Fluorometric Detection of Microorganisms on Sterilized Surfaces

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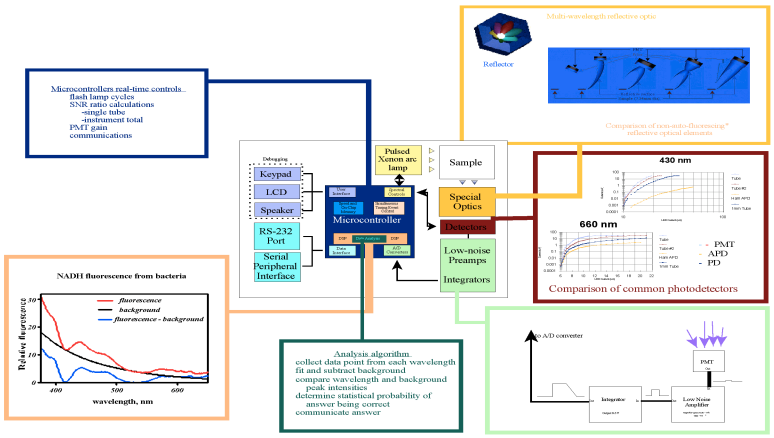

Figure 1. Block Diagram of Prototype Device

Description

We propose to develop and test non-contact sensors for determining the presence of microorganisms on surfaces with very low expected bacterial counts. Such surfaces could be encountered in purposely sterilized surfaces on space flight instruments and hardware as well as in desert soils that have extremely low water content.

There is considerable interest in Code U in the ability to monitor the microbial load of surface on the Space Station. This same requirement is present for Code S in terms of control of bioload on spacecraft surfaces as part of the planetary protection protocols. Of interest to Astrobiology is the study of microbial life in extreme environments. In extreme deserts the environment can be so extreme that there are virtually no life forms present. The ability to do *in situ* assays of the microbial population of these almost sterile soils would be of benefit to field studies.

Instrumentation will be developed based on the intrinsic fluorescence signatures of amino acids, structural proteins, metabolites, and DNA/RNA which will be capable of detecting ~10^2 cells/cm^2 and distinguishing live cells, spores, and proteinaceous matter *in situ*.

Innovative Claims/NASA Significance

Detection of low-level microbial populations on surfaces and in liquids is of interest to both Earth Science and Space Science. It is of value in the context of space hardware contamination control, environmental monitoring to protect crew health and the search for life. Today, NASA's search for life is taking place at the edges of the Earth's biosphere (extreme terrestrial environments) and beyond (Mars and the moons of the outer planets). The life detection approach proposed here has the potential to provide NASA with a powerful tool for *in situ* non-destructive detection and characterization of microbes that will make a significant contribution in high priority areas such as life detection in the solar system, life detection in extreme terrestrial environments, health of humans in space, and planetary protection. The potential applications of this instrument to NASA projects includes: Life Sciences Experiments on the Space Station, planetary protection and life detection on planetary missions, and non-contact and rapid field studies of life in extreme environments.

Plans

Milestones and deliverables for the first year include selection of intrinsic fluorescence markers for the instrumentation development, analysis algorithms employing these markers, and development and construction of a fully tested bench-top prototype instrument.

The second year milestones and deliverables consist of results from the application of the bench-top prototype instrument to samples from extreme environments, design of a portable prototype instrument based on these results, and a fully tested portable prototype instrument.

The third year milestones and deliverables are the results of application of the portable prototype instrument to *in situ* measurements in extreme environments and on spacecraft surfaces.