

"Bystander Effect" Hints at Dangers of Low-Dose Radiation

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That lead apron you wear during a dental x-ray is supposed to protect the rest of you from radiation. But it may not work very well, according to a new study. When cancer-prone mice were placed in lead containers and irradiated on just the lower half of their bodies, they developed brain tumors. The results suggest that radiation could be riskier than scientists thought.

The study builds on a surprising effect, first observed 16 years ago. When cells in culture are exposed to ionizing radiation, even those not directly hit sustain damage to chromosomes. Apparently, the irradiated cells pass on a distress signal or emit some chemical that breaks the DNA of neighboring cells (*ScienceNOW*, 7 September 2005). Although this "bystander effect" has been observed in tissue culture and recently in living animals, no experiments have yet linked it to the main reason for concern: Bystander effects might trigger cancer. Some scientists even suspect the opposite--that the bystander responses could protect against the disease by killing damaged cells.

Now it seems that the cancer risk is real. Radiation oncologist Anna Saran at the Italian National Agency for New Technologies, Energy and the Environment in Rome and colleagues studied mice with a mutation in a gene called *Patched* that makes them susceptible to brain tumors early in life. They placed newborn mice in lead shields that protected their heads and upper bodies, then zapped them with high-dose x-rays, or about 12,000 times the dose of a dental or chest x-ray. The scientists found that the cerebellums of these animals had higher than normal amounts of DNA damage and apoptosis, or programmed cell death. By 40 weeks of age, 39% of the shielded mice had developed brain tumors. That's a lot considering that the rate was 62% in *Patched* mice that were irradiated all over, including their heads. *Patched* mice that weren't irradiated did not develop brain cancer.

When the team injected the shielded mice with a chemical that blocks cell-to-cell communication before irradiating them, they detected no DNA breaks and the amount of apoptosis decreased more than threefold. Even though the irradiated tissues are far away from the brain, they are connected by neurons that could be passing on bystander signals, Saran says. The results appear online this week in the *Proceedings of the National Academy of Sciences*.

"This is a milestone paper," says Columbia University radiation physicist David Brenner. He suggests that current estimates of cancer risk from low doses of radiation--say, from naturally occurring radon and diagnostic tests--may underestimate the danger by failing to take into account bystander effects. To learn more, however, the mouse work should be repeated with lower doses of radiation, Saran says.

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