A Dual Reporter Bacterial Biosensor Using Bacterial Luciferase and Green Fluorescent Protein to Simultaneously Detect Oxidative and Genotoxic Conditions

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Using the genes for the green fluorescence protein and bacterial luciferase and the promoters for the recA and katG genes, three Escherichia coli biosensors have been constructed contain two reporter systems on a single plasmid. DUO1 has a recA::GFPuv4 fusion gene oriented divergently with that of the katG::luxCDABE fusion operon while in DUO2 they are in a tandem orientation with the recA promoter controlling the expression of GFPuv4 and, in concert with the katG promoter, luxCDABE expression. DUO3 harbors a katG::GFP fusion gene divergent to that of a recA::lux fusion operon. These cells respond to DNA and oxidative damage, resulting in a higher fluorescence and bioluminescence under respective toxic conditions. The responses were characterized with several toxicants that induce these promoters, e.g., mitomycin C, hydrogen peroxide and cadmium chloride, as well as others. To demonstrate the specific responsiveness of these strains to these two stresses, several chemical mixtures that elicit different stress responses were tested. Results show that these strains are capable of measuring individual toxic responses both in a single chemical sample and in chemically complex systems