The Effects of Microgravity on the Metastasis of Cancer Cells.

E. E. Williams[1], N. Miller[2], E. Ancel[2], C. Manarinjara[1], S. Moore[1], C. Sczamarski[2], D. Tollaver[2], and S. Ullah.
[1]Dept. of Biological Sciences, Salisbury University, Salisbury, MD, and [2]Dept. of Mechanical Engineering, Old Dominion University, Norfolk, VA.

A key characteristic of metastatic cancer cells is their increased deformability compared to normal cells and to non-metastatic cancer cells. This enhanced deformability is though to be a result of changes in cytoskeletal structure and membrane organization. Experiments with cells in space have shown that microgravity profoundly influences both the cytoskeleton and the structure of cell membranes. Thus microgravity might influence the ability of cancer cells to metastasize (i.e., escape their primary tumor and invade new tissues). Currently, little is known about the relationship between microgravity and the ability of cancer cells to metastasize. Drawing on our experience with murine leukemia cells (T27A line) on an earlier rocket flight, we have designed, constructed and tested a second generation payload instrument that will allow us to simultaneously measure tumor cell deformability in nine independent chambers during suborbital rocket flight. The deformability assay is based on the ability of tumor cells to survive being hydrostatically forced through filters with very small and very well defined pores. Surviving cells are chemically fixed upon entering the post-filter chambers and counted after payload retrieval. One g bench tests using in-flight protocols showed that 105.5% (± 6.2 SEM) of cells survived passage when no filters were present. In tests using filters with pores of 1, 5, and 8 μm, survival rates were, respectively, 7.6% (± 2.4), 79.0% (± 4.1), and 97.9% (± 3.7) (The cells are approx. 10μ in diameter; all values are based on a minimum of 12 triplicate tests). These results indicate that this assay as performed by this instrument will be able to detect microgravity-induced changes in cell deformability during rocket flight, which is anticipated to launch in 2007.

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