NASA SBIR/STTR Technologies

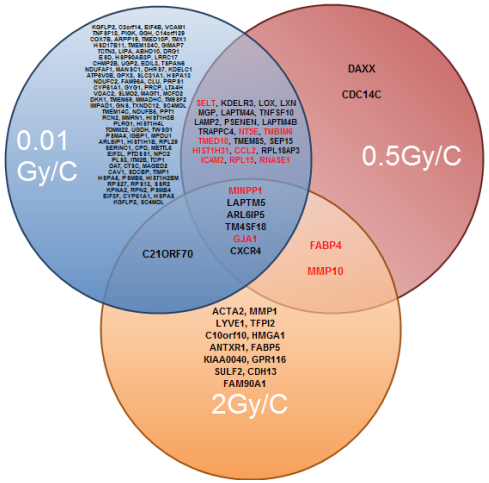
T1.02-9952 - Non-destructive Detection and Separation of Radiation Damaged Cells in Miniaturized, Inexpensive Device

PI: Kapil Pant, CFD Research Corporation, Huntsville, AL

Identification and Significance of Innovation

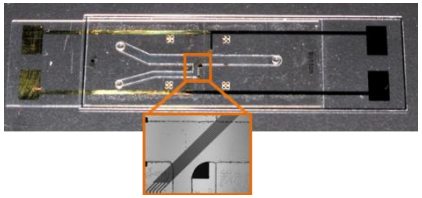
- Deep-space exploration flights carry with them a high risk to human health, particularly from exposure to space radiation Diagnosis of exposure, development of protectants/ countermeasures depend on the ability to accurately identify and separate rare genetically altered and damaged cells
- Current methods for identification and separation of these cells are manual labor intensive and require central laboratories
- There is a clear need for using novel, non-destructive surface markers in conjunction with a miniaturized, automated device to sort radiation damaged cells

Expected TRL Range at the end of Contract (1-9): TRL-3



Genes implicated in radiation damage

Bead decoration of radiation-damaged cells



Microfluidic chip for sorting and counting of radiation-damaged cells

Technical Objectives

- Our overall objective is to identify, separate and count radiation damaged cells from cell samples, in a miniaturized, microfluidic platform. Specific technical objectives are:
- Identify novel cell surface markers indicating radiation damage using microarrays (gene expression) followed by validation
- Demonstrate automatic sorting and counting of tagged cells using Dielectrophoretic (DEP) sorting and Electrical Impedance Spectroscopy (EIS) based counting technology

Work Plan

- Endothelial cells (both primary and cell line) were radiated with dose of 0.01 to 10 Gy. Gene expression studies were performed to identify biomarkers of radiation damage. RT-PCR and FACS were used to verify and validate identified biomarkers. Comet assay was used to assess DNA damage.
- DEP response of bead-decorated cells was obtained. Cell sorting and counting of tagged cells was demonstrated

NASA and Non-NASA Applications

The technology will enhance NASA's capability for research on protective and preventive countermeasures ensuring astronaut health and performance. It will also benefit efforts focused on other space-induced biological phenomena such as bone loss, immune modulation, oxidative stress and altered gravity effects on gene expression.

Non-NASA applications include:

- Pharmaceutical and drug discovery companies
- Ex-vivo and cellular therapies
- Pre-clinical and clinical researchers
- Hospital & health site diagnostics/monitoring

Firm Contacts

Dr. Kapil Pant, CFDRC, kxp@cfdrc.com, (256) 327-0663
Dr. Mohammad Kiani, Temple, mkiani@temple.edu, (215) 204-4644

NON-PROPRIETARY DATA