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Can You Catch Cancer?

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New research shows you can. Here's what you should know before you talk with your doctor.

Thirty-five weeks into her third pregnancy, Edmonton mother Kristine Fersovich was diagnosed with cervical cancer. Her doctors wanted to treat her as soon as possible, so at 37 weeks her son was delivered by Caesarean section. While she was still under local anesthesia, she had a radical hysterectomy and surgeons also removed her lymph nodes. "Basically, they showed my son to me, they said, 'Here's your baby—kiss,' and then they took him away," Fersovich recalls. "They kicked my husband out and brought in the surgeons." Fortunately, her son was "perfect," and today she is cancer-free.

Fersovich's mother had the same disease at 28, and though she, too, survived with surgery, Fersovich doesn't want to take any chances with her nine-year-old daughter, Alexis. Now she doesn't have to: The 34-year-old mother will see to it that Alexis gets a vaccine to protect her from cervical cancer.

Fersovich and others like her are in the middle of a revolution that will change the face of medicine forever. For years, we've thought cancer was caused by lifestyle choices (fatty diet, smoking, lack of exercise), environmental factors (pollution, radiation, ultraviolet light) or genetic mutations. But now scientists have discovered that infections—produced by viruses, bacteria or parasites—can trigger some cancers. Insidious and symptomless, these infections fester quietly and produce cellular changes that can result in malignancies. Until now, people often were unaware that anything was amiss, so they didn't seek treatment. Usually, these infections alone don't lead to malignancies. The standard trio of risk factors—lifestyle, environmental, genetic—may also be needed. But because we now know that some cancers won't develop without the underlying infection, we have a whole new cancer-prevention strategy: Get tested (and cured) for any of these infections, or get vaccinated to avoid them in the first place.

Persistence Pays Off

In the early '70s, dr. Harald zur Hausen announced a radical idea at a scientific conference in Key Biscayne, Fla.: Human papillomavirus (HPV), which can cause genital warts, was the culprit behind cervical cancer. No one believed him. But zur Hausen, now an emeritus professor at the German Cancer Research Centre in Heidelberg, was on a mission to get to the bottom of the disease, which kills almost 300,000 women annually around the world. "I was convinced I was on the right track, although I knew it would require a lot of additional work to prove it." There were many strains of HPV—some relatively harmless and others quite dangerous—so it was only after the molecular analysis of thousands of warts that a breakthrough came, in 1984. That's when zur Hausen realized that just two strains of the virus—HPV 16 and 18—were found in 70 percent of cervical cancers.

At the end of 2006, a vaccine was approved in 49 countries, including Canada. Since HPV is transmitted sexually, the ideal time for girls to get the vaccine is before they become sexually active. So far, more than 40 million doses of the vaccine have been distributed worldwide. Cervical cancer is slow-growing, and it will take years before the full benefit of the vaccine is known. However, a February 2010 study of more than 17,000 women in Bogotá showed that getting the vaccine reduced the number of cervical abnormalities related to HPV 16 and 18 by more than 90 percent. In 2008, zur Hausen received Canada's Gairdner Award and the Nobel Prize for his work.

An Unusual Cocktail

In 1984, in Perth, Australia, Dr. Barry Marshall stood in his laboratory, wearing his white lab coat, said, "Cheers," then downed a glassful of clear liquid. No ordinary cocktail, this drink contained 100 million *Helicobacter pylori* (*H. pylori*) bacteria. Marshall was convinced *H. pylori* caused gastritis, an inflammation of the stomach lining, as well as stomach ulcers and, eventually, stomach cancer. But he had become frustrated with his inability to convince the medical establishment, who believed gastritis and ulcers were caused by stress and dietary factors, that this was true.

"I was a bit nervous; I was drinking pure bacteria," Marshall recalls. "It's like eating a strange food, swallowing a raw egg or a goldfish. It took a bit of willpower to get it down." As he had predicted, Marshall got gastritis. Then he cured himself with antibiotics.

Ten years later, the U.S. National Institutes of Health approved antibiotics as the standard cure for ulcers, and the World Health Organization declared *H. pylori* a carcinogen. Before Marshall swallowed his unusual drink, no one knew how to ward off stomach cancer. Now we're learning how. Aklavik, a small community of roughly 600 in the Northwest Territories, has had exceptionally high stomach-cancer rates for years—men here develop it at about three times the national average.

Billy Archie had always worried about the disease, so in 2004, when he became mayor of Aklavik, he decided to do something. He got the Aklavik Health Committee up and running to address his concerns, and in February 2008, a team of 25 doctors, nurses and

support staff flew to Aklavik to launch a long-term research project about *H. pylori*. As with infections from other carcinogens, infection from *H. pylori* often goes undetected. Scientists think it's probably picked up from ingesting infected food or water, or from kissing an infected person. Either a breath test or an internal scope can reveal the presence of the bacteria. In Aklavik, more than 200 people tested positive for the bug and were offered treatment with antibiotics. This gave the researchers an idea of just how common the infection was in the area, but left other questions unanswered. For example, which medications would prove most effective in the long run? Is there a way to ensure people won't be reinfected once cured? Will treatments have any effect in patients who have precancerous gastric lesions?

Karen Goodman, an epidemiologist and associate professor of medicine at the University of Alberta, says it will probably take about ten years to get the answers—answers that can help reduce stomach-cancer rates not just in Aklavik, but in the rest of Canada, too. For now, though, Marshall would like to see testing for *H. pylori* become a standard part of medical checkups. “You could do it when you're in your 40s, when you start checking your thyroid, your cholesterol,” he says. Quick treatment with antibiotics could be just as standard, he says. Plus, with early detection of and treatment for the *H. pylori* infection, he says, “you would never get stomach cancer.”

In 1996, Marshall received Canada's Gairdner Award for his work. And in 2005, he was honoured with a Nobel Prize.

More Stealth Infections

In the early '70s, a young American named Dr. R. Palmer Beasley was studying hepatitis B in Taiwan, where rates of the disease were high. Beasley was working at a research facility established by Seattle's University of Washington. While learning how the disease was transmitted—from mother to newborn, among other ways—he came to realize that Taiwan also had an unusually high incidence of liver cancer. After more research, he postulated that hepatitis B caused the cancer.

“People thought I was crazy,” recalls Beasley, now a professor of epidemiology at the University of Texas, in Houston. “I was told it was nonsense. The vision then was that the big answers would come from chemicals.” But Beasley persisted and, in 1975, began a landmark study that eventually showed liver cancer occurred almost exclusively in people who had been infected with hepatitis B—the majority of whom were carriers with no symptoms of liver disease.

Normally, liver cancer is fatal, killing almost 700,000 people every year. But now we can thwart it. Last year, a study showed that six-to-19-year-olds in Taiwan who received the hepatitis-B vaccine at birth had a 70-percent-lower risk of developing liver cancer than did those who weren't vaccinated at birth. Cervical, stomach and liver cancers are the major ones triggered by infection. But less common ones—including those of the immune system (Burkitt's lymphoma and Hodgkin's disease), the larynx, the esophagus,

the skin (Kaposi's sarcoma and Merkel cell carcinoma)—arise the same way. "Globally, 21 percent of cancers are linked to infection," says the German Cancer Research Centre's Dr. zur Hausen. "This exceeds even the incidence of cancers linked to smoking, which is 18 percent globally. I suspect we'll find more."

The Work Goes On

Lorelei Mucci, an epidemiologist and assistant professor of medicine at the Harvard School of Public Health, recently completed a study of the link between sexual infection and prostate cancer. Results from the more-than-1,300 subjects showed that exposure to the common sexually transmitted infection trichomoniasis nearly triples a man's risk of developing a particularly aggressive, lethal form of prostate cancer.

Caused by a parasite—*Trichomonas vaginalis*—the infection "is silent in women," Mucci explains. It rarely causes symptoms in males, either. "It lasts for a very long time," she says.

"And it causes chronic inflammation, which damages cells and tissue, leading to precancerous changes." If this association is confirmed by further research, some forms of prostate cancer could be prevented with a short course of antibiotics. "People used to believe trichomoniasis was not a serious disease," Mucci says. "We now know we should be concerned about its long-term effects." Worldwide, about 250,000 men die of prostate cancer every year; about four percent of American men develop an aggressive form of the

What We Learn From Animals

In 1911, New York physician Francis Peyton Rous proved that an infectious agent caused a mysterious cancer in chickens. Dr. Rous took diseased tissue from one bird and injected it into another, producing a tumour. Researchers have also found cancer-causing viruses in rabbits, frogs and even the rare Tasmanian devil. Findings such as these often provide good clues about pathogens in humans. The discovery of viruses in chickens, cats, cattle and nonhuman primates linked to animal leukemia and lymphomas has prompted researchers to look for similar ones that might cause those diseases in humans. Research on mice may one day help scientists explain the cause (or causes) of human breast cancer, the most common malignancy in women. Between five and ten percent of breast cancers are hereditary, but it is still not known how the rest occur.

In 1936, American doctor John Bittner demonstrated that breast cancer in mice is caused by a virus, now called the mouse mammary tumour virus (MMTV). Dr. James Holland, a professor specializing in oncology at the Mount Sinai School of Medicine in New York, has been investigating MMTV for almost 20 years. Proving something like MMTV could cause breast cancer in women "has been an uphill battle," says Holland, "but people are much less resistant to the idea than they used to be."

In the mid-'90s, working with colleague Dr. Beatriz Pogo, Holland showed that a virus whose gene sequence was more than 95 percent similar to that of MMTV occurred in

about 40 percent of the breast-cancer tumours in American women. Then in 1999, Dr. Thomas Stewart, an emeritus professor of medicine at the University of Ottawa, mapped the distribution of breast cancer around the world. He compared this geographical distribution to the range of the domestic mouse, which harbours MMTV. The overlap was almost perfect: Where the domestic mouse was common, so was breast cancer, and where the mouse was rare (Vietnam, for instance) so was breast cancer.

Last November, in a study published in the journal *Advances in Tumour Virology*, Holland and his colleagues revealed that they had identified the MMTV-like pathogen in 72 percent of inflammatory breast-cancer tumours. But so far, it is guilty by association only: Holland knows this virus is found in some breast cancers, but does it cause those tumours? “We must prove women are infected with the virus before they develop breast cancer,” he says. In an attempt to prove this very point, he plans to study blood samples from groups of women, screening for breast cancer and monitoring if, when and where the virus appears. He hopes this will establish a causal link and make a vaccine possible.

The stakes are high: Every year, breast cancer kills almost half a million women worldwide. “If we can prove breast cancer is caused by a virus, it will change our paradigm completely,” Holland says. B.C.-based Hans Krueger, co-author of the recent book *HPV and Other Infectious Agents in Cancer*, believes research on cancer and infection could potentially save millions of lives. “The field is complex,” he says. “But our understanding of it is growing on an almost daily basis.”