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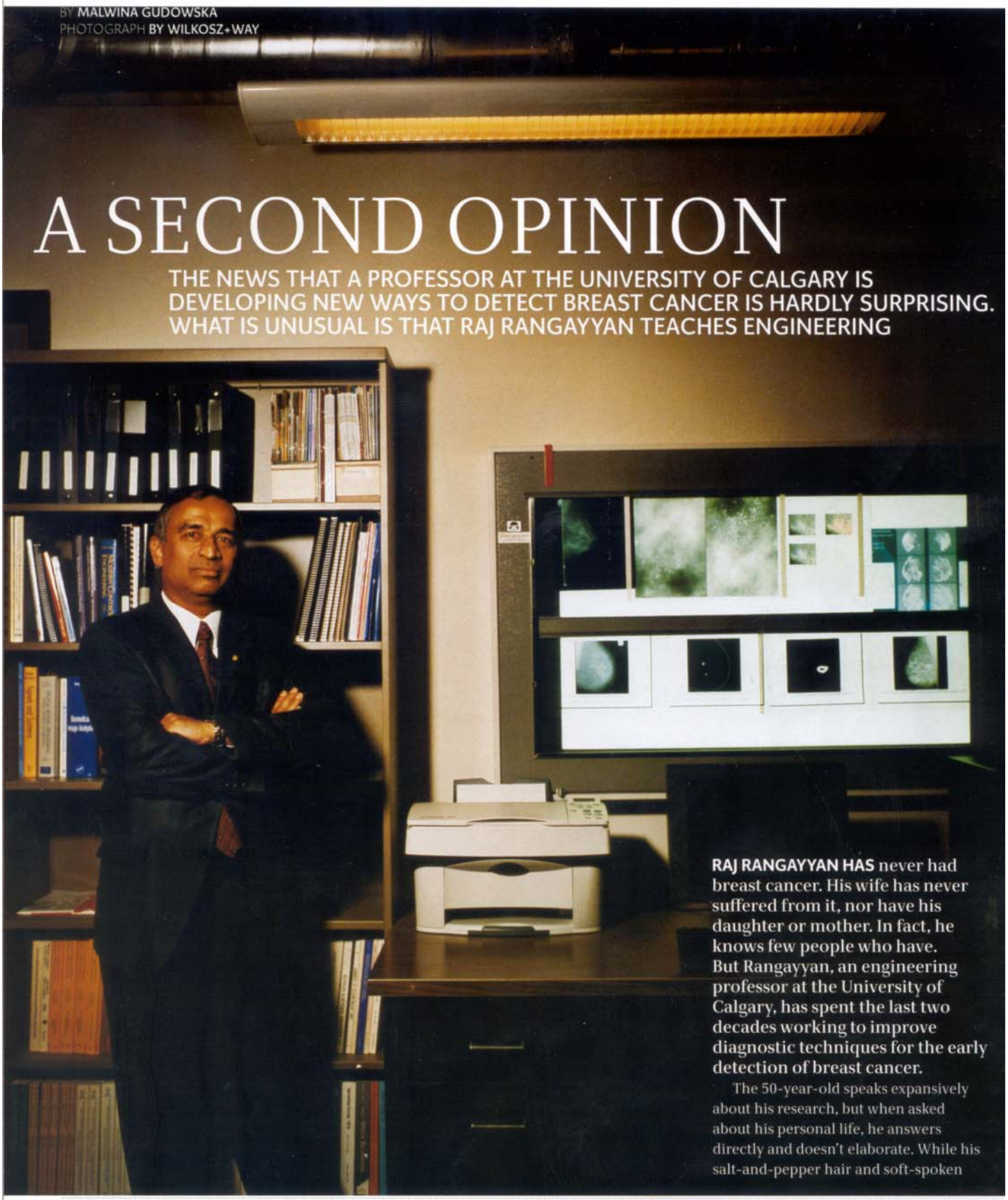
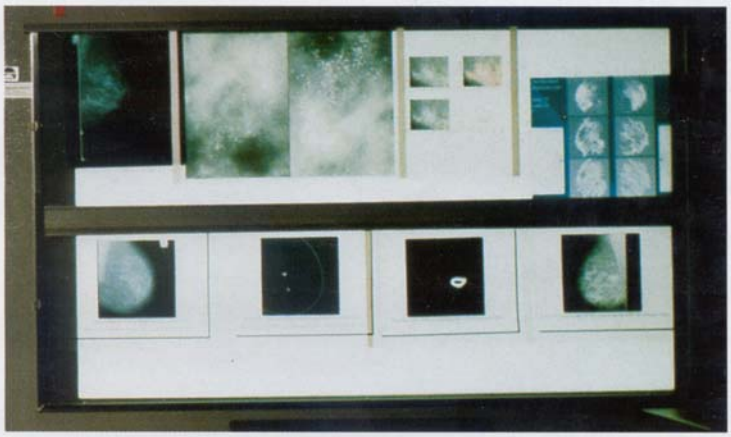
A SECOND OPINION

THE NEWS THAT A PROFESSOR AT THE UNIVERSITY OF CALGARY IS DEVELOPING NEW WAYS TO DETECT BREAST CANCER IS HARDLY SURPRISING. WHAT IS UNUSUAL IS THAT RAJ RANGAYYAN TEACHES ENGINEERING



RAJ RANGAYYAN HAS never had breast cancer. His wife has never suffered from it, nor have his daughter or mother. In fact, he knows few people who have. But Rangayyan, an engineering professor at the University of Calgary, has spent the last two decades working to improve diagnostic techniques for the early detection of breast cancer.

The 50-year-old speaks expansively about his research, but when asked about his personal life, he answers directly and doesn't elaborate. While his salt-and-pepper hair and soft-spoken



MAMMOGRAMS ARE AMONG THE MOST DIFFICULT X-RAY IMAGES TO INTERPRET; THE DISTINCTION BETWEEN A NORMAL PATTERN AND A PATTERN THAT HAS BENIGN OR MALIGNANT DISEASE IS RATHER SMALL

nature are in keeping with the image of a serious academic, Rangayyan does have some unexpected interests. After receiving training on the bansuri (a bamboo flute) and sitar in Bangalore, India he has performed internationally, accompanied by Utpal Mazumdar on tabla. The duo have a number of CDs and their music has been licensed to museums and yoga and meditation schools.

Rangayyan grew up in Mysore, India and began his engineering studies at the university there. After receiving his bachelor's degree, he earned a PhD from the Indian Institute of Science. He spent three years at the University of Winnipeg before coming to Calgary for a tenured professorship.

Although he has researched a variety of topics, it is his collaboration with Dr. Leo Desautels, a medical doctor, in studying computer-aided diagnosis (CAD) of breast cancer that has garnered the most attention. When asked why he began work in this area, Rangayyan simply says that he likes a challenge.

CAD systems are becoming a source of reliable second opinions in cases where a radiologist has provided an initial diagnosis but has some doubts and believes the mammogram warrants further review. Rangayyan and Desautels are developing computer programs, mathematical procedures and algorithms that will read mammograms and provide objective information that would aid in determining a diagnosis—yes the calcifications, masses or tumours apparent could be signs of breast cancer or no, they are unlikely to be cancerous.

According to the Canadian Cancer Society, 1,950 Alberta women will be diagnosed with breast cancer this year and 430 women will die of the disease. About 23,000 women get mammograms in Alberta through the screening program every year, and while the early-detection program is working—the incidence of breast cancer is increasing but mortality is decreasing—the numbers of mammograms put pressure on those interpreting the results. To complicate matters, mammograms are among the most difficult X-ray images to interpret; the distinction between a normal pattern and a pattern that has benign or malignant disease is rather small, Rangayyan says.

That's where computer-aided diagnosis comes in. Currently, most commercial systems look for calcifications, masses or tumours in the mammogram. However, Rangayyan is focused on two other indicators: bilateral asymmetry and architectural distortion.

In the mammogram of a healthy woman, the breasts look similar (they're not identical because the breasts are compressed). But in the case of diseases, there can be larger differences between the two breasts—a condition known as bilateral asymmetry.

Rangayyan's work on architectural distortion explores other subtle signs of breast cancer: tissue in the breast that is distorted or displaced and could possibly develop into a tumour. These subtle signs are still difficult to identify, and false positives are common, in part because of an inherent limitation of mammograms—the breast is three-dimensional and the mammogram is a two-dimensional image in which ducts and ligaments that are orientated at different angles could overlap and produce a distortion like pattern.

This means that more work needs to be done to develop accurate CAD systems, Rangayyan says. He is talking to a couple of companies that have expressed interest in his research and hopes these potential backers will fund more research or license the techniques that he and his team have developed. But until then, he plans to continue applying for grants, writing letters of intent and publishing his work. "At the university, my interest is more in research than in building a system for selling, so we are happy to chug along like this," he says. "What we want to do is to improve the accuracy of diagnosis of breast cancer, and if that happens we will be happy."