

as mechanical noise to the soles of the feet, or when applied as electrical noise at the knee and to the back muscles.

SR using imperceptible stochastic electrical stimulation of the vestibular system (stochastic vestibular stimulation, SVS) applied to normal subjects has shown to improve the degree of association between the weak input periodic signals introduced via venous blood pressure receptors and the heart-rate responses. Also, application of SVS over 24 hours improves the long-term heart-rate dynamics and motor responsiveness as

indicated by daytime trunk activity measurements in patients with multi-system atrophy, Parkinson's disease, or both, including patients who were unresponsive to standard therapy for Parkinson's disease. Recent studies conducted at the NASA JSC Neurosciences Laboratories showed that imperceptible SVS, when applied to normal, young, healthy subjects, leads to significantly improved balance performance during postural disturbances on unstable compliant surfaces. These studies have shown the benefit of SR noise characteristic opti-

mization with imperceptible SVS in the frequency range of 0–30 Hz, and amplitudes of stimulation have ranged from 100 to 400 microamperes.

This work was done by Jacob Bloomberg and Millard Reschke of Johnson Space Center; Ajitkumar Mulavara and Scott Wood of USRA; Jorge Serrador of Dept. of Veterans Affairs NJ Healthcare System; Matthew Fiedler, Igor Kofman, and Brian T. Peters of Wyle; and Helen Cohen of Baylor College. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-25013-1

Developing Physiologic Models for Emergency Medical Procedures Under Microgravity

Lyndon B. Johnson Space Center, Houston, Texas

Several technological enhancements have been made to METI's commercial Emergency Care Simulator (ECS) with regard to how microgravity affects human physiology. The ECS uses both a software-only lung simulation, and an integrated mannequin lung that uses a physical lung bag for creating chest excursions, and a digital simulation of lung mechanics and gas exchange. METI's patient simulators incorporate models

of human physiology that simulate lung and chest wall mechanics, as well as pulmonary gas exchange.

Microgravity affects how O₂ and CO₂ are exchanged in the lungs. Procedures were also developed to take into account the Glasgow Coma Scale for determining levels of consciousness by varying the ECS eye-blinking function to partially indicate the level of consciousness of the patient. In addition, the ECS was modi-

fied to provide various levels of pulses from weak and thready to hyper-dynamic to assist in assessing patient conditions from the femoral, carotid, brachial, and pedal pulse locations.

This work was done by Nigel Parker and Veronica O'Quinn of Medical Education Tech, Inc. for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-23922-1

PMA-Linked Fluorescence for Rapid Detection of Viable Bacterial Endospores

This method has applications in the pharmaceutical, food microbiology, semiconductor, and other industries requiring surface sterilization.

NASA's Jet Propulsion Laboratory, Pasadena, California

The most common approach for assessing the abundance of viable bacterial endospores is the culture-based plating method. However, culture-based approaches are heavily biased and oftentimes incompatible with upstream sample processing strategies, which make viable cells/spores uncultivable. This shortcoming highlights the need for rapid molecular diagnostic tools to assess more accurately the abundance of viable spacecraft-associated microbiota, perhaps most importantly bacterial endospores.

Propidium monoazide (PMA) has received a great deal of attention due to its ability to differentiate live, viable

bacterial cells from dead ones. PMA gains access to the DNA of dead cells through compromised membranes. Once inside the cell, it intercalates and eventually covalently bonds with the double-helix structures upon photoactivation with visible light. The covalently bound DNA is significantly altered, and unavailable to downstream molecular-based manipulations and analyses. Microbiological samples can be treated with appropriate concentrations of PMA and exposed to visible light prior to undergoing total genomic DNA extraction, resulting in an extract comprised solely of DNA arising from viable cells. This ability to extract DNA

selectively from living cells is extremely powerful, and bears great relevance to many microbiological arenas.

While this PMA-based selective chemistry has been applied to several polymerase chain reaction (PCR)-based molecular protocols, it has never been coupled with fluorescence *in situ* hybridization (FISH)-based microscopic methods. FISH microscopy is a powerful technique for visualizing and enumerating microorganisms present in a given sample, which relies on the ability of fluorescently labeled oligonucleotide probes to gain access to, and hybridize with, specific nucleic acid sequences within cells. Dogmatic princi-