Bioluminescent bioreporter integrated circuit sensing of the chemical and biological spacecraft environment

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Advancements in lux-based bioluminescent bioreporter design and application have produced novel monitoring technologies for rapid (<30 minutes), sensitive (part-per-billion), and specific detection of chemical and biological agents within complex environmental matrices. These bioreporter systems rely on lux gene fusions with characterized promoter elements responsive to the agent(s) of interest for autonomous, real-time generation of bioluminescent signals. Typical application emphasis has been towards chemical contaminant detection and monitoring, but novel engineering schemes have produced bioluminescent bioreporters sensitive to microorganisms (i.e., bacterial pathogens) as well. In addition, bioreporters can be microelectronically interfaced with miniaturized integrated circuit luminometers for wireless sensor deployment for pinpointing locations or time events of potential biohazardous concern. The low-power, low-mass, and low-maintenance characteristics of these bioluminescent bioreporter integrated circuit (BBIC) detectors provides extensive compatibility with current spacecraft monitoring needs. We will present an overview of our current research efforts towards the establishment of multiarray BBICs for tailored sensing of the spacecraft environment.