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Thinking PINK

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For Kansas State University biochemist Anna Zolkiewska, the battle against breast cancer starts in the laboratory.

By studying breast cancer stem cells, Zolkiewska is working to prevent cancer recurrence and metastasis — the major causes of death among breast cancer patients. Around 40,000 U.S. women die from breast cancer every year, according to the American Cancer Society.

Zolkiewska, associate professor of biochemistry and molecular biophysics, is using a four-year $1.245 million grant from the National Cancer Institute — at the National Institutes of Health — to study a promising breast cancer marker called ADAM12 and its role in breast tumor-initiating cells, or BTICs. Her research also has received support from the university's Johnson Cancer Research Center, which is a team of multidisciplinary faculty scientists who perform basic cancer research.

Breast tumor-initiating cells — known as cancer stem cells — drive breast tumor progression and tumor recurrence or metastasis. Zolkiewska’s research can provide clinicians with better diagnostic tools, new cancer prevention strategies and improved treatment options.
“Our studies strive to produce new research and diagnostic tools for detection of breast tumor-initiating cells and to develop new therapies to target these cells,” Zolkiewska said.

While current treatments for breast cancer — such as surgery, chemotherapy and radiation therapy — can destroy the majority of tumor cells, these treatments cannot eradicate cancer stem cells. Current treatments also have many negative side effects.

“The problem is that cancer stem cells are present in very low amounts,” Zolkiewska said. “They are difficult to detect. But we know that they exist and they are practically resistant to chemotherapy and radiation therapy.”

Even when chemotherapy appears to work, breast tumor-initiating cells can cause tumors to re-emerge or metastasize to bones, lungs or the brain.

“One once metastasis occurs, the chances to cure the patient decrease dramatically,” Zolkiewska said. “It is absolutely critical to be able to identify cancer stem cells and to find more effective treatments against them.”

Zolkiewska is focusing on ADAM12, which is a member of the ADAM family of cell-surface disintegrin-metalloproteases. Unlike other current cancer markers — which are found in both healthy and cancerous tissues — ADAM 12 is not expressed in healthy human mammary glands.

Zolkiewska’s work suggests that ADAM12 is induced precisely in breast cancer stem cells. ADAM12 can be used with existing markers for improved detection, isolation and characterization of breast tumor-initiating cells in the laboratory.

Long term, Zolkiewska wants to understand exactly how ADAM12 functions in cancer stem cells at the molecular level. She also wants to know how breast tumor-initiating cells differ from other breast tumor cells.

“We might be able to use ADAM12 to develop targeted therapies to eradicate cancer stem cells with fewer side effects, which is of great importance,” Zolkiewska said. “Ultimately, we hope we can improve the quality of life for breast cancer patients.”

Zolkiewska also is completing a three-year $444,000 grant from the National Institutes of Health for research on mutations in the ADAM12 gene. Her research team includes Hui Li, postdoctoral researcher; Sara Duhacheck Muggy, doctoral student in biochemistry; and Yue Qi, doctoral student in biochemistry.