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News Release

What is Best in Life? - Conan the Bacterium Reveals its Recipe for Survival

BETHESDA, Md. – The discovery of long-sought chemical antioxidants in the world’s toughest microbe is reported in a breakthrough study titled “Small-Molecule Antioxidant Proteome-Shields in *Deinococcus radiodurans*.” First studied nearly 50 years ago, this bacterium can survive massive exposures to gamma-radiation, ultraviolet radiation, desiccation, and other agents which kill cells by generating reactive oxygen species (ROS).

The study, headed by Michael J. Daly, Ph.D., professor at the Uniformed Services University of the Health Sciences (USU) Department of Pathology, appears in the September 3 edition of *PLoS ONE* (<http://dx.plos.org/10.1371/journal.pone.0012570>).

Daly’s team previously reported that *D. radiodurans* accomplishes its astonishing survival feats in an unexpected way – by protecting its proteins from oxidation. This spares DNA repair enzymes from radiation damage and allows the cells to reassemble their broken genomes with extraordinary efficiency. The current study identifies divalent manganese-complexes in *D. radiodurans* cell extracts, which protect purified proteins, and *Escherichia coli* and human cells from extreme cellular insults caused by ionizing radiation. When bombarded by gamma-rays, *D. radiodurans* appears to salvage breakdown products of protein and DNA, endowing mixtures of peptides and orthophosphate with potent ROS-scavenging activities when combined with Mn(II).

When reconstituted, the Mn-complexes were immensely protective of irradiated enzymes, preserving their structure and function, but they did not protect DNA significantly. Prospectively, *D. radiodurans* has presented the scientific community with a novel and highly defensive chemical strategy to combat oxidative stress in diverse settings, including bioremediation of radioactive waste, preparation of irradiated vaccines, long-term protein storage, against ultraviolet rays during sunbathing, during radiotherapy and as we age.

The three-year project was a collaboration between Daly’s group at USU, a team led by Dr. Rodney L. Levine, chief of the laboratory of biochemistry at the National Heart, Lung, and Blood Institute (NHLBI) at the National Institutes of Health and Drs. Juliann G. Kiang and Risaku Fukumoto at the Armed Forces Radiobiology Research Institute (AFRRI) in Bethesda, Md. Funding was by the Air Force Office of Scientific Research (AFOSR) and the intramural programs of the NHLBI and AFRRI. For more information on *Deinococcus* research visit http://www.usuhs.mil/pat/deinococcus/index_20.htm.

The USU, located in Bethesda, Maryland, on the grounds of the National Naval Medical Center, is a traditional U.S. academic health center with a unique emphasis on educating the next generation of health care providers and researchers in military medicine, tropical diseases, humanitarian assistance, as well as responses to disasters and other public health emergencies. USU’s nationally ranked military and civilian faculty conduct cutting edge research in the biomedical sciences and in areas specific to the DoD health care mission. For more information or to speak with Dr. Daly, call the Office of External Affairs at (301) 295-3981.