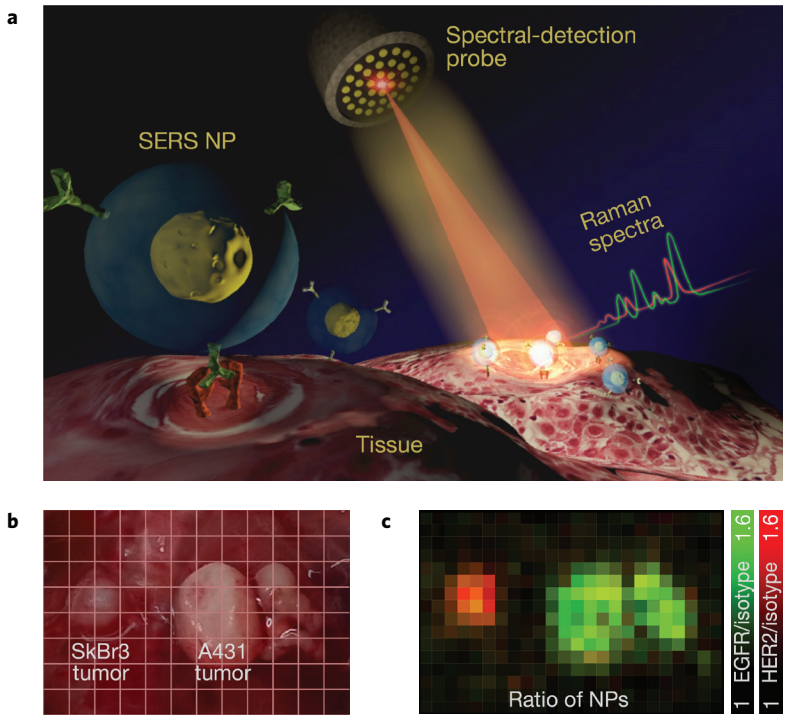
World Scientific

ICP Imperial College Press

PRESS RELEASE

Nanoparticle "barcodes" can be painted onto tissues to enable the rapid diagnostic imaging of multiple cancer-related biomarkers

April 17, 2014 — Surface-enhanced Raman scattering (SERS) nanoparticles can be used to target a panel of protein biomarkers for the accurate diagnosis of cancer when detected with a miniature fiber-optic probe.



Panel A is an artist's depiction of the multiplexed detection of biomarker-targeted SERS nanoparticles (NPs) on tissue surfaces with a custom spectral-detection device. Panel B is a photograph of surgically exposed tumors and surrounding normal tissues (SkBr3: breast adenocarcinoma cell line, A431: epidermoid carcinoma cell line). Panel C shows the ratio of EGFR-targeted vs. nontargeted NPs (green) and HER2-targeted vs. nontargeted NPs (red) after a mixture of these three different NP types are "painted" onto the tissues. The simultaneous ratiometric quantification of targeted NPs allows for an unambiguous assessment of molecular expression.

A team of researchers at Stony Brook University (State University of New York) and the University of Toronto have demonstrated that nanoparticle barcodes can be used to rapidly stain fresh tissues and reveal the relative expression level of

multiple cancer-related biomarkers. The authors have reported their findings in the journal TECHNOLOGY, demonstrating that surface-enhanced Raman scattering (SERS) nanoparticles are ideal for detecting multiple biomarker targets because of their ability to bind to their targets with high affinity when painted onto tissues for only 5 minutes. This rapid ability to identify various tumor types may potentially be used for clinical applications such as the early detection of cancers or guiding the surgical removal of tumors.

"We have developed high-affinity targeted SERS nanoparticles, a portable spectral-detection device, as well as a ratiometric method to accurately identify and image biomarker expression in tissues in a way that mitigates ambiguities due to nonspecific binding and the passive accumulation of the nanoparticles in tissues," says Dr. Jonathan Liu, Ph.D., a faculty member at Stony Brook University and senior author of this report. "These nanoparticle barcodes are ideal for the multiplexed detection of various biomarkers because they can all be illuminated at a single wavelength and detected simultaneously. This allows us to quantify the specific vs. nonspecific binding ratio of the nanoparticles extremely accurately compared with other types of contrast agents that we use such as fluorescent dyes. As a result, we can clearly identify regions of elevated biomarker expression in spite of nonspecific effects that often create a lot of ambiguity in the field of molecular imaging."

The team at Stony Brook is now trying to apply their techniques for the detection of esophageal cancers by developing a miniature spectral-imaging endoscope for use in small animal models of esophageal disease. In addition, they are pursuing clinical applications such as surgical guidance. "We believe that we can rapidly image excised tissues in the operating room and tell surgeons when to stop cutting based on whether the edges of the surgical specimens contain residual tumor," says Dr. Yu "Winston" Wang, the first author of this paper.

Additional co-authors of the TECHNOLOGY paper are: Altaz Khan, Madhura Som, Danni Wang, Ye Chen, Steven Leigh, and Daphne Meza at Stony Brook University and Patrick McVeigh and Brian Wilson at the University of Toronto.

This research was supported in part by grants from the U.S. National Institutes of Health (NIBIB R21 EB015016), as well as the Department of Biomedical Engineering and the Office of the Vice President for Research at Stony Brook University (SUNY).

Corresponding author for this study in TECHNOLOGY is Jonathan Liu, jonathan.liu@stonybrook.edu.

About TECHNOLOGY

Fashioned as a high-impact, high-visibility, top-echelon publication, this new ground-breaking journal — TECHNOLOGY — will feature the development of cutting-edge new technologies in a broad array of emerging fields of science and engineering. The content will have an applied science and technological slant with a focus on both innovation and application to daily lives. It will cover diverse disciplines such as health and life science, energy and environment, advanced materials, technology-based manufacturing, information science and technology, and marine and transportations technologies.

About World Scientific Publishing Co.

World Scientific Publishing is a leading independent publisher of books and journals for the scholarly, research and professional communities. The company publishes about 500 books annually and more than 120 journals in various fields. World Scientific collaborates with prestigious organisations like the Nobel Foundation, US National Academies Press, as well as its subsidiary, the Imperial College Press, amongst others, to bring high quality academic and professional content to researchers and academics worldwide. To find out more about World Scientific, please visit www.worldscientific.com.