RADIATION MONITORING CONTAINER DEVICE (16-IML-1)

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As the era of Space Station Freedom and solar system travel approaches, it becomes increasingly important to develop radiation protection for the people who will live and work in space for long durations. As we know, the Earth's atmosphere, a dense blanket of air, effectively protects us from most of the space radiation, particularly against the high-energy radiation at levels lethal to most living species. Beyond the Earth's atmosphere, what can protect life from such damaging radiation? This experiment with the Radiation Monitoring Container Device is designed by NASDA to give a preliminary answer to this question. The investigation measures the radiation levels inside the space transportation systems like shuttle and looks at basic effects from the aspect of radiation biology. The data gathered will be analyzed to understand any interrelation between the physical properties of the radiation and its biological effects and used to develop a sensitive solid-state nuclear track detector for future space systems.

In this experiment, layers of the radiation detectors and biological specimens, bacterial spores (Bacillus subtilis), shrimp eggs (Altemia salina), and maize seeds (Zea mays) are sandwiched together in the Radiation Monitoring Container. The detectors, sheets of plastic materials (TS-16 and CR-39), record the nuclear track of cosmic radiation. The dosimeter package contains conventional detectors made of materials such as lithium fluoride or magnesium-silica-terbium. These thermoluminescent materials (TLD) will, when moderately heated, emit luminescent photons linearly depending upon the dose of radiation received. The experiment, enclosed in a box-like container, is mounted on the aft end cone of the Spacelab, the area where the shielding is somewhat less than other locations.

Each plastic detector in the device can register individual nuclear tracks in three dimensions while the TLD accumulates radiation energy. The biological specimens in the device are exposed to cosmic radiation for approximately 6 days during the mission. All specimens and radiation detectors are analyzed after the mission to correlate the radiation characteristics and biological effects. The plastic detectors are etched chemically to visualize the radiation tracks called "etch pits". The geometric properties of the etch pit can reveal the physical characteristics of the radiation, such as incident angle, energy, and nucleon type. Three-dimensional trajectories are analyzed by a computerized microscopic image handler with a three-dimensional stage controller, and reconstructed through the piled detector sheets in relation to the positions of the biological specimens. The specimens will be evaluated for radiation effects by biological and biochemical methods using such intrinsic characteristics as the processes of development, sporulation, hatching, and germination. Primary genetic studies will also be carried out at the cellular, organ, and individual levels.

SECTION II

MICROGRAVITY SCIENCE