Secret of radiation-proof bugs proposed

Helen Pearson

Internal antioxidants may shield cells from radiation damage.

US researchers have come up with a novel theory for how a tiny, tough bacterium can survive doses of radiation 2,000 times those that would fry a person.

The unassuming red bacterium, called *Deinococcus radiodurans*, was discovered around 50 years ago in a batch of irradiated meat. Ever since, scientists have wondered how it can withstand radiation better than almost any other organism in the world. "They're better than cockroaches," says microbiologist James Imlay at the University of Illinois, Urbana.

Researchers know that the bug is particularly good at patching up DNA damage wrought by radiation. Now Michael Daly of the Uniformed Services University of the Health Sciences in Bethesda, Maryland, and his team have come up with a possible explanation why.

By comparing bacteria with different sensitivities to radiation, the team found that the most resistant bacteria tend to store up high levels of manganese and relatively low levels of iron. By contrast, the bacteria that shrivel up at a hint of radiation have little manganese and more iron.

Deinococcus radiodurans survives extreme blasts of radiation.

Artificially lowering the manganese levels also made bacteria more susceptible to radiation damage, the team reports report in *Science*[1]. "It was quite stunning to us," Daly says.

The marvels of manganese

Daly suggests that the manganese helps to clear up damaging molecules, such as free radicals, that are released by the bugs' metabolism. This leaves the bacteria in a healthier state and better able to patch up DNA damaged by radiation. To test this theory, the team is now trying to create radiation-resistant strains of *Escherichia coli* by pumping up their levels of manganese.

If manganese also proves protective in human cells, Daly foresees numerous uses. A dose of antioxidants that mimic some of the effects of manganese, such as vitamin E, might safeguard the cells of those who are exposed to radiation by a nuclear accident, for example.

The discovery might also help those receiving radiation therapy for cancer, Daly speculates. A drug might be designed that boosts the amount of manganese in healthy cells, but leaves cancerous ones alone. This would render healthy tissue resistant to the radiation, and avoid some side-effects of the therapy. "There's some really important stuff here," Daly says.

But Imlay cautions that such speculation is premature, because the radiation-resistant bacteria might have high manganese for another reason unconnected to their hardiness. The team needs to show exactly how manganese helps bacteria recover from radiation damage, he says.

Before this, scientists have come up with other explanations for the robustness of the bacteria. Last year, a team of scientists proposed that peculiar circular rings of DNA in the bacteria help them patch up their damaged DNA[2]. But Daly grew bacteria in which these rings were missing and showed that they were just as hardy.