Area of Research:
Neuroautonomic Cardiovascular Regulation

NASA Program:
Biomedical Research and Countermeasures

NASA Field Center:
Johnson Space Center, Houston, Texas 77058

Abstract:

Work in the Neuroautonomic Laboratory is currently focused on research involving the neural control of the heart and autonomic cardiovascular regulation. Present efforts are especially focused on both clinical research and on advanced technology development in the field of computerized electrocardiography (ECG). There is evidence to suggest that long-duration spaceflight may be associated with an increased propensity for ventricular arrhythmia, mediated in part by changes in the autonomic nervous system. Episodes of myocardial ischemia during long-duration space flight are also of potential concern, and improved methods for prediction and early detection of both arrhythmia and ischemia are desired. The Neuroautonomic Laboratory has recently developed or enabled several advanced ECG-based algorithms in software that can potentially predict both arrhythmia and myocardial ischemia well in advance of conventional ECG-based techniques. A key aspect of these algorithms is that they also function in real-time, rather than just offline, and so provide clinicians, including space medical clinicians, with enhanced real-time monitoring capabilities.

Software developed in the Neuroautonomic Laboratory is currently being utilized in collaborative clinical research studies in several institutions in the United States. These institutions include the Mayo Clinic in Rochester, MN (Dept. of Cardiovascular Anesthesiology), the Texas Heart Institute in Houston, TX (Heart Failure and Cardiac Transplantation Clinics), the University of Texas at Houston and the University of Texas Medical Branch at Galveston, TX (Cardiology Divisions), the Carolinas Medical Center in Charlotte, N.C. (Dept. of Emergency Medicine), the New York University (Autonomic Laboratory), and the United States Navy (Pensacola, FL). The ECG algorithms currently being employed in these studies utilize techniques such as advanced signal averaging (e.g., real-time multichannel high frequency QRS ECG), advanced heart rate variability (e.g., real-time “deterministic chaos” HRV, etc.), and advanced real-time QT and PR interval variability techniques.

Postdoctoral fellow applicants may choose either of the following tracks or a combination of the two:

1) Clinical Science track, with focus on conducting clinical trials and publishing (in physiology and/or clinical medical journals) the results of ECG-related scientific protocols carried out at NASA and/or in conjunction with our clinical partners, as noted above

2) Bioengineering/Computer Science track, with a focus on developing advanced electrocardiographic technologies, especially software-based ECG technologies in the C or C++ programming languages, with concomitant pursuit of publications in bioengineering journals