



Media Backgrounder

\$25,000 Dave Mitchell Award of Distinction

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Mr. Cameron Piron

The Sentinelle Vanguard® Breast MRI Table with Variable Coil Geometry™

Who?

- Cameron Piron (BASc, MSc), Co-Founder, President and Chairman of the Board of Sentinelle Medical®, is the innovator of a unique system for breast magnetic resonance imaging and intervention.

What?

- Breast magnetic resonance imaging (MRI) has emerged as a safe and sensitive imaging tool and is now recommended in addition to mammograms for high risk patients. The Sentinelle Vanguard system incorporates several innovations that make breast MRI and biopsy highly sensitive, patient-friendly, efficient and cost effective.
- The Sentinelle Vanguard breast MR system includes a table for the patient to lie on, special radiofrequency (RF) coils that can be positioned close to the breast tissue to pick up signals, and software to convert the signals into three dimensional images.

Why?

- Breast cancer affects more women worldwide than any other cancer. With early detection, survival rates can improve from 21 to 96 percent. The Sentinelle Vanguard® Breast MRI Table with Variable Coil Geometry™ allows radiologists to detect breast cancer even in its early stages when tumours are very small.

Where?

- Sentinelle Medical is headquartered in downtown Toronto, Ontario, and has a satellite location in Waterloo, Ontario. Over 95% of the Sentinelle Vanguard system components are made in North America.
- Cameron Piron developed Sentinelle's core technology while completing his MSc in Medical Biophysics at the University of Toronto, Sunnybrook Campus.

- Institutions that use the Sentinelle Vanguard system for research and patient treatment include Sunnybrook Health Sciences Centre (Toronto, Ontario); Royal Victoria Hospital, McGill University (Montreal, Quebec); and University of California San Francisco (San Francisco, California).
- Leading North American cancer centres that use the Sentinelle Vanguard system include New York-Presbyterian, (New York, New York), Memorial Sloan-Kettering Cancer Center (New York, New York), Scripps Health (San Diego, California), and Princess Margaret Hospital (Toronto, Ontario).

Better Imaging, Sooner

Breast cancer is the most common cancer to affect women worldwide and an estimated 5400 Canadian women will die from it this year. In Canada, about one in nine women develop breast cancer — in the United States, the rate is one in eight. But there is an even more important message about breast cancer: when detected early, survival rates can increase from 21 to 96 percent.

Since the 1970s, women in Canada and the United States have relied on breast self-examination and mammography to detect breast cancer. While mammography is a useful screening tool for the general population, it has its drawbacks, particularly for high risk groups.

For one, mammography uses low dose X-rays to reveal tumours in breast tissue. X-rays are a form of ionizing radiation. Magnetic resonance imaging (MRI), on the other hand, does not emit ionizing radiation and has no known lasting effect on the body. "It's becoming a great tool for screening of patients who are asymptomatic," says Cameron Piron of Sentinelle Medical. Piron has won the 2009 Dave Mitchell Award of Distinction from the Ernest C. Manning Awards Foundation for developing a unique and dedicated system for breast MRI and intervention.

In some studies MRI has shown to be three times more sensitive than physical exams, standard X-rays, CT scans, or even ultrasound in high-risk populations, Piron notes. With MRI, radiologists can clearly distinguish among water, muscle, fatty deposits, nerve tissue, glandular tissue and other soft tissues. The technique can even show differences between *types* of tumours.

Says Piron, "we are starting to move to a new time when we'll be not just differentiating cancer from non-cancer, but more importantly, differentiating the grade of cancer."

Canadian Innovation Moves Breast Cancer Screening Into New Era

In 1998, when Piron began his MSc in Medical Biophysics at the University of Toronto, Sunnybrook Campus, he and his supervisor, Dr. Don Plewes, were determined to find ways to use MRI in breast cancer screening. Their first idea was to develop a combined MRI-ultrasound system, but Piron's work quickly took an exciting detour.

Initially it was difficult to obtain good quality magnetic resonance (MR) images of breast tissue. The procedure was also time-consuming and costly. But by the time Piron graduated in 2001, he had completed the basic research needed to create a dedicated breast MRI system. In 2004, along with Sunnybrook colleagues Chris Luginbuhl and Gal Sela, Piron co-founded Sentinelle and swiftly transformed a series of innovations into a commercial reality.

The basic MRI procedure is the same for various body tissues. The patient lies on a table that is pushed into the bore of a doughnut-like scanner. A powerful magnet acts on the water molecules of the body, causing the hydrogen atoms in water to align with the magnetic field. A coil then sends a pulse of radiofrequency (RF) energy to the area being examined. Hydrogen atoms absorb the pulse, and then, like glow-in-the-dark paint, release the RF energy a split-second later. Different body tissues and tumours release the energy at different rates. Additional RF coils act as antennae to pick up the energy signals and send them to a computer to generate an image.

To reduce the signal-to-noise ratio and produce high resolution images, the RF detection coils must sit close to the patient's body. Piron solved this challenge by creating adjustable RF detection coils that can be properly positioned on each side of the breast. The coils are a key feature unique to Sentinelle's Vanguard system.

Piron not only designed new circuitry for the RF coils, but his team also developed a software package called Aegis with BRIGHT® for advanced 3D imaging and analysis.

Dr. Nola Hylton has been working with Sentinelle on a breast MRI project funded by the US National Institutes of Health (NIH). Hylton is a Professor of Radiology and Biomedical Imaging and Director of the Breast Imaging Research Program at the University of California, San Francisco. She says the Sentinelle Vanguard system is "unparalleled in terms of image quality, patient comfort and interventional access." Says Hylton, "it is the first breast MR solution to solve many of the problems I have been facing in my efforts to conduct breast MR imaging."

To allow for proper positioning of the breasts during MRI (and needle biopsy, if anything suspicious is detected), Piron designed a custom table. Even with the Sentinelle Vanguard system, it takes the radiologist over 20 minutes to scan enough body tissue to produce a three-dimensional image, and throughout this procedure, the patient must stay completely still. This would be a tall order for a patient in discomfort, and more difficult still, should the physician need to take a biopsy.

The Sentinelle Vanguard table resembles a massage table. The patient lies on her front, arms at her side, supported by comfortable padding. A cavity in the table allows the radiologist or physician access to the breast tissue. Because the patient does not have to stretch her arms up as she would during a mammogram, the breast is not obscured by muscle and it is easier for the patient to remain still.

"Patient comfort is key to the success of the procedure," explains Hylton. "An uncomfortable patient is more likely to move and cause the procedure to be repeated."

In addition, if a procedure is uncomfortable, patients are less likely to comply with regular screening.

"Radiologists have found a partner willing to listen to their needs," says Hylton. "(Piron) has developed a product that is helping change the way medical professionals detect, diagnose and treat breast cancer."

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Reducing Costs, Improving Access

Canada's aging population will place an increasing burden on our health care system, notes Piron. "To control that, there needs to be an exponential adoption of new technologies that are going to bring more effective health care at a much lower cost," he says.

Breast MRI initially cost 10 times as much as a mammogram — a price high enough to bankrupt the health care system if breast MRI were to be used for general screening. This cost has since been cut by half. Sentinelle and its research partners are continuing to improve the efficiency of breast MRI, says Piron, noting that its cost will soon be comparable to that of digital mammography, which uses X-rays to produce images that are stored as digital files.

The ability to prepare patients outside the MRI suite and then wheel them in for the procedure makes the Sentinelle Vanguard for GE system very efficient. With the cost of running an MRI about \$500 an hour, it is crucial to complete as many scans as possible in a day.

Since 2007, the American Cancer Society has recommended annual breast MRI exams in addition to mammography for high risk patients who have a genetic risk for aggressive breast cancer that occurs before menopause. Breast MRI screening is also gaining acceptance for newly recognised high risk groups, such as women with dense breast tissue or women who have had any type of cancer.

Piron views more widespread MRI screening as part of a new era of personalized care that takes into account an individual's risks. By catching disease in its early stages, health care costs can be lessened — and patients and their families spared unquantifiable suffering.

New Possibilities for MRI

Piron sees potential for MRI that goes beyond capturing informative images. One goal is to bring imaging into the surgical suite. MRI could be used to guide surgeons in minimally invasive therapies, such as focussed ultrasound to break up tumours, delivered with a tiny probe.

Sentinelle's work in breast MRI has led to parallel research in prostate imaging, conducted at the Princess Margaret Hospital in Toronto, Ontario. The recently released results show that MRI can be a powerful tool for detecting cancer of the prostate, among other cancers. "Its applications are really growing exponentially right now," Piron says.

Where Does Innovation Come From?

The buzz of energy and enthusiasm at Sunnybrook made Piron's graduate studies an exciting and innovative time, he says. His Master's thesis — the longest in University of Toronto history — has so far spawned three research papers and 12 patents, with half of his research yet to be commercialized.

Along with other members of the Plewes' lab, Piron depended on an MRI facility and machine shop made possible by a \$10 million infrastructure grant from the Canadian Foundation for Innovation (CFI). Various grants have supported the lab's research, including a \$10 million grant from the Ontario Research and Development Challenge Fund (ORDCF) to promote research with promise for commercialization.

Sentinelle co-founders Piron, Luginbuhl and Sela and their families used their own money to help launch the company in 2004. Since then, strong relationships with leading research institutions have enabled the company's research and development capabilities to grow. A \$700,000 USD grant from the NIH has supported a five-year project with the University of California, San Francisco. In 2008, Sentinelle received over \$1.8 million Can in tax credits from the provincially and federally funded Scientific Research and Experimental Design program.

In founding Sentinelle — which now has 120 employees — Piron says the company captured Sunnybrook's spirit of innovation. "It's incredibly exciting watching the next generation of engineers, researchers, physicists...develop tools and solutions to problems that I know I would never have been able to," he says.

"Winning (a Manning Innovation Award) is actually a real honour and a bit shocking to me," Piron admits. "But underlining innovation in Canada is something that needs to be done much more aggressively," he says, adding that when people see other Canadians succeed at innovation, more will step forward to do it.

The Ernest C. Manning Awards Foundation

This year the Foundation will award \$165,000 in prize money. Four awards, totalling \$145,000, will go to leading Canadian innovators. Another \$20,000 will go to Young Canadians chosen at the 2009 Canada-Wide Science Fair.

The Foundation was established in 1980 in the name of prominent Alberta statesman, Ernest C. Manning, to promote and support Canadian innovators. Since 1982, the Foundation has presented over \$4 million in prize money through its annual awards program (www.manningawards.ca).