PROJECT NUMBER: **NASA-WASHINGTON PROJECT- NAGW 1998**

TITLE: **NASA SUPPORTING STUDIES FOR MICROGRAVITY RESEARCH ON EYE MOVEMENTS- FINAL TECHNICAL REPORT**

PRINCIPAL INVESTIGATOR: **BERNARD COHEN, M.D.**

INSTITUTION: **MOUNT SINAI SCHOOL OF MEDICINE**

DATES OF PROJECT: **1/1/90 - 12/31/90**

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FINAL REPORT:

The purpose of the work on this project was to provide support for ground-based studies on the effects of gravity on eye movements. In this research we investigated the efffects of microgravity on the optokinetic eye movements of humans. OKN was induced by having subjects watch 3.3° stripes moving at 35°/s for 45 s in a binocular, head-fixed apparatus. The field (hor., 88°; vert., 72°), was rotated about axes that were upright or tilted 45° or 90°. The head was upright or tilted 45° on the body. Head-horizontal (yaw axis) and head-vertical (pitch axis) components of OKN were recorded with electro-oculography (EOG). Slow phase velocity vectors were determined relative to gravity. With the head upright, the axis of eye rotation during yaw axis OKN was coincident with the stimulus axis and the spatial vertical. With the head tilted 45° on the body, a persistent vertical component of eye velocity developed during yaw axis stimulation, and there was an average shift of the axis of eye rotation toward the spatial vertical of $\approx 18°$ in six subjects. During oblique optokinetic stimulation with the head upright, the axis of eye rotation shifted 12° toward the spatial vertical. When the head was tilted, the axis of eye rotation rotated to the other side of the spatial vertical by 5.4° during the same oblique stimulation. This counter-rotation of the axis of eye rotation is similar to the "Müller (E) effect", in which the perception of the upright counter-rotates to the opposite side of the spatial vertical when subjects are tilted in darkness.

The data were simulated by a model of OKN. Despite the short OKAN time constants, strong horizontal to vertical cross-coupling was produced if the horizontal and vertical time constants were in proper ratio, and there was no suppression of nystagmus orthogonal to the stimulus direction. This shows that the spatial orientation of OKN can be due to a restructuring of the system matrix of velocity storage as a function of gravity. We conclude that although human OKAN is weak, velocity storage orients the slow phase velocity of OKN towards the spatial vertical.

A paper describing these results has been submitted to Experimental Brain Research.

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June 23, 1993

Dr. Janis Stoklosa
Mail Code ULM, Office 2441
Life and Microgravity Sciences
and Applications
NASA Headquarters
Washington DC 20546-0001

Dear Dr. Stoklosa:

Please find enclosed the final technical report for our project NASA-Washinton NAGW 1998, NASA SUPPORTING STUDIES FOR MICROGRAVITY RESEARCH ON EYE MOVEMENTS.

Sincerely,

Bernard Cohen, M.D.

OMB No. 0990-0081
Expiration Date: 12/31/

DEPARTMENT OF
HEALTH, AND HUMAN SERVICES

REPORT OF CAPITALIZED NONEXPENDABLE EQUIPMENT

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