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Researchers uncover protection mechanism of radiation-resistant bacterium

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Recent discoveries by researchers at the Uniformed Services University of the Health Sciences (USU) could lead to new avenues of exploration for radioprotection in diverse settings. Michael J. Daly, Ph.D., an associate professor in USU's Department of Pathology, and his colleagues have uncovered evidence pointing to the mechanism through which the extremely resilient bacterium Deinococcus radiodurans protects itself from high doses of ionizing radiation (IR).

The results of the recent study, titled "Protein Oxidation Implicated as the Primary Determinant of Bacterial Radioresistance" were published in the March 20 edition of *PLoS Biology*.

These discoveries likely will cause a shift in D. radiodurans research, changing the focus from DNA damage and repair toward a potent form of protein protection. These findings point to new avenues of exploration for radioprotection, which could eventually influence how individuals are treated for exposure to chronic or acute doses of radiation; could lead to ways to protect cancer patients from the toxic effects of radiation therapy; and may prove significant in efforts to contain toxic runoff from radioactive Cold War waste sites.

Fifty years ago, scientists discovered D. radiodurans, leading to speculation that the incredible degree of resistance exhibited by the bacteria has to do with its mechanism of DNA repair, and the majority of research on the bacteria has centered on this hypothesis. However, D. radiodurans has subsequently shown nothing obviously unusual in its

DNA repair components, and it appears that bacteria at differing levels of resistance sustain the same amount of DNA damage from a given dose of IR. Additionally, many bacteria are killed by IR doses that actually cause very little DNA damage.

In a 2004 study, Daly and colleagues found that resistant and sensitive bacterial cells had significantly different metal concentrations, pointing to high levels of manganese and low iron levels as possible influences on cellular recovery following irradiation. The team showed that the most resistant bacterial species contained approximately 300 times more manganese and three times less iron than the most sensitive species. In the new study, which examined the functional consequences of this disparity, the researchers demonstrated that high cytosolic manganese and low iron concentrations enable resistance by protecting proteins, but not DNA, from IR-induced oxidative damage.

Source: Henry M. Jackson Foundation for the Advancement of Military Medicine

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