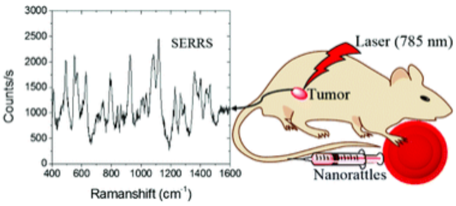
TARGET: Tunable and Amplified Raman Gold Nanoprobes for Effective Tracking

Unmet Need

Surface-enhanced Raman scattering (SERS) has led to the development of important biomedical analysis and sensing tools ranging from *in vitro* diagnostics to *in vivo* imaging through SERS nanoprobes. However, these nanoprobes have limited real-life applications because they are unstable due to detachment or leakage of the reporter molecules in the physiological conditions often encountered in *in vitro* and *in vivo* measurements. In addition, the available nanoprobes do not allow for tunability of the type and amount of reporter molecules loaded on the nanoprobes in order to achieve the properties required for the particular application of interest. It is therefore a great challenge to develop SERS nanoprobes that are highly stable under harsh physiological conditions and therefore usable for many real-life applications.

Technology

Duke inventors have developed a unique and robust probe intended for *in vitro* and *in vivo* surface enhanced Raman scattering (SERS) applications. The technology is named TARGET (Tunable and Amplified Raman Gold Nanoprobes for Effective Tracking). It consists of a gold core inside a larger gold shell with a tunable interstitial gap similar to a “nanorattle” structure. The combination of galvanic replacement and the seed mediated growth method was employed to load Raman reporter molecules and subsequently close the pores to prevent leaking and degradation of reporters under physiologically extreme conditions. Precise tuning of the core–shell gap width, core size, and shell thickness allows us to modulate the amount of loaded reporters, allowing for tunability of the plasmonic effect in order to achieve a maximum electric-field (E-field) intensity. The



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Publication(s)

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External Link(s)

• From the lab of Dr. Tuan Vo-Dinh

interstitial gap of TARGET nanoprobes can be designed to exhibit a plasmon absorption band at 785 nm, which is in resonance with the dye absorption maximum and lies in the “tissue optical window”, resulting in ultra-bright SERS signals for *in vivo* studies. The results of *in vivo* measurements of TARGETs in laboratory mice illustrated the usefulness of these nanoprobes for medical sensing and imaging.

Advantages

- Highly tunable
- Physiologically stable
- Ultra-bright
- Biocompatible for *in-vivo* applications
- Emission in the “optical window” where tissue absorbs least for maximum sensitivity