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Nanotechnology brings personalized therapy one step closer to reality

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A novel technology can make nanoscale protein measurements, which scientists can use in clinical trials to learn how drugs work.

"We are making progress toward the goal of understanding how drugs work in different individuals," said Alice C. Fan, M.D., instructor in the division of oncology at Stanford University School of Medicine. "Using new technologies makes it possible to measure effects of therapeutic agents in tumor cells and different cell populations within our patients. Now that we can make these measurements, we are one step closer to being able to tailor therapy for each patient."

This research was presented at the Fourth AACR International Conference on Molecular Diagnostics in Cancer Therapeutic Development.

Currently, research on cancer agent activity requires patients to undergo several invasive biopsies to generate enough cells for testing. Fan and colleagues developed a highly sensitive test called the nano-immunoassay (NIA) that can make nanoscale protein measurements in cells from minimally invasive blood draws or fine-needle aspirates. The researchers used a microfluidic instrument called the Nanopro1000 (Cell Biosciences).

After studying NIA in several clinical trial settings, diagnostic testing results showed that protein profiles in the RAS and MAP kinase pathways could distinguish tumor cells from normal cells. Researchers

could use these profiles to group different tumor types.

The researchers analyzed proteins in cells from patients with lymphoma or myelodysplastic syndrome. Two novel treatments for these diseases had a measurable effect on protein activity in tumor cells, Fan said.

Finally, the team used NIA in conjunction with flow cytometry to determine a drug's differential effects in tumor cells vs. normal cells within each patient.

"These results have immediate application because they can identify which drugs actually hit protein targets in patient cells," Fan said.

In the long-term, nanoscale approaches may eventually affect all stages of cancer care.

"The ability to make meaningful protein measurements using minute quantities of tissue will allow for earlier discovery of tumors, characterization of small amounts of residual disease and detection of recurrence," Fan said.

NIA could be particularly useful in studying rare cell populations such as circulating tumor cells and cancer stem cells.

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