

Tiny Tardigrades May Hold Clues to Cancer Care

Researchers found that a protein made by tiny creatures called tardigrades can protect mouse and human cells from radiation damage.

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Most cancer patients undergo some sort of radiation therapy as part of their treatment plan. High doses of radiation can damage the DNA inside cancer cells, which destroys the cells and shrinks tumors.

But radiation treatments can harm healthy cells as well, which can lead to severe side effects. These effects can be especially challenging for patients with head and neck cancer and those with prostate cancer. Oral tissues can become inflamed after radiation therapy for head and neck cancer, making eating difficult. Radiation therapy for prostate cancer can damage the rectum.

In the hope of protecting healthy tissue during radiation therapy, an NIH-supported research team took inspiration from miniature creatures called tardigrades, or water bears. These tiny eight-legged animals are less than a millimeter in size, barely visible to the naked eye. They can survive in a wide range of extreme environments, from the ocean's depths to the vacuum of outer space. They also can endure high doses of radiation that would kill most other organisms.

The scientists focused on a damage-suppressing protein found in tardigrades called Dsup. Dsup interacts with DNA strands and keeps them from breaking. The researchers envisioned a novel approach in which Dsup could be precisely delivered to healthy tissues before radiation treatment to curtail radiation damage.

Led by Dr. Giovanni Traverso of MIT and Dr. James Byrne of the University of Iowa, the scientists tested their methods and refined their strategies in a series of experiments described in [Nature Biomedical Engineering](#) on February 26, 2025.

To deliver Dsup to healthy cells, the researchers created nanoparticles that encased messenger RNA (mRNA) with instructions for making the Dsup protein. They showed that the nanoparticles could ferry the mRNA into mouse or human cells and trigger broad production of Dsup.

To see how long Dsup production would last in the body, the scientists injected the nanoparticles into the oral or rectal tissues of mice. The protein's production peaked about 6 hours after

injection, then declined. Four days after the injection, little or no Dsup could be detected.

To test protection against radiation, the nanoparticles were injected into healthy mice about 6 hours before exposure to a radiation dose that's similar to what cancer patients receive. A control group of mice received radiation but no nanoparticles. The nanoparticle-treated mice showed much less DNA breakage after radiation treatment than the non-treated mice. Additional experiments found evidence that the protective effects of nanoparticles remained limited to the injection site. As such, the particles are unlikely to have the unwanted effect of protecting nearby tumor cells.

Taken together, the results show the Dsup protein's potential to protect healthy cells against radiation damage. More research is still needed to improve the approach and assess possible clinical applications to improve radiation treatment.

"Radiation is an important tool for treating all kinds of cancer, but the side effects caused by radiation-induced damage to healthy tissue can be severe enough to stop patients from completing the therapy," Byrne says. "This is an entirely novel approach for protecting healthy tissue and may eventually offer a way to optimize radiation therapy for patients while minimizing these debilitating side effects."

This [research summary](#) was published by the National Institutes of Health on March 25, 2025.