EXOBIOLOGY EXPERIMENT CONCEPTS FOR SPACE STATION

L.D. Griffiths, MATSCO, Washington, DC
D.L. DeVincenzi, NASA Headquarters, Washington, DC

The exobiology discipline uses ground-based and space flight resources to conduct a multidiscipline research effort dedicated towards understanding fundamental questions about the origin, evolution, and distribution of life and life-related molecules throughout the universe. Achievement of this understanding requires a methodical research strategy which traces the history of the biogenic elements from their origins in stellar formation processes through the chemical evolution of molecules essential for life to the origin and evolution of primitive and, ultimately, complex living species. Implementation of this strategy requires the collection and integration of data from solar system exploration spacecraft and ground-based and orbiting observatories and laboratories.

The Science Lab Module (SLM) of the Space Station orbiting complex may provide an ideal setting in which to perform certain classes of experiments which form the cornerstone of exobiology research. These experiments could demonstrate the pathways and processes by which biomolecules are synthesized under conditions that simulate the primitive Earth, planetary atmospheres, cometary ices, and interstellar dust grains. For some of these experiments, gravity is a critical factor. Others may require exposure to the ambient space environment for long periods of time. Still others may require on-orbit preparation, servicing, maintenance, fixing, and analysis of samples. The pressurized SLM provides sufficient duration in the space environment and the crew interactions needed to assure implementation of these investigations.

Exobiology experiments proposed for Space Station generally fall into four classes: interactions among gases and grains (nucleation, accretion, gas-grain reactions), novel high-energy chemistry for the production of biomolecules, physical and chemical processes occurring on an artificial comet, and tests of the theory of panspermia. Clearly, many of these simulations contain aspects of interest to the planetary sciences such that a close coupling between these disciplines will maximize science return and promote a more efficient use of resources.