Directed Radioresistance via Genetic Engineering (Year V)

Schieman, Maximus (School: Satellite High School)

Ionizing radiation, including atomic radiation and high energy electromagnetic radiation, causes numerous adverse health effects. Ionizing radiation creates fear which limits the potential for nuclear energy. Cosmic radiation limits extraterrestrial exploration. Ultraviolet radiation is responsible for 90% of non-melanoma skin cancers and 65% of melanoma cases (Kim, 2014). Ionizing radiation was repeatedly induced into Saccharomyces cerevisiae cultures throughout subsequent generations. Through this repeated ionization, cells could resist cellular damage and other mutations caused by further radiation. S. cerevisiae possess the Ogg1 (8-OxoGuanine Glycosylase) gene which repairs damaged DNA during cell division. Irradiating S. cerevisiae culture generations before and during the exponential phase, suggests that the cells could result in radioresistance. An analysis of radioresistant genes (Ogg1, Rad52, Rad6, Rad3) within S. cerevisiae was conducted by irradiating strains with and without the genes. A comparison of the strains will suggest which genes, if any, provide for radioresistance. A CRISPR application with the dCas9-VP64 activator (RNP complex) was implemented within the genome of S. cerevisiae, targeting regions of the DNA with the genes that were determined to contribute to radioresistance. If enhanced expression occurs, S. cerevisiae may become an extremophile and resist ionization. Radiation resistance was indicated by X1 and X2 cells. The cells maintained a steady average percentage of area occupied similar to control group. No mutations were apparent for X1 and X2 cells. Despite contamination, cells expressing RNP complex were observed microscopically. The ANOVA indicated no statistical significance and the null hypothesis failed to be rejected.