



## **Researching the Effects of the Presence and Absence of Ionizing Radiation (REPAIR): A Biological Investigation Deep Underground**

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### **ABSTRACT:**

Considerable attention has been given to understanding the biological impacts of low dose ionizing radiation exposure. Few studies have ever examined the biological significance of the natural background radiation (NBR) which pervades Earth's surface from sources both cosmic and terrestrial. The major contributing factor to this is that the only location technically suitable for such research is deep underground, where the rock overburden uniquely shields components of NBR. Researching the Effects of the Presence and Absence of Ionizing Radiation (REPAIR) is a novel deep underground research experiment located 6,800 ft. (2km) underground. We hypothesize that NBR is essential for life and maintains genomic stability, and that prolonged exposure to sub-background radiation environments will be detrimental to biological systems. To this end, the REPAIR Project has recently established the technical infrastructure necessary to perform tissue culture based molecular biology experiments deep underground to investigate this unique research question. We are testing this hypothesis using characterized tissue culture models, which are being grown underground and in surface control laboratories at NOSM. A specialized tissue culture incubator (STCI) allows for control and reduction of NBR components below ambient surface levels. Experimental endpoints include growth rates, radiation survival challenges, gene expression analysis among other molecular assays. Quantitative dosimetry of gamma, neutron and radon components of NBR have been performed in surface and control laboratories and validate levels within the STCI are reduced below ambient surface concentrations. Protracted tissue culture based experimentation is currently in progress at the surface and within the novel STCI where sub-NBR levels are maintained. Utilizing unique model systems and a novel research environment deep underground, the REPAIR Project is working to elucidate the biological significance of terrestrial and galactic cosmic NBR.