Cancer, *JACS Au* (2022). DOI: 10.1021/jacsau.1c00553