Novel Mutations in *Escherichia coli* that Increase the UV Radiation Survival of a *uvrA* Strain

Quynh V. Duong, Deborah A. Hudman, M.S., Neil J. Sargentini, Ph.D.

Department of Microbiology and Immunology, A.T. Still University of Health Sciences, Kirksville College of Osteopathic Medicine; Kirksville, Missouri, USA

**Background:** Our lab has an on-going study to identify genes in *Escherichia coli* involved in DNA repair after UV- or X-ray radiation treatment. Previously, we screened the Keio collection of 3,909 single-gene knock-out mutants for this purpose and identified 70 genes, in which a knockout mutation produced a strain showing increased killing after UV irradiation. The focus of the current study was to begin to determine the mechanistic basis of these strains showing increased radiation sensitivity, which we assume to be due to defects in the nucleotide excision repair (NER) or recombination repair (RR) mechanisms.

**Methods:** We transduced the mutations into a *uvrA* strain (deficient in NER) and tested each constructed double-mutant strain for UV radiation sensitivity. Unexpectedly, some double-mutant strains exhibited less radiation sensitivity than the *uvrA* parent strain. For this reason, five strains were re-constructed by first transducing the Keio mutation of interest into a wild-type strain (SR749), and then transducing a *uvrA::Tn10* mutation into each strain to create a new double-mutant strain.

**Results:** Of the 70 Keio mutations tested for their effect on UV radiation sensitivity in a *uvrA* strain, 10 mutations increased radiation sensitivity, suggesting they compromised RR. Thirty-three mutations had no effect on radiation sensitivity, suggesting they compromised NER (or some repair mechanism other than RR). Surprisingly, 27 mutations seemed to make the *uvrA* parent strain less sensitive, suggesting they suppressed the *uvrA* defect in NER or made some other DNA repair mechanism more efficient. To verify this interesting phenotype for this last set of mutations, five Keio mutations showing the largest effect (*bgfJ, groL, thyA, upp, xerD*) were selected for a different approach to construct *uvrA* Keio mutation double-mutant strains. A UV radiation survival test was applied to these five new double-mutant strains. The results were that two *uvrA::Tn10* strains (with *groL* and *thyA*) showed less sensitivity than the *uvrA::Tn10* parent strain, confirming the earlier result. However, two other *uvrA::Tn10* strains (*upp* and *xerD*) were not less sensitive, and one strain (*bgfJ*) had the same sensitivity as the *uvrA::Tn10* strain.

**Conclusions:** The genetic control of radiation survival in *Escherichia coli* currently seems much more complicated and involves many more genes than previously expected.

**Responsible Author:** Neil J. Sargentini, Ph.D., nsargentini@atsu.edu; 660.626.2559

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