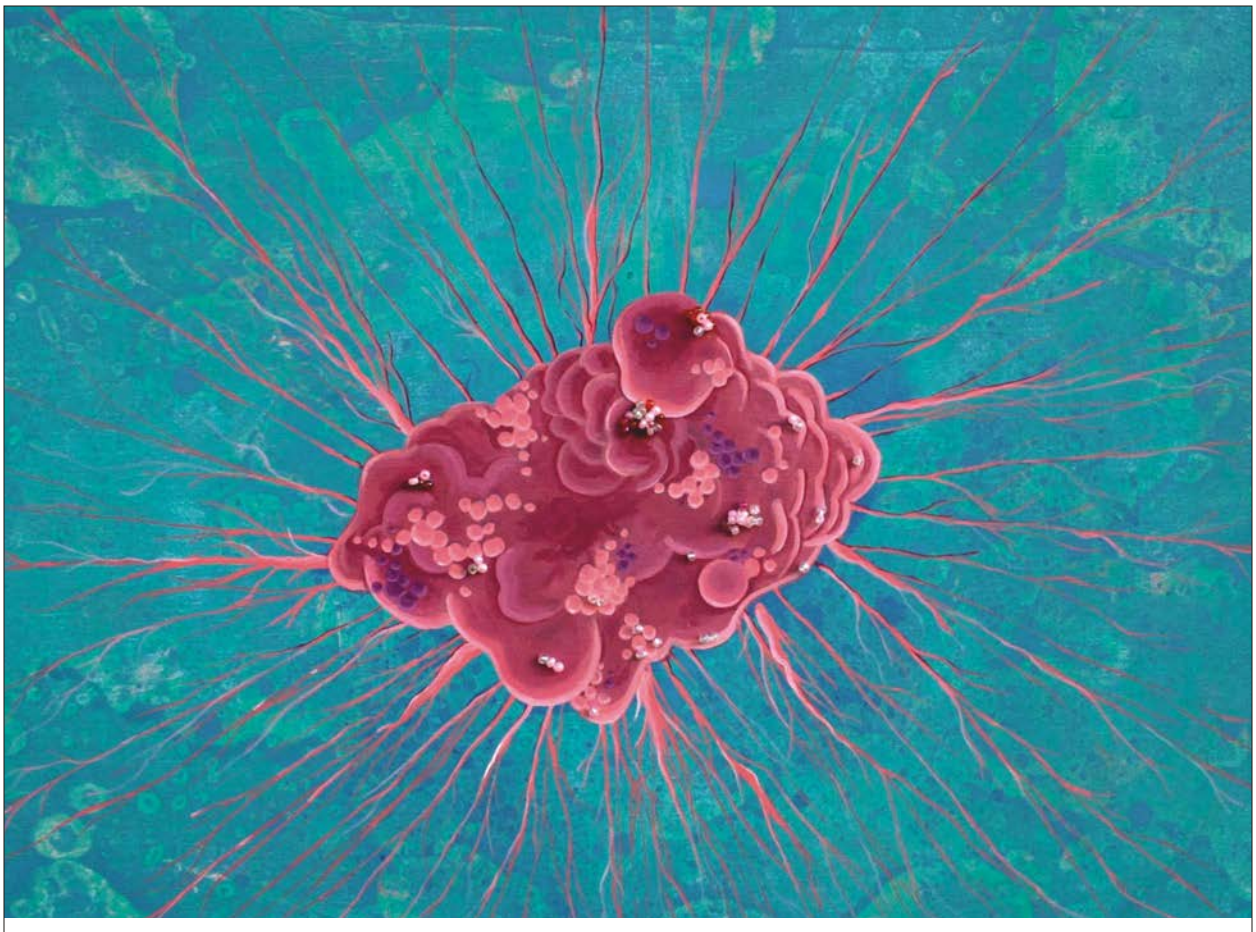

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Nanoparticles May Enhance Circulating Tumor Cell Detection

Tiny gold particles can help doctors detect tumor cells circulating in the blood of patients with head and neck cancer, researchers at Emory and Georgia Tech have found.

The detection of Circulating Tumor Cells (CTCs) is an emerging technique that can allow oncologists to monitor patients with cancer for metastasis or to evaluate the progress of their treatment. The gold particles, which are embedded with dyes allowing their detection by laser spectroscopy, could enhance this technique's specificity by reducing the number of false positives.

The results are published online in the journal Cancer Research.

One challenge with detecting CTCs is separating out signals from white blood cells, which are similarly sized as tumor cells and can stick to the same antibodies normally used to identify tumor cells. Commercially available devices trap CTCs using antibody-coated magnetic beads, and technicians must stain the trapped cells with several antibodies to avoid falsely identifying white blood cells as tumor cells.

Emory and Georgia Tech researchers show that polymer-coated and dye-studded gold particles, directly linked to a growth factor peptide rather than an antibody, can detect circulating tumor cells in the blood of patients with head and neck cancer.

"The key technological advance here is our finding that polymer-coated gold nanoparticles that are conjugated with low molecular weight peptides such as EGF are much less sticky than particles conjugated to whole antibodies," says Shuming Nie, PhD, a professor in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University. "This effect has led to a major improvement in discriminating tumor cells from non-tumor cells in the blood."

The particles are linked to EGF (epithelial growth factor), whose counterpart EGFR (epithelial growth factor receptor) is over-produced on the surfaces of several types of tumor cells.

Upon laser illumination, the particles display a sharp fingerprint-like pattern that is specific to the dye, because the gold enhances the signal coming from the dyes. This suggests that several types of nanoparticles could be combined to gain more information about the growth characteristics of the tumor cells. In addition, measuring CTC levels may be sensitive enough to distinguish patients with localized disease from those with metastatic disease.

"Nanoparticles could be instrumental in modifying the process so that circulating tumor cells can be detected without separating the tumor cells from normal blood cells," Nie says. "We've demonstrated that one tumor cell out of approximately one to ten million normal cells can be detected this way."

In collaboration with oncologists at Winship Cancer Institute, researchers used nanoparticles to test for CTCs in blood samples from 19 patients with head and neck cancer. Of these patients, 17 had positive signals for CTCs in their blood. The two with low signals were verified to have no circulating cells by a different technique.

"Although the results have not been compared or validated with current CTC detection methods, our 'one-tube' SERS technology could be faster and lower in costs than other detection methods," says Dong Moon Shin, MD, Professor of Hematology and Oncology and Otolaryngology, Associate Director of Academic Development for Winship Cancer Institute and Director of the Winship Cancer Institute Chemoprevention Program. "We need to validate this pilot study by continuing with larger groups of patients and comparing with other tests."

Source: X. Wang, X. Qian, J. J. Beitler, G. Chen, F. R. Khuri, M. M. Lewis, H. J. C. Shin, S. Nie, D. M. Shin. Detection of Circulating Tumor Cells in Human Peripheral Blood using Surface-Enhanced Raman Scattering Nanoparticles. Cancer Research, 2011; DOI: 10.1158/0008-5472.CAN-10-3069