Chemical engineer studies breast cancer by building bone, brain and lung tissues

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Shelly Peyton, a chemical engineer at the University of Massachusetts Amherst, says scientists know that breast cancer will spread to many different types of tissues in the body, and that this migration is the key reason the cancer is deadly. What they don't know is why some forms of the cancer move to the brain, while others seek out bone or lung tissues.

Peyton is now using a three-year, $590,000 grant from the National Science Foundation to study how different types of breast cancer interact with different human tissues – tissues she and her research team can create in the laboratory to study how the cancer cells behave as these cells and tissues interact.

She also says by studying the destination of the cancer cells in the body, not the primary site where the cancer first develops, she hopes to be able to develop patient-specific therapies that can attack the cancer as it tries to seek out and colonize these diverse tissues.

Because Peyton is trying a new approach to understanding breast cancer, one based in engineering, not more traditional medical studies, her grant actually came from a subset of the NSF called the Physical and Engineering Sciences in Oncology, she says. "I think they saw what I was doing as a next step in the research on this disease," Peyton says.

The problem scientists face in combatting breast cancer is complex, and lends itself to new methods that are outside traditional medical research. Peyton says scientists understand that the reason 90 percent of the patients die from breast cancer is because it has spread to other parts of the body – a process known as metastasis. They also know that it moves to several very specific types of human tissues, depending on the type of breast cancer. Her task is to unravel the questions about which type of cancer moves to each type of tissue and to hopefully find a way to stop the spread of the disease.

"The critical question for me is where does it go and why," Peyton says. "We think there is some mechanical relationship there, but we don't know what it is."

Peyton will seek answers by combining her engineering expertise in creating biomaterials that mimic specific body tissues with a systematic measurement of the biological responses to certain types of cancer. Her team will build bone, brain and lung tissues in the laboratory and form those tissues around different kinds of cancer cells. Using this method, they can analyze how the cancer cells and tissues interact. This can provide information on how the cancer grows once it arrives in the new tissues and what attracts the cancer cells in the first place, Peyton says.

Peyton creates testing platforms from polymers that have many key aspects of human tissues. When the artificial tissues are subject to real cancer cells, she says, it's possible to see how the disease develops and how cells move within those diseased tissues.

It's her dual role as biologist and an engineer that has opened up this type of research, Peyton says. "We are biologists enough where we can study cancer," she says, "and we're materials scientists enough to make the polymer tissue platforms."

Once the information is gathered, the results will then be subject to statistical modeling designed by her colleague Nicolas Reich, a UMass Amherst research professor in biostatistics. Peyton's plan is to correlate all these results so her lab can identify or create a drug for each specific cell-tissue interaction for each type of breast cancer. That way, they can develop patient-specific treatments.

"So we not only want to kill the breast cancer cells, but also block their ability to spread to other tissues in the body," says Peyton. "That would be a revolutionary therapy that can be geared for each individual patient."

Provided by University of Massachusetts Amherst

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