Breakthrough in early cancer detection

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Cape Cod-TV correspondent Melissa Chartrand went into the hospital three years ago to undergo a hysterectomy, a common procedure that was supposed to eliminate her abdominal pains. But for Melissa, a far more serious pain was just beginning.

"I went in for a hysterectomy and when I woke up, they told me I had ovarian cancer. Let's just say I was in total shock," recalls Chartrand. Her shock was followed by five months of intense chemotherapy for advanced ovarian cancer that put her life on hold. The five-year survival rate for her stage III diagnosis was roughly one in three. Chartrand, a mother of three, was in for the fight of her life.

With few early symptoms, ovarian cancer--like many cancers--can be hard to detect without invasive and expensive procedures. "Early detection is absolutely not only key but probably the only way for us to win the war on cancer," says Vadim Backman who is a biomedical engineer at Northwestern University in Evanston, Ill.

With support from the National Science Foundation (NSF), in part funded through the American Recovery and Reinvestment Act of 2009 (ARRA), Backman's research is shedding light on how early cancer detection can be made cheaper, more accurate and less invasive. "We're developing new optics technologies to learn about tissue structure and composition, and we are applying these technologies for early cancer screening," he says.

The team's research is part of a field that's called bio-photonics, where

light becomes an analytical tool for biology. Backman and his colleagues perfected a new type of microscopy, which they most recently demonstrated using cheek cells harvested with a small brush stroked against the inside of the mouth. When the researchers shine light on the harvested cells, photons bounce off structures within them at different angles depending on whether the cells are healthy or not.

The process is highly sensitive, able to detect even subtle abnormalities that could indicate problems elsewhere in the body. Backman is currently developing screeners for a number of cancers by harvesting cells from areas near organs that could become malignant. For example, cheek cells are harvested as a pre-screener for lung cancer, and cells harvested from just inside the rectum can be analyzed to prescreen for potential colon cancer.

Backman says both technologies are minimally invasive and can be practiced in a primary care setting. He adds that the colon screening he's testing doesn't involve the discomfort of bowel prep that, as Backman says, "Everyone loves to hate."

A slightly more invasive pre-screener takes cells from the upper intestine to screen for pancreatic cancer. The current test for pancreatic cancer involves taking a probe into ducts around the pancreas and poses a high risk of injury.

Once the harvested cells are analyzed, Backman says he can detect details previously unseen with conventional microscope technologies. "We see alterations in cells that are indicative of pre-pre cancer, if you will. If you were to take the cells under the microscope, you could not tell a difference."

A few miles from Backman's lab is Evanston Hospital. It's part of Chicago Land's NorthShore University HealthSystem. Dr. Hemant Roy

is NorthShore's director of gastroenterology. He's also Backman's research partner. Roy showed us a probe that takes Backman's technology out of the lab and into practical use. The probe, which does not yet have a name, is currently used in clinical trials. It uses bio-photonics to analyze tissue inside the mouth for early lung cancer screening. It's a small, elongated, flexible flashlight, no thicker than a pencil. It shines a small light on the inside of the mouth, reads back how the light is reflected and sends the data to a computer. Roy takes a reading by simply pushing a button while shining the light on tissue inside the cheek. Raw data sampled from the light is displayed as a small graph on the computer's screen.

"With this probe, we've probably done a couple of hundred patients. We're about 90 percent accurate," says Roy. "I think if this works, we could really make a big difference in how we treat patients. We can make a huge impact on population screening." One day Backman and Roy hope that devices similar to this will be used in physical exams as routinely as taking blood pressure or using that tongue depressor to make you say "ahh."

Backman and Roy will soon be part of a new clinical trial using bio-photonics to screen cervical cells for signs of ovarian cancer. That's something Melissa Chartrand, who has been cancer-free for over two years now, can truly appreciate. "If there had been some pre-screening tool or some kind of early detection, I might not have had to go through any of what I went through," says Chartrand. "If they caught it earlier, it might have gone from stage III to hardly a stage I. Maybe I'd have no chemo or even less surgery. Imagine that."

If Backman and Roy's research is any indication, the early detection that Chartrand imagines might soon be a reality.

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