Bio Detectors for Radiation Detection: Diversifying the System

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Ionizing radiation causes DNA and protein damage, which triggers induction of the genes encoding proteins that repair DNA, or respond to protein damage. In *Escherichia coli* and other heterotrophic bacteria, some systems can provide linear responses to gamma-ray doses of 1 - 50 Gy. However, the same response genes can be triggered by other stresses.

Currently reported radiation-sensitive systems include combinations of genes involved in SOS response in *Esherichia coli* which are used as sensor genes with the *lux* gene used as a reporter. All so far developed systems have been constructed and maintained in *Escherichia coli* and contributed to our understanding of basic processes of radiation response in this organism. However, these systems have strong disadvantages and limitations for field applications due to the biology of *Esherichia coli* as the host (low viability, sensitivity to desiccation and environmental factors, pathogenicity etc.) and to the dose-response limitations of its SOS-system and *lux* reporter system used.

We propose a bioscintillator that will utilize stable, desiccation-tolerant food-grade bacteria or yeast, or non-pathogenic algae capable of withstanding high levels of radiation. We propose to use sensory genetic systems with a response specific for ionizing radiation. The gene for *gfp* (Green Fluorescent Protein) will be used as a reporter thus providing additional performance assurance to the system and options for both remote and local sensing.

The design, a plan for its implementation and testing of the system will be discussed. This mix-and-match design that involves different hosts and a variety of genetic systems will allow robustness and performance assurance of the bioscintillator under different environmental conditions and over an extended dose range. A co-design of "bioware" and hardware will also be addressed.