Chemists develop optical imaging tool to target cancer cells

October 17 2017, by Tiffany Carter

Dr. Ning Fang of the Chemistry Department at Georgia State University has developed a new optical imaging technique, Single Particle Orientation and Rotational Tracking (SPORT), to image rotational motions in live cells and ultimately target cancer cells.

Fang's invention is a differential interference contrast (DIC) microscopy-based imaging tool, which tracks plasmonic nanoparticles of various shapes and sizes. The SPORT is a modified commercial microscope with five-dimensional single- particle tracking capabilities.

"DIC microscopy has long been used as a complementary technique to image cells because it provides better visualization of cellular features than other far-field optical microscopy techniques," said Fang. "The recent efforts made in my laboratory have transformed DIC microscopy into a primary research tool for tracking plasmonic nanoparticles in biological samples."

The SPORT enables scientists to acquire fundamental knowledge about the detailed rotational dynamics of cellular processes, such as adhesion, endocytosis and transport of functionalized nanoparticles relevant to drug delivery and viral entry. Fang received the prestigious Innovation Award from the Federation of Analytical Chemistry and Spectroscopy Societies for this invention.

Gold nanoparticles can inhibit cancer cell migration and prevent metastasis, which is a leading cause of cancer-related deaths. Until now,

not much has been understood about why gold nanoparticles have this ability, Fang said.

The SPORT helps answer this question, providing insight into nanoparticle-protein and cell interactions specifically related to cell migration.

"Our efforts contribute important fundamental knowledge to answer the most critical, yet still elusive question for the past two decades," said Fang. "What are the underlying mechanism of the profound effects of nanoparticles on cytotoxicity, human health and environments?"

The next step for Fang and his research team is to develop computer stimulations to understand the effects of nanoparticle shapes, sizes and surface modifiers.

More information: Kuangcai Chen et al. Characteristic rotational behaviors of rod-shaped cargo revealed by automated five-dimensional single particle tracking, *Nature Communications* (2017). DOI: 10.1038/s41467-017-01001-9

Moustafa R. K. Ali et al. Targeting cancer cell integrins using gold nanorods in photothermal therapy inhibits migration through affecting cytoskeletal proteins, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1703151114

Provided by Georgia State University