PNNL finds breast fluid better for detecting cancer

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Researchers at Pacific Northwest National Laboratory and the University of California Los Angeles have developed a new method of extracting and analyzing fluid from a woman's breast. The development may provide a more accurate, less expensive and noninvasive way to determine a patient's risk for breast cancer or to diagnose it in its early stages.

In a paper published in the July 3 issue of *Breast Cancer Research and Treatment*, the scientists at PNNL and UCLA report they have discovered six times more proteins than previously identified in this fluid, called nipple aspirate fluid, or NAF. The presence of these additional proteins suggests that NAF could be a resource for biomarkers, or biological indicators, of breast cancer, which is expected to claim the lives of about 40,000 American women this year.

"We believe this fluid could be the best option for discovering biomarkers for early-stage breast cancer," said Rick Zangar, a Battelle principal investigator at PNNL. "With further analysis, we could detect up to 10 times more proteins in NAF. The more proteins we identify, the better chance there is to find one that is linked to breast cancer."

When cancerous cells begin to develop, they create their own proteins that, if detected in NAF, could indicate the presence or risk of breast cancer. Current screening methods include breast self-exams and mammograms.

NAF is continuously secreted and reabsorbed in breasts of women who aren't pregnant or lactating. It is generated from cells lining the ducts that form a network throughout the breast — the same network that provides milk in a lactating woman. These ductal cells are the source of 70 to 80 percent of breast cancer.

"NAF offers a unique window through which we can monitor the processes occurring inside the breast ductal system," Zangar said.

The NAF samples were collected using a process that is less painful than other extraction methods but obtains just as much fluid. It was developed by co-author Chandice Covington, a professor in the UCLA School of Nursing. While NAF has been studied for more than 25 years, most extraction methods have been painful. With Covington's process, women use warmth, massage and a simple breast pump that eases the fluid from the breast without discomfort.

"Women need early mechanisms for detecting potential or existing disease," Covington said. "Current detection methods rely on feeling a lump in a self-exam or visualizing a lump in a mammogram. By the time a lump has formed, the cancer has progressed. My technique, combined with Battelle's protein analysis capabilities, makes our approach one of the leading methods for identifying biomarkers for breast cancer in the early stages, before a lump is detectable."

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Zangar and colleague Susan Varnum analyzed the NAF samples using high-throughput mass spectrometers at the William R. Wiley Environmental Molecular Sciences Laboratory, a DOE national user facility at PNNL. Fifteen of the 65 identified proteins are potential biomarkers for breast cancer. This implies that NAF provides a useful sample for analysis of known breast-cancer biomarkers and possibly others not yet identified in blood samples.

The results are promising, but Zangar also noted there are more questions that need to be addressed. “Will a biomarker show up sooner in NAF than in blood? We don’t know yet, but we do know that NAF is a concentrated source of proteins specifically released by breast cells. A marker protein released into the blood, on the other hand, is more diluted, and it’s more difficult to determine where in the body the protein came from.”

Zangar and his team hope to secure funding to continue the study using a protein microarray they developed that can screen dozens of proteins simultaneously. The Department of Defense Breast Cancer Research Program funded the majority of the NAF research.■