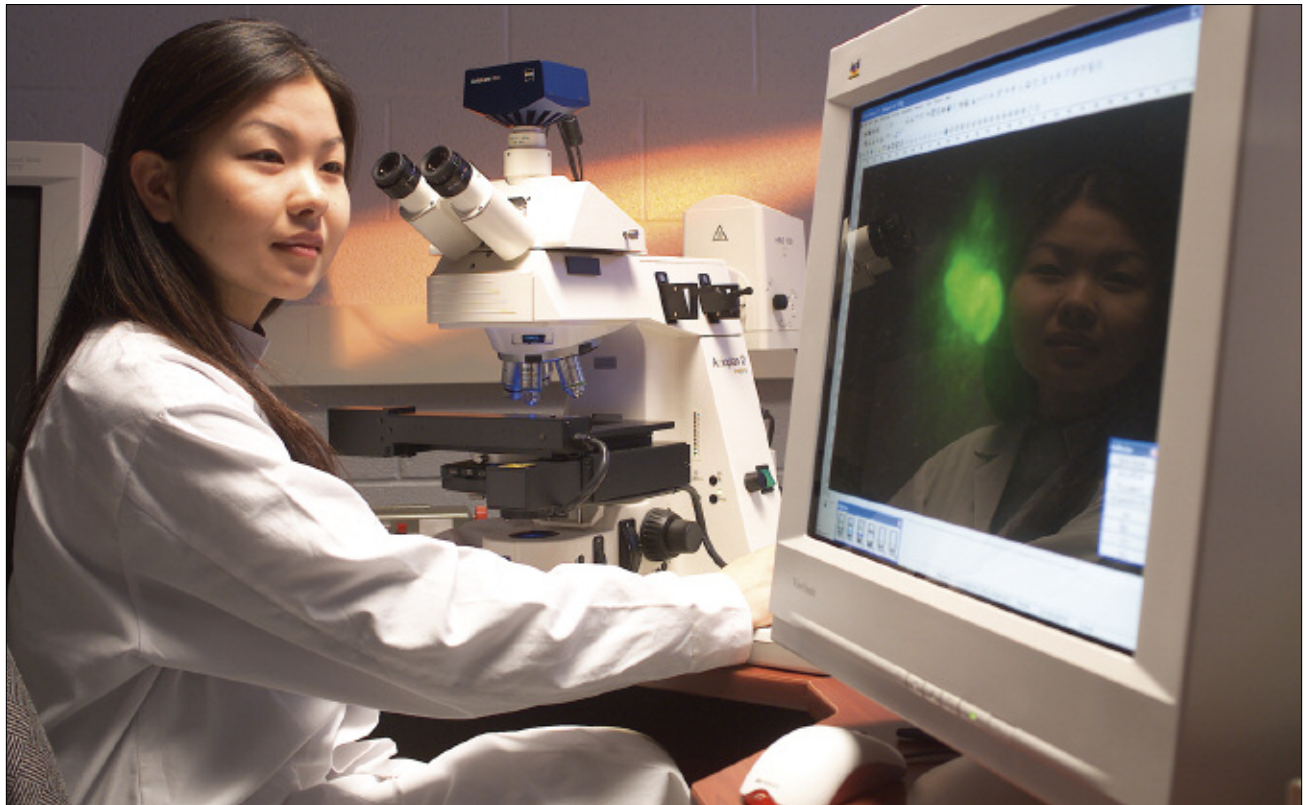


# Ideas on the Edge



## The Strange Arithmetic of Radiation

LOW-DOSE RADIATION IS A FACT OF MODERN LIFE. MCMASTER UNIVERSITY RESEARCHER DOUGLAS BOREHAM IS DISCOVERING THAT A LITTLE MAY ACTUALLY BE GOOD FOR US.

In science, as in life, things don't always add up the way we think they should.

That's what Dr. Douglas Boreham of McMaster University is discovering in his research into low-dose radiation. Dr. Boreham has been looking at the kinds of exposure people receive from medical and dental x-rays, medical scanners and other sources. And his findings are calling into question some wide-spread assumptions about the arithmetic of radiation.

"There are lots of people out there making the

argument that if you get a single CT scan a year over five years, your risk of getting cancer goes up four or five percent," explains Dr. Boreham. On the surface, it makes sense. But there's a problem: "This is all based on extrapolation from atomic bomb survivors, and that one single dose." Dr. Boreham's research, based on studies of patients exposed through x-rays and other diagnostic procedures, suggests a different conclusion: low doses may not be cumulative at all.

The arithmetic really breaks down when it comes to radiation's role in producing genetic defects. Dr. Boreham's research shows that low-dose exposure plus high dose exposure can equal...no exposure. "If you give a low dose of radiation to a male mouse before exposing him to a big dose, not only does it reduce the frequency of genetic transformation passed on to the offspring, it actually reduces it to the level of a mouse that's never been irradiated. So a big dose of radiation after a little

**RESEARCH THAT MATTERS**  
REAL-WORLD BENEFITS FOR ONTARIANS:

- tests for potential over-sensitivity to low-dose diagnostic radiation
- cancer treatments tailored more precisely to individual patients
- new radiation protection strategies for nuclear workers and the public

dose is the same as not getting exposed at all.”

Nothing’s that simple of course. Individuals vary significantly in their response to radiation, and environmental factors can play an important role. “It’s very complicated,” cautions Dr. Boreham. “Lots of factors come into play here, and we’re trying to figure those things out.” As a result, his research at McMaster leads in many different directions. He’s also looking, for example, at genetic tests that may one day be able to predict how well or otherwise an individual patient will respond to medical procedures involving radiation.

Finding answers to some of these complex questions may have just gotten a little easier. Dr.

Boreham’s lab now has an invaluable new tool: a biological micro-beamline—the first of its kind in Canada—funded in part by the Ontario Innovation Trust. The new technology allows

scientists to deliver alpha particles to precise targets within a single cell. Combined with other

high-tech tools like a spectral karyotyping system, a flow cytometer cell sorter, and a comparative genomic hybridization microarray system, the biological microbeam will shed even more light on the effects of radiation at the cellular level.

Dr. Boreham expects that these experiments will confirm his findings about the sometimes-strange arithmetic of low-dose exposure. But he’s not ready to make any final pronouncements. He believes that low dose radiation isn’t harmful and has positive biological effects. “I’m going to spend the next ten years proving that I’m right. That’s research.”



DOUGLAS BOREHAM

**Project:** Biological Microbeam for Low Dose Radiobiology Research

**Institution:** McMaster University

**Research Sector:** Natural Sciences

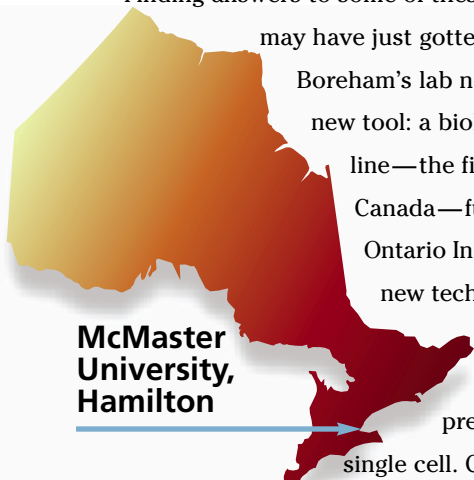
**Principal Investigator:** Douglas Boreham

**Trust Investment:** \$323,582

**Ontario Research Fund Investment:** \$145,990

**CFI Investment:** \$469,572

**Total research investment from all sources:** \$1,174,624



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## Infrastructure for Innovation About the Ontario Innovation Trust

The Ontario Innovation Trust was created in 1999 by the Government of Ontario to invest in research equipment and facilities at Ontario’s universities, colleges, hospitals and other non-profit research institutions. The Trust is governed by a volunteer Board of Directors, according to the terms of a Trust agreement established by the Ontario government. A small permanent staff looks after day-to-day operations.

Since its inception, the Trust has committed almost \$843 million to strengthen Ontario’s position in the global marketplace of ideas. This represents more than a third of the \$2.44 billion in total funding that has been invested in Trust-supported projects.