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TITLE: CAUSATIVE AGENTS DURING SPACE MOTION SICKNESS

INVESTIGATORS: W. E. Thornton, M.D., NASA JSC/CB

1.0 SCIENCE OVERVIEW

1.1 Hypothesis and Objectives

The purpose of this DSO is to attempt a broad band search for changes in blood components that would indicate possible humoral agents causing or affecting space motion sickness. The components being analyzed are the neuro-hormones and the gastro-intestinal hormones with the exception of vasoactive intestinal peptides. The plasma will be analyzed for the following: nor-epinephrine, epinephrine, serotonin, vasoactive intestinal peptide, and insulin. If blood quantities permit, leuco enkephalin and somatostatin analysis will also be performed. It is hypothesized that changes in any of these components during space motion sickness (SMS) would indicate possible humoral agents causing or affecting SMS. Identification of causative agents would be the first step in developing a countermeasure for SMS.

1.2 Justification

From our inflight studies on STS-4 through STS-8, it appears that the cause of space motion sickness is a sensory conflict, probably intravestibular, which is transmitted to both brain and gastrointestinal track in some way as yet unknown. The results are a cessation of or great reduction of G.I. motibility, with anorexia, reflex vomiting, and variable sensitivity to motion along with malaise, lethargy, somnolence, and headache. The possible modes of transmission are: (1) by neural pathways (nervous), (2) by blood-borne hormone or hormone-like substances (humoral), or (3) possibly a combination. While there is little, other than individual prejudice, to suggest one method over the other at this time, there are great implications for treatment. To track the neurological mechanisms is a formidable and possibly impossible task at this time, with no reason to believe that countermeasures would be possible. Conversely, if humoral agents can be found and identified, there is a high probability that they can be blocked or otherwise modified. Thus, a countermeasure for SMS could be rapidly developed.

Advisors for the proposed studies are:

° Dr. William McGaugh, Chairman of the Center for Neurobiology and Learning, University of California at Irvine (Neurology).

° Dr. DeMeester, Chairman of the Department of Surgery, Creighton University (Gastro-Intestinal Motility).

Others that have contributed are:

° Dr. William Bunney, Chairman of the Department of Psychiatry UCI (formerly NIMH).

° Dr. James Thompson, Chief, Department of Surgery, UTMB.

° Dr. Alphin, A. H. Robins (Pharmacological Development).

1.3 Repetitions

Blood samples are required from a minimum of eight subjects affected with SMS. Therefore, this DSO should be assigned to sufficient flights to obtain a total of eight SMS subjects on which blood has been obtained early with onset of SMS, on each day with SMS, and after symptoms clear.

1.4 Investigation Design

This DSO will be performed by the STS crew on a voluntary basis. Venous blood will be obtained from subjects with active SMS and later in the flight when symptoms have cleared. The serum samples are analyzed post-flight to determine any humoral changes from baseline values.

1.4.1 Flight Investigation

Blood will be collected from each STS crewmember affected with SMS (voluntary basis) early and mid-mission. An inflight sample 2-3 days after symptoms have cleared is also collected. Postflight, blood is collected from participating crewmembers as part of the scheduled physicals. The inflight samples are obtained using standard venipuncture techniques/hardware using EDTA-treated collection tubes. The samples are centrifuged, and the tubes are stored frozen until they are returned to the investigator.

1.4.2 Supporting Ground-Based Investigation

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1.5 Data Analysis and Reporting

The samples will be analyzed postflight. After each flight, a status report will be prepared by L+45 days. After collection of all data required is completed, a detailed summary report will be prepared. The plan for sample analysis is as follows: Dr. W. McGaugh's laboratory will perform all analysis with the exception of vasoactive intestinal peptide and insulin, which will be performed by a selected commercial immunonuclear laboratory.