

Docket #: S19-246

A NOVEL SURFACE ENHANCED RAMAN SCATTERING GOLD NANOPARTICLE FOR IMAGING TUMOR OXIDATIVE STRESS

Background:

Reactive oxygen species (ROS) are a well-validated contributor to the development of various diseases, including cancer. However, the ability to detect the state of cellular stress from ROS is limited, impairing both diagnosis and treatment monitoring of conditions associated with oxidative stress. One solution, detection via Raman spectral fingerprints, is hampered by low signal intensity.

Technology:

Researchers at Stanford have developed ROS-sensing nanoparticles that can amplify Raman fingerprint signals and detect changes in ROS. Using Raman spectrometry augmented with nanoparticles that leverage Surface Enhanced Raman Scattering (SERS), the researchers demonstrate detection of ROS at femtomolar levels in cell models and a mouse xenograft model. Using a mesoporous SiO₂ shell to contain the SERS-utilizing gold particles, nanoparticles are targeted to cancer cells via an integrin-targeting cystine knot peptide.

Results

In vitro

SERS nanoparticles detected oxidative stress in variety of cancer cell lines, as measured by quantification of Raman signal levels. Stress was not detected in non-cancer cell lines, and were consistent with alternative assays for ROS like DCFH-DA.

In vivo

The inventors demonstrate in a mouse model that SERS nanoparticles administered via IV localize to tumors with high ROS levels and are detectable in whole animal imaging, with no signal detected in healthy tissue.

Applications

- ROS detection in cancer
- Cancer diagnostics across multiple imaging platforms
- Treatment and tumor monitoring/theranostics

Advantages

- Higher sensitivity than fluorescent ROS markers
- No photobleaching, unlike fluorescent markers
- Versatile across diagnostic types (PET, CT, optoacoustic imaging)
- Broad use across cancer types

Patents

- Published Application: [WO2020252042](#)

Innovators

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