Uniformed Services University
of the Health Sciences
4301 Jones Bridge Road
Bethesda, MD 20814-4799

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Contact: Office of External Affairs
Voice: 301-295-1219
Fax: 301-295-3757
Email: anicholson@usuhs.mil

News Release

One Small Step for *Deinococcus* or One Giant Leap for Radiation Biology?

BETHESDA, Md. – Results of a recent study titled "Protein Oxidation Implicated as the Primary Determinant of Bacterial Radioresistance," will be published in the March 20 edition of *PLoS Biology*. The study headed by Michael J. Daly, Ph.D., associate professor at the Uniformed Services University of the Health Sciences (USU), Department of Pathology, shows that the ability of the bacterium *Deinococcus radiodurans* to endure and survive enormous levels of ionizing radiation (X-rays and gamma-rays) relies on a powerful mechanism that protects proteins from oxidative damage during irradiation.

The field of radiobiology is built on the premise that radiation is dangerous because of its damaging effects on DNA. Contrary to that view, Daly *et al* report that the ability of cells to survive radiation is highly dependent on the amount of protein damage caused during irradiation. Surprisingly, a dose of radiation that is sufficient to cause only minor DNA damage in radiation sensitive cells will cause high levels of protein damage compared to resistant cells exposed to the same dose. This new model of radiation toxicity shifts the emphasis away from DNA damage toward protein damage, where DNA repair-related proteins in sensitive cells are devastated by radiation long before DNA is significantly damaged. In contrast, repair enzymes in extremely resistant cells survive and function with great efficiency after irradiation because they are protected, specifically by a chemical mechanism involving manganese (II) ions.

The new model of extreme radiation resistance reconciles many seemingly conflicting results published over the last two decades, and points directly at the existence of potent manganese-based radioprotectors that prevent protein damage. Daly expects that delivery of purified radioprotective Mn-complexes into sensitive cell-types will make them temporarily radiation resistant. This possibility opens up new avenues for radioprotection, including approaches to facilitate recovery from short- or long-term exposures to radiation such as cancer therapies, accident- or terror-related nuclear events, and astronauts exposed to cosmic radiation. Furthermore, given that many bacteria with favorable bioremediation functions are extremely sensitive to radiation, the new insight provided by *D. radiodurans* on how to survive radiation might prove useful in efforts to contain the toxic runoff from the immense radioactive- and heavy metal-contaminated waste sites left over from the Cold War.

The work was funded by the US Department of Energy Office of Science's Environmental Remediation Science Program (ERSP). DOE's Office of Science is the single largest supporter of basic research in the physical sciences in the nation, manages 10 world-class national laboratories, and builds and operates some of the nation's most advanced R&D user facilities. Its website address is www.science.doe.gov.

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The complete manuscript can be read in *PLoS Biology* at: **http://www.plosbiology.org**. *PLoS Biology* is an open-access, peer-reviewed journal that features works of exceptional significance in all areas of biology. In ISI's category of general biology journals, *PLoS Biology* is ranked number-one.

USU is located on the grounds of the National Naval Medical Center in Bethesda, Md. The University provides military and public health-relevant education, research, service and consultation to the nation and the world, pursuing excellence and innovation during times of peace and war.

For more information or to speak with Dr. Daly, call the Office of External Affairs at (301) 295-1219.

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