

## A little poison may not be a dangerous thing

*A controversial theory called hormesis is picking up support in scientific circles. It holds that radiation, toxic chemicals or lack of food can be good for you in small doses or for short periods. ANNE McILROY reports*

By ANNE McILROY

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Jim Pfeifer visits an old uranium mine in Montana every year, going deep underground to breathe in radon gas and expose his ailing body to low-level radiation. It's not something he talks much about for fear that people will think he is nuts. Even his doctor doesn't know about his annual trips. Mr. Pfeifer, who lives in Camrose, Alta., made his first visit to the Free Enterprise Radon Health Mine in 1996, when the pain from rheumatoid arthritis was making it hard for him to do much of anything, even sit through one of his son's hockey games. He had gone to the mine during a vacation with his family, and decided to go back and give it a try. He took the elevator down 26 metres, and found himself in a rocky tunnel made as comfortable as possible with lights, heat lamps and benches. After the first three days of spending three hours underground, he noticed a dramatic difference. "During the night, it seemed like something had lifted. I was never in pain that much again," says Mr. Pfeifer, who was diagnosed with arthritis in his early 40s and is now 49. The 10-day treatment costs \$150 (U.S.). Mr. Pfeifer, who works for the telephone company Telus, says he finds it easier to climb stairs and button up his shirts after he has had a regular dose of radon, a natural gas that seeps from the Earth's crust. Conventional wisdom holds that even small amounts of radiation are bad for you, but he believes otherwise, and a growing number of scientists are finding evidence that he might be right. "It sounds like witchcraft, but there is a scientific basis for it," says Ron Mitchel, a biologist with Atomic Energy of Canada Ltd. in Chalk River, Ont. Dr. Mitchel, who has been doing experiments for years that suggest low levels of radiation may actually be beneficial, recently showed that in both mice and human cells, small doses may stimulate the body's cancer defences. Doctors use precisely targeted high doses of radiation to kill rapidly growing cancerous cells, but they take precautions to protect healthy tissue from damage. Dr. Mitchel is talking about much lower doses, roughly about 10 times what the average Canadian is exposed to over a year. "It is another kind of stress, and with stress, what doesn't kill you helps you," he says. A controversial theory called hormesis holds that radiation, toxic chemicals, too much cold or heat, or a lack of food -- things that are indisputably bad for you in high doses or over long periods of time -- can actually be good for you in tiny doses or for a short period. Hormesis (pronounced horm-ee-sis) has moved from the fringes of science into the mainstream over the past several years. Its most high-profile champion is American toxicologist Edward Calabrese, who has credibility in environmental circles because of his work proving that some toxic chemicals can cause cancer after a single exposure. Dr. Calabrese became intrigued with the concept of hormesis as a college student, when he made a mistake and sprayed peppermint plants with a more diluted dose of herbicide than the instructions in the science experiment called for. The plants flourished instead of shrivelling and dying. Later in his career, his interest was piqued again, and he reviewed thousands of research papers on toxic chemicals, radiation and other stressors. In study after study designed to test the toxicity of a substance, he found overlooked data showing that at very low levels, harmful chemicals can prolong life, reduce the risk of cancer or spur animals and plants to grow faster. For example, rats fed small amounts of dioxin, which can cause cancer, lived longer than animals in a control group that were fed a poison-free diet. How hormesis works is unclear. In the case of radiation, it may be that low-level exposure prompts chromosomes to repair themselves. It also may put the immune system on heightened alert to seek out and destroy cancerous cells or stimulate damaged cells to kill themselves before they become cancerous, Dr. Mitchel says. There are many unanswered questions about hormesis, and the fact that Dr. Mitchel works for a government agency dedicated to nuclear power may prompt some critics to dismiss his experiments as biased. But he is not alone, and the proponents of the theory have gained significant ground in the past few months. Dr. Calabrese wrote a commentary this year on the theory for the prestigious journal *Nature*, his work was recently featured in the U.S. journal *Science*, and the latest editions of the two leading U.S. toxicology textbooks will for the first time cover hormesis. The U.S. scientist has been asked to address the Society of Toxicology of Canada annual symposium in Montreal in Dec. 7 and 8. The society's president, University of Calgary researcher Sheldon Roth, says it is not overstating to say hormesis could revolutionize the field of toxicology. "We are all going to be on the

edge of our seats." For Dr. Calabrese, all of this attention is "like going from the outhouse of science to the penthouse." He says Dr. Mitchel has made an important contribution to the credibility of hormesis with his work on low-level radiation. That work began in the late 1970s, when Dr. Mitchell, now 61, began zapping yeast and other primitive organisms with low-level radiation and measuring its effects. It wasn't a new idea. He says there is data from 1910 and 1920 showing that low-level radiation stimulated the immune system. People were using radiation to treat infections in the 1920s and '30s. But the data had long been overlooked. Dr. Mitchel progressed from primitive organisms to mice and human cells. One of his most recent experiments involved mice bred to be prone to paralyzing tumours of the spine. He found that one low dose of radiation gave them a reprieve -- 100 extra cancer-free days, which is a lot to a mouse that lives only three years. The low dose of this type of radiation was roughly 10 times what the average Canadian is exposed to over a year. But a higher dose, 100 times the annual exposure, had the opposite effect: Mice suffered from more tumours than appeared earlier. Recently, Dr. Mitchel presented his findings at a scientific seminar being held by the U.S. Department of Energy in Washington, another sign that hormesis is gaining credibility. He and Dr. Calabrese argue that hormesis may change how regulators determine safe exposure levels to radiation or to toxic chemicals. "We really have to take a hard look at what is going on at low doses. We are assuming it is harmful, and we go to great lengths to prevent people from exposure to minuscule amounts when we may actually be increasing their risk," Dr. Mitchel says. Dr. Calabrese suspects that beneficial exposure to some chemicals may be at levels now considered unacceptably high. But hormesis is still controversial, says Michel Cl  roux, a spokesman for the Canadian Nuclear Safety Commission, which regulates the use of nuclear material in Canada. Mr. Cl  roux says the commission is unlikely to revise its safety standards because it is impossible to know what an individual's exposure to radiation has been. Someone who has had frequent X-rays or lives in a part of Canada where high levels of radon gas naturally seep from the Earth's crust might be hurt, not helped, if nuclear plants were permitted to emit more low-level radiation. It may also be difficult -- both politically and scientifically -- to justify increasing the general level of exposure to toxic substances such as dioxins or mercury because of the potential health benefits. Individual sensitivities to toxic chemicals probably vary, and different species of plants and animals may be more affected by low levels of toxins. There is also evidence that for one class of chemicals in particular, the endocrine disrupters that mimic natural hormones, low levels may be particularly dangerous for developing fetuses. But hormesis makes sense to Pat Lewis, who runs the Free Enterprise Radon Health Mine in Montana. Over the years, as many as half of her clients have been Canadians. She now gets about 400 people a year, far fewer than in the 1950s, when the treatment was wildly, if briefly, popular. It was her grandfather, Wade Lewis, who first brought people down in the mine to improve their health. Soon there were 16 radon therapy mines operating in the area. "This research is validating what we have been seeing for years," Ms. Lewis says. There are similar spas in Europe and Japan, and some of the treatments are funded by public medical systems, Dr. Mitchel says. Mr. Pfeifer believes that his treatments at the Montana mine have given him more freedom of movement and relieved his debilitating pain, and he is glad that researchers are making discoveries that back up his faith in low-level radiation. "I wouldn't come back every year if I didn't think it was working," he says.

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