Commercial Generic Bioprocessing Apparatus (CGBA)

In-Cabin

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Overview

CGBA experiments that explore the ways biological processes are affected by microgravity—the near-weightlessness of space—may allow researchers to better understand the nervous system. Scientists also plan to use the CGBA to investigate growing human tissue for use in surgical procedures such as skin grafts and organ transplants and in developing medicines.

Two experiments will be conducted on STS-106.

Synaptogenesis in Microgravity

This primary experiment will examine how space flight affects the developing nervous system of the fruit fly (*Drosophila melanogastor*). Researchers are particularly interested in learning how nerves that control movement navigate through the embryonic central nervous system and attach to the muscle fibers they will control and how synapses, which are the communication junctures between nerves where signals are transferred from one nerve to another, differentiate and develop to their mature form during embryonic and postembryonic life.

The fruit fly is an ideal model for studying the effects of microgravity on normal developmental processes because its development on Earth is well characterized and it has a small set of genes. A better understanding of these effects could have implications not only for long-term space travel, but also for processes related to various diseases and the disorders of aging.

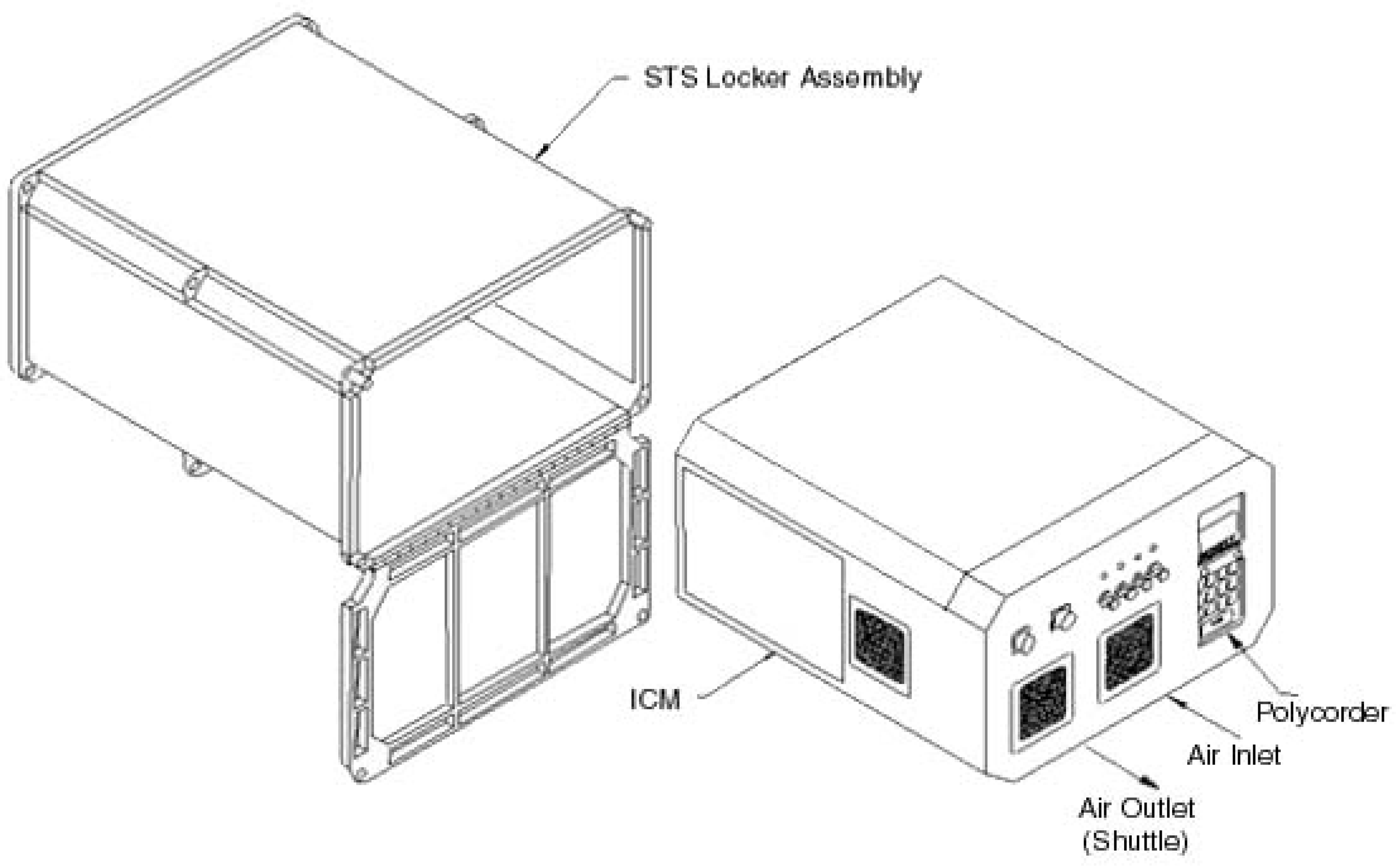
Kidney Cell Gene Expression

The second experiment is a follow-up to an STS-90 investigation. In that earlier experiment, microgravity caused large-scale alterations in kidney cell genes. The follow-up experiment will examine how microgravity alters the gene expression in kidney cells that ultimately enables kidneys to develop and function normally.

The ultimate goal of this experiment is to manipulate the kidney cells to produce specific tissues for use in humans or as models in developing medicines. Cells grown in suspension in space can join together and form three-dimensional tissues similar to their counterparts in an intact organ. These tissues are difficult to produce in Earth's gravity.

History/Background

The Commercial Generic Bioprocessing Apparatus allows automated in-flight processing of a variety of biological experiments contained in eight individually programmable, temperature-controlled devices. The CGBA payload hardware consists of the generic bioprocessing apparatus (GBA), which occupies a single middeck locker, and the isothermal containment module (ICM), a middeck locker apparatus for storing biological samples in a temperature-controlled environment.



The GBA is a self-contained mixing and heating module for processing biological fluid samples. Up to 120 triple-contained glass syringe fluid samples (in Lexan sheaths) are stored in either the ICM or a middeck locker. These fluids are manually mixed in the syringes and transferred to containment vials that are heated and incubated. At the end of the incubation period, the fluid vials are returned to the ICM or stowage locker.

The ICM maintains a preset temperature environment, controls the activation and termination of the experiment samples, and serves as an interface for crew interaction, control, and data transfer.

The fruit fly experiment will occupy seven sample containers, and the kidney cell gene expression experiment will occupy the eighth.

The Commercial Generic Bioprocessing Apparatus is a cooperative commercial experiment facility sponsored by NASA's Space Product Development Program at the Marshall Space Flight Center in Huntsville, Ala. BioServe Space Technologies designed, built, and manages the apparatus. BioServe is a NASA Commercial Space Center with facilities at the University of Colorado in Boulder and Kansas State University.

Yale University and NASA's Ames Research Center at Moffett Field, Calif., are conducting the fruit fly research, which is cosponsored by the National Institutes of Health. The Fundamental Biology Program at Ames is sponsoring the kidney cell experiment.

Various configurations of CGBA have flown on 13 previous Space Shuttle missions and 2 Mir missions. The CGBA technology is being advanced and refined for future use on the International Space Station.

Benefits

The interdisciplinary nature of this research offers unique educational opportunities for undergraduate and graduate students. Improving applications and developing new products will benefit U.S. industry, enhance the quality of life, and propel the field of biotechnology toward new frontiers.