STS-106

Protein Crystal Growth (PCG) Enhanced Gaseous Nitrogen (EGN) Dewar

In-Cabin

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Overview

The primary purpose of the EGN Dewar experiment is to demonstrate a low-cost platform for conducting a large number of experiments to determine the optimum conditions for growing large, high-quality protein crystals in space. Researchers require crystals of sufficient size and suitable quality for crystallographic analysis of their molecular structure by X-ray diffraction and computer modeling. EGN promises to give researchers greater access to space and the opportunity to conduct a statistically significant number of experiments per mission, which will increase the likelihood of obtaining crystals worthy of X-ray analysis.

Researchers will also use data from EGN in selecting the methodologies and proteins for future liquid-liquid diffusion experiments which will investigate the factors that influence the nucleation, growth, order, and stability of crystals and determine the effects of microgravity on those phenomena.

Protein samples are flash frozen before a mission and placed inside the Dewar, a vacuum-jacketed container similar to a thermos bottle. An absorbent inner liner is saturated with liquid nitrogen, which keeps the samples frozen until they reach orbit. As the system absorbs heat, the nitrogen boils away and the samples begin to thaw. Crystals begin to grow when the samples have completely thawed.

Astronauts will transfer the EGN payload from Atlantis' middeck to the International Space Station, where the crystals will continue to grow until the package is returned to Earth for analysis on the next Shuttle mission. EGN is the the first microgravity science experiment to be conducted on board the International Space Station.

EGN is upgrade of an experiment that was flown on Shuttle-Mir missions. The earlier version allowed the samples to thaw gradually over 12 to 20 days. The enhanced version incorporates heaters that will control the rate of nitrogen boil-off and, thus, the rate of thawing. The new design also includes devices for recording the temperatures inside the Dewar and storing the data.

History/Background

The gaseous nitrogen Dewar was flown on five Shuttle-Mir missions祐TS-71, 74, 76, 79, and 81. The experiment packages were transferred from the Shuttle orbiter to a module of the Mir station, and the samples were allowed to grow uninterrupted until the next Shuttle mission.

Benefits

Proteins play an important role in every biochemical reaction in plants and animals. In order to understand the basic processes of living things, scientists must first understand proteins. Computer models of the structures of protein crystals grown in the near-vacuum of space are expected to improve their understanding of the function and behavior of proteins. Scientists also hope to learn more about why biological crystals grow differently in space than they do under the influence of Earth's gravity.