

WHY DESERT BACTERIA ARE RADIATION RESISTANT? H. J. Sun¹, C. P. McKay², C. D. Georgiou³, and M. Daly⁴. ¹Desert Research Institute, Las Vegas, NV 89119, henry.sun@dri.edu, ²Ames Research Center, Moffet Field, CA 94035, ³University of Patras, Patras - 26500, Greece, ⁴Uniformed Services University of the Health Sciences, Bethesda, MD 20814.

The Earth surface is a low-radiation environment. Yet, paradoxically, bacteria from arid environments are extraordinarily resistant to ionizing radiation. This seemingly useless attribute is traditionally explained as a coincidence: mechanisms that are protective against desiccation are also protective against radiation.

Our recent work suggests that the unusual radio resistance in desert bacteria arose in response to elevated oxidative stress. UV irradiation of minerals produces superoxide and hydroxyl radicals. In the dry summer months, these oxidants permeate to a depth of several centimeters. This is the time when the bacteria in the soil are dried out, unable to deploy their enzymatically-based defense – superoxide dismutase, catalase, peroxidase. To survive, these organisms synthesize antioxidants in the form of low molecular weight compounds such as trehalose, or import inorganic antioxidant manganese from the environment, when they are metabolically active. Ionizing radiation is deleterious mainly because it generates superoxide and hydroxyl radicals. Hence, desert bacteria, being well protected by two layers of defense, are difficult to kill by radiation.