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Catherine F. Kasperek, et al

Naval Aerospace Medical Research Laboratory  
Pensacola, Pennsylvania

30 June 1971

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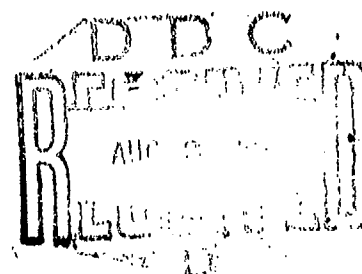
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30 June 1972

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*id*

## FOREWORD

Documents published at the Naval Aerospace Medical Research Laboratory (NAMRL), Naval Aerospace Medical Institute (NAMI), since 1 July 1971 are included in this fourth annual supplement to the annotated bibliography of reports dated 30 June 1968. That bibliography is DDC accession number AD 674 914; the first supplement is AD 691 415, the second supplement is AD 710 764, and the third supplement is AD 731 993.

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Catherine F. Kasperek  
Christine E. Turner

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Footnotes:

- \* Denotes those studies supported by the National Aeronautics and Space Administration.
- + Denotes studies performed jointly with and supported by the United States Army Aero-medical Research Laboratory, Fort Rucker, Alabama.

Work Unit

MR011.01.01.9  
N/MRL-1135  
(AD 735 102)

The Relationship Between Past  
Background and Drug Use.

6/28/71

S. F. Bucky

**Abstract:**

The purpose of the present study was to determine whether social-history variables discriminate among no-drug, marijuana, amphetamine, LSD, and heroin users. A questionnaire with items on specific drug use, family background, school and military history was anonymously administered to 1508 Navy enlisted men. Approximately 13.6 per cent refused to fill out the form. There were significant differences among the groups. Although little difference between the no-drug and marijuana groups was observed, in general there was a progression from the no-drug to the marijuana, amphetamine, LSD, and heroin groups in terms of family difficulties, trouble in school, and disciplinary action in the Navy. The vast majority of the marijuana group had not taken other drugs, whereas the majority of the other drug groups had taken marijuana. Multiple correlations of .47 and .68 using no drug and heroin use as the criteria suggest that prediction for these groups is possible. Multiple correlations ranging from .23 to .29 for the marijuana, amphetamine, and LSD groups make prediction of such drug use virtually impossible.

Work Unit

MR041.01.01-0120B8FG.6  
NAMRL-1142  
(AD 731 995)

Response From Arousal and Thermal Sweat  
Areas During Motion Sickness. 8/26/71

J. A. McClure, A. R. Fregly, E. Molina,  
and A. Graybiel

Also published in Aerospace Med., 43:176-179, 1972

**Abstract:**

The sweat response from the palm (an arousal sweat area) is compared with that from the dorsal hand and arm (a thermal sweat area) during the elicitation of motion sickness by vestibular stimulation. Both palmar and dorsal sweating were detected by using galvanic skin response techniques. In addition, the dorsal sweat response was monitored by an electrochemical sweat sensor.

The palmar sweat response is maximal during the first few head movements while a subject is rotating at constant velocity and quickly declines with continuation of the stimulus. This is typical of the arousal sweat response seen on the palm of the hand in response to any unusual sensory input. On the other hand, dorsal sweating has a definite latency, followed by a gradual increase in magnitude of the response. This is characteristic of most motion sickness symptomatology.

With two of the eight subjects an increase in environmental temperature was required to obtain a dorsal sweat response. This suggests that the neural activity evoked by vestibular stimulation is superimposed on that already existing as a result of the thermal state.

MR041.01.01-0120B8FG.7  
NAMRL-1144  
(AD 735 455)

Walk on Floor Eyes Closed (WOFEC): A New  
Addition to an Ataxia Test Battery. 10/1/71

A. R. Fregly, A. Graybiel, and M. J. Smith

Also published in Aerospace Med., 43:395-399, 1972

**Abstract:**

The problem of quantifying a simple, often-used clinical ataxia test (tandem walking) for inclusion in an ataxia test battery was overcome by adopting the method of counting the number of heel-to-toe steps (1 to 10) a person can take without sidestepping with eyes closed and arms folded against chest. Standardization under these rigid conditions was based on

testing 287 normal men and 100 normal women. Validation was based on testing 22 individuals having labyrinthine defects of varying severity and origin. This newly quantified test was found to be as valid an indicator of vestibular ataxia as other subtests of a multidimensional quantitative ataxia test battery with which it was compared. It has the advantages, however, because of its simplicity, that unlike all other items of the battery, 1) it appears to be free of age influences, at least within the age range of 17 to 65 years sampled; and 2) nearly all of the normal and none of the abnormal individuals obtained a perfect score. Its use in combination with a related subtest of the battery (Sharpened Romberg) having equally high validity ( $r_{pt. bis} = .837$ ) is recommended for rapid, economical screening purposes. Data analysis permitted an innovative definition of ataxia in terms of a 5th percentile cut-off criterion (4th percentile for WOFEC) relative to normative distributions of scores on all (five) ataxia battery subtests performed with eyes closed. A unique finding of special interest and having both practical and theoretical implications suggested that abnormal function of the semicircular canals alone or of the otolith organs alone may be sufficient to demonstrate vestibular ataxia with this test battery. An ataxia test battery that includes WOFEC has applications in general medical, aerospace medical, audiological, pharmacological, and psychological, otological, and neurological clinics and research laboratories.

MR041.01.01-0120B8FG.8  
NAMRL-1148  
(AD 736 922)

A Sweat Sensor for Qualitative  
Measurements.

11/15/71

J. A. McClure, E. A. Molina, and  
A. R. Fregly

**Abstract:**

To study objectively the sweat response during motion sickness, a need existed for a small sweat-sensing device with a short latency of response, a fast response time, and the ability to follow the time course of the sweat response. The design and function of a sweat-sensing device for continuous monitoring of the sweat response are described. A lithium chloride-aluminum chloride sensing element, which changes resistance depending on the uptake or release of moisture, is used in this sensor. The sensing element is enclosed in a

housing that is designed to circulate air from the skin surface to the sensing element. Air is supplied from a compressed-air cylinder and is controlled with a needle valve flowmeter assembly. With an air-flow rate of 15 cc/min and in response to a step change in moisture content on the skin surface, the sensor has a latency of 1.5 seconds and a rise time to reach 90 percent of the saturation level of about 28 seconds. A major disadvantage of the sensor is that with heavy sweat rates, the sensing element saturates, resulting in relatively long "drying out" times. This can be partially offset by using higher air-flow rates, but at the expense of reduced sensitivity. The application of this sensor has shown that it is capable of responding to the cyclic sweat activity commonly seen when skin-resistance measurement techniques are used to monitor the sweat response.

MR041.01.01-0120B8FG.9  
NAMRL-1153  
(AD 740 801)

Effect of Environmental Temperature on  
Sweat Onset During Motion Sickness. 12/6/71

J. A. McClure and A. R. Fragly

Abstract:

Since the sweat response is observed as part of some motion-sickness-rating procedures, it is useful to know if other variables such as environmental temperature can affect the response during vestibular stimulation. Eight young men were each exposed to the same vestibular stimulation on several occasions. On each occasion the run was carried out with a different environmental temperature. At a relatively high temperature the thermal stress caused a sweat response, and no vestibular stimulation was required. With lower environmental temperatures, a longer period of vestibular stimulation was required to evoke the sweat response. At a relatively low temperature no sweating was observed despite continuous vestibular stimulation and the development of severe nausea. The results indicate that environmental temperature can affect the sweat response during motion sickness and suggest the possible hazard of excessive fluid and electrolyte loss when both vestibular and thermal stress are present. By proper selection of environmental temperature, sweating can be induced before the onset of nausea. In this situation the sweat response could serve as a useful predictor of motion-sickness onset in the

administration of adaptation schedules and in monitoring persons in the space-flight environment.

MR041.01.01-012088FG.10  
NAMRL-1157  
(AD 743 075)

Forehead Sweating During Motion Sickness. 2/7/72

J. A. McClure and A. R. Fregly

Abstract:

Forehead sweating was monitored on fifteen subjects during the elicitation of motion sickness by vestibular stimulation. An electrochemical sweat sensor and a skin-resistance technique were used simultaneously to detect the sweat responses. None of the subjects showed any arousal type sweat responses at the time of onset of the vestibular stimulation. Two of the subjects showed no evidence of any forehead sweating despite an advanced degree of nausea. For the remaining thirteen subjects, a forehead sweat response was obtained after a latent period that ranged anywhere from 5 seconds to 4 minutes. Once initiated, the response tended to increase in magnitude as long as the stimulus was continued. This pattern of response is characteristic of most motion sickness symptomatology. For certain subjects the forehead sweat response was compared with their dorsal-hand response obtained from a previous run carried out under the same standard conditions. These comparisons suggest that the forehead is a less active sweat area than the dorsal hand during motion sickness.

MR041.01.01-012088FG.11  
NAMRL-1160  
(AD 743 074)

Revised Normative Standards of Performance of Men on a Quantitative Ataxia Test Battery. 3/15/72

A. R. Fregly, M. J. Smith, and A. Graybiel

Abstract:

Revised normative standards of performance of men, ages 16-60 years, on a quantitative ataxia test battery in terms of new chronological age groupings based on a sample of 1055 normal men are presented. Five age groups--16-30, 31-40, 41-45, 46-50, and 51-60 years--were found to be required to reduce the correlation with age to a nonsignificant level. All subtests of the battery, except Walk On Floor Eyes Closed (WOFEC), were very nearly similar in sensitivity to aging influences, implying a reliably unitary sensitivity of the battery to aging influences on the complex postural equilibrium function sampled by it. Present

findings tentatively suggest that the negative aging influences become apparent several years earlier than reported previously (within the age range of 31-40 years rather than 43-50 years). The progressive nature of this aging influence along the life span sampled is similar to that previously reported on women. The new normative standards should allow more precise laboratory and clinical applications of the test battery which has proved to be useful particularly in the vestibular physiological and neuro-otological assessment of postural equilibrium-disequilibrium, including spontaneous and induced vestibular ataxia. The test battery has other clinical and/or research applications.

Work Unit

MF12.524.002-5012DX5X.3  
NAMRL-1141  
(AD 735 101)

Selected Anthropometric Dimensions  
of Naval Aviation Personnel.

8/10/71

W. F. Moroney, R. S. Kennedy,  
E. C. Gifford, and J. R. Provost

**Abstract:**

Since the previous study of the anthropometric features of naval aircrewmen, the physical and academic requirements for entrance into the flight program have been changed. The present study was undertaken to determine whether these changes combine with changes in the anthropometric features of the population in general to influence certain anthropometric dimensions. Selected anthropometric features of 6534 aviation training candidates were examined. These measures included: weight, stature, sitting height, shoulder width, buttock-knee length, buttock-heel length, per cent of body fat, and lean body weight. Measures of central tendency and dispersion were calculated for each variable, and correlations between variables were obtained. In addition,  $t$  tests were used to determine the significance of the differences between mean values obtained by the aviation training candidates and the mean values reported by the Naval Air Development Center and the USAF Aeromedical Laboratory for other populations.

The dimensions of the aviation training candidates in this study differed significantly from those reported in the other samples. Possible reasons for these differences include: growth of the population in general, characteristics of the samples involved, and different anthropometric and academic requirements for acceptance into the aviation training program.

Work Unit

MF12.524.002-5013DX5X.3  
NAMRL-1139  
(AD 743 928)

Comparative Motion Sickness Symptomatology  
and Performance Decrements Occasioned by  
Hurricane Penetrations in C-121, C-130, and  
P-3 Navy Aircraft.

7/22/71

R. S. Kennedy, W. F. Moroney, R. M. Bale,  
H. G. Gregoire, and D. G. Smith

**Abstract:**

The purpose of this research was to compare complex monitoring performance and motion sickness symptomatology during hurricane penetration in three types of aircraft.

Three different Navy aircraft made six flights, each flight penetrating hurricane Inga several times. The controlling aircraft (a C-121) is routinely employed by the Navy for hurricane penetrations. The other two aircraft (C-130 and P-3) followed the C-121 into the storm at short intervals and penetrated the storm at the same altitude, heading, airspeed, etc.

Most subjects experienced slight to moderate malaise during the flights, with generally higher sickness rates occurring during the more turbulent flights. The subjects' overall flying experience afforded some protection. Airsickness rates in the C-121 were greater than those in the C-130 and P-3. The results on a complex counting task showed that performance decreased as a function of increased turbulence.

In-flight recordings of linear and angular accelerations were related to sickness rates, and it is suggested that the frequency of the linear oscillations may be a more important variable for producing motion sickness than the magnitude of the acceleration per se. Further, because the relationship between motion sickness and linear accelerations does not appear to be linear, this finding could have important implications for the design of vehicles to be used in similar force environments. These implications are discussed.

Work Unit

MF12.524.004-5001BX5G.14  
NAMRI-1138  
(AD 731 380)

Nystagmus Responses During Triangular  
Waveforms of Angular Velocity About  
the Y- and Z-Axes.

7/22/71

R. D. Gilson, C. W. Stockwell, and  
F. E. Guedry, Jr.

**Abstract:**

Nystagmus response parameters were estimated by a test procedure using short triangular waveforms of angular velocity. Mean estimates were determined as follows:  $\Pi/\Delta = 15.5$  seconds and  $K_n(\theta/\Delta) = 8.0$  seconds for the horizontal semicircular canals, and  $\Pi/\Delta = 6.8$  seconds and  $K_n(\theta/\Delta) = 5.4$  seconds for the vertical semicircular canals. The  $\Pi/\Delta$  values are consistent with results obtained by other methods. Values of  $K_n(\theta/\Delta)$  have not been heretofore assessed. Determination of the effects of stimulus distortion on the values of the response parameters and estimates of inter-subject and intrasubject variability are included. Also included are nomograms that permit a simple and accurate method for calculating  $\Pi/\Delta$  and  $K_n(\theta/\Delta)$ .

MF12.524.004-5001BX5G.15  
NAMRL-1140  
(AD 732 444)

Effects of Different Alcohol Dosages and  
Display Illumination on Tracking Per-  
formance During Vestibular Stimulation.

7/26/71

R. D. Gilson, D. J. Schroeder,  
W. E. Collins, and F. E. Guedry, Jr.

Also published in Aerospace Med., 43:656-660, 1972

**Abstract:**

A previous investigation showed that alcohol impairs the ability to suppress vestibular nystagmus, thus degrading visual compensatory tracking performance during angular acceleration. Reduced display illumination, independently, has also been shown to degrade tracking performance during vestibular stimulation. The present study investigated the way in which low and moderate dosages of alcohol and two levels of instrument-display illumination combined to affect tracking performance a) in a static (no motion) environment, and b) in a dynamic (whole-body motion) environment. Mean blood-alcohol levels as low as 0.027 per cent significantly

( $p < .05$ ) decreased tracking performance during whole-body motion, yet caused little change in performance in a stationary environment. Impairment was much more pronounced with dim display lighting (0.1 ft-L) than with bright lighting (1.0 ft-L). These results suggest that serious problems may even be encountered by the pilot who drinks lightly and who considers flying, especially at night.

Work Unit

MF12.524.005-5016BX1J.7  
NAMRL-1143  
(AD 735 119)

Orientation-Error Accidents in Regular  
Army Aircraft During Fiscal Year  
1968: Relative Incidence and Cost. 9/8/71

J. I. Niven, W. C. Hixson, and  
E. Spezia

**Abstract:**

This report is the second in a longitudinal series of reports dealing with the pilot disorientation/vertigo accident problem in Army fixed wing and rotary wing flight operations. Incidence and cost data presented for fiscal year 1968 include a total of 75 major and minor orientation-error accidents (26 of which were fatal), resulting in 91 fatalities, 75 nonfatal injuries, and an over-all aircraft damage cost of \$12,381,805. The contribution of rotary wing accidents to these totals was 66 accidents (21 of which were fatal), resulting in 80 fatalities, 70 nonfatal injuries, and an over-all aircraft damage cost of \$9,077,065.

MF12.524.005-5016BX1J.8  
NAMRL-1145  
(AD 735 457)

Orientation-Error Accidents in Regular  
Army UH-1 Aircraft During Fiscal Year  
1968: Relative Incidence and Cost. 10/15/71

J. I. Niven, W. C. Hixson, and  
E. Spezia

**Abstract:**

This report is the second in a longitudinal series of reports dealing with the magnitude of the pilot disorientation/vertigo accident problem in Regular Army UH-1 helicopter operations. Incidence and cost data presented for fiscal year 1968 include a total of 53 major and minor orientation-error accidents (17 of which were fatal), resulting in 74 fatalities, 60 nonfatal injuries, and \$8,224,607 aircraft damage.

MF12.524.005-5016BX1J.9  
NAMRL-1147  
(AD 738 808)

Major Orientation-Error Accidents in  
Regular Army UH-1 Aircraft During  
Fiscal Year 1968: Accident Factors. 10/29/71

W. C. Hixson, J. I. Niven, and  
E. Spezia

**Abstract:**

This report is the second in a longitudinal series of reports dealing with the pilot disorientation/vertigo

problem in Regular Army UH-1 helicopter operations. Individual case history data extracted from the USABAAR master aircraft accident files are presented on 52 major orientation-error accidents that occurred in UH-1 aircraft during fiscal year 1968. Summary data listings involving a variety of operational and pilot-related accident factors are presented for each of the cases. The listings are arranged to distinguish between those factors and events present before takeoff; i.e., the initial conditions associated with a given accident, and those which occurred or were manifested during the actual airborne phase of the accident.

MF12.524.005-5016.10  
NAMRL-1161  
(AD 743 483)

Orientation-Error Accidents in Regular  
Army Aircraft During Fiscal Year 1969:  
Relative Incidence and Cost.

4/7/72

W. C. Hinson, J. I. Niven, and  
E. Spezia

**Abstract:**

This report is the third in a longitudinal series of reports dealing with the pilot disorientation/vertigo accident problem in Army fixed wing and rotary wing flight operations. Incidence and cost data presented for fiscal year 1969 include a total of 71 major and minor orientation-error accidents (22 of which were fatal), resulting in 51 fatalities, 79 nonfatal injuries, and an over-all aircraft damage cost of \$11,928,660. The contribution of rotary wing accidents to these totals was 65 accidents (20 of which were fatal), resulting in 46 fatalities, 78 nonfatal injuries, and \$11,724,852 aircraft damage.

MF12. 54.005-7015BX8X.1  
NAMRL-1152  
(AD 737 220)

The Effectiveness of Benactyzine Hydrochloride and Other Antimotion Sickness Drugs in New Combinations.

12/6/71

C. D. Wood and A. Graybiel

**Abstract:**

Five different drug preparations are compared for their effectiveness in preventing motion sickness, with the effectiveness found for the combination of scopolamine 0.6 mg with d-amphetamine 10 mg in previous studies. Promethazine 25 mg plus d-amphetamine 10 mg was essentially equal to the baseline drug in range of effectiveness. Halving the doses of the baseline combination did not provide the protection that it did in an earlier study. Benactyzine 3 mg was only slightly effective and when combined with d-amphetamine 10 mg was only moderately so. Promethazine 25 mg plus ephedrine 25 mg was about one-fourth less effective than the baseline preparation. The unexpected finding of the efficacy of small doses (25 mg) of promethazine plus ephedrine is pointed out, and the benefits from the relatively great reduction in side effects found with this drug combination are stressed.

MF12.524.015-0013BEOX.1  
NAMRL-1137  
(AD 731 994)

Central-Nervous-System Effects as  
Measured by Reaction Time in Squirrel  
Monkeys Exposed for Short Periods to  
Extremely Low-Frequency Magnetic  
Fields.

8/10/71

J. D. Grissett and J. de Lorge

**Abstract:**

The U. S. Navy has current interest in electromagnetic radiation including the extremely low-frequency (ELF) region. The Navy has begun a major research effort to scientifically document any physiological effects which these fields can have on man and his ecology. This present experiment was designed to detect any acute instantaneous central-nervous-system effects resulting from exposure to an ELF magnetic field. Reaction-time measurements were taken on three squirrel monkeys for 37 one-hour daily sessions. No significant changes in these measurements were observed between control sessions and sessions in which the animals were exposed to 3 gauss at 45 Hz or to a field of 3 gauss at 7 Hz. Two other indices of performance, reinforcement ratio and efficiency ratio, were also unchanged. The small number of subjects does not permit a firm conclusion; however, the evidence indicates that the magnetic field did not produce a central-nervous-system response measurable by the technique employed in this study.

MF12.524.015-0013BEOX.2  
NAMRL-1146  
(AD 735 456)

Exposure of Squirrel Monkeys for Long  
Periods to Extremely Low-Frequency  
Magnetic Fields: Central-Nervous-System  
Effects as Measured by Reaction Time.

10/21/71

J. D. Grissett

**Abstract:**

The U. S. Navy is currently interested in the physiological effects of electromagnetic radiation. This interest covers a broad range of the spectrum, including the extremely low-frequency (ELF) region used in power generation and distribution systems. Operation and maintenance personnel on these systems are often exposed to significant ELF fields for short periods. The present experiment was designed to detect cumulative central-nervous-system effects resulting from exposure to ELF magnetic fields.

Three squirrel monkeys were exposed continuously for 42 days to a 10-gauss magnetic field at 45 Hz. Reaction-time measurements were taken daily for 23 days prior to exposure, during the exposure period, and for 9 days after exposure. No significant changes in these measurements were observed between control sessions and exposure or postexposure sessions. Two other indices of performance, reinforcement ratio and efficiency ratio, were also unchanged. These results indicate that if a psychophysiological effect exists, it is probably quite subtle and will therefore require a broad range of very sensitive experiments to evaluate properly the long-term effects of the ELF environment.

MF12.524.015-0013BEOX.3  
NAMRL-1052

A New Technique for Measuring Scotopic  
Critical Flicker Frequency to Indicate  
Psychophysiological Stress.

6/1/72

J. D. Grissett

**Abstract:**

Scotopic critical flicker frequency is difficult to measure because the retinal sensitivity in the scotopic range is greater in the periphery, thereby requiring the subject to perform the unnatural task of fixating on one point in the visual field and mentally concentrating on an event occurring at another point. Other sources of error (common also to photopic measurements) are a varying rate of frequency change and the photic driving effect from prolonged exposure to flickering light. These errors were reduced by developing apparatus and techniques with the following significant features: 1) a uniform light source subtending a large visual angle, thus reducing the fixation difficulty; 2) a discontinuous exposure to the flickering stimulus without changing the intensity of the stimulus, thus eliminating the photic driving effect while also permitting the subject to compare a flicker and fused condition continually throughout the measurement period; 3) a constant rate of frequency advance from a randomly selected starting point to the subject's threshold; 4) an active response by the subject for each stimulus period in which the light appeared to be flickering; and 5) a printed record of each response from which the experimenter can, not only measure the threshold, but also judge the subject's discriminating ability as he approaches the threshold.

NASA L-43518  
NA/MRL-1149  
(AD 735 098)

The Influence of Vision on Susceptibility  
to Acute Motion Sickness Studies Under  
Quantifiable Stimulus-Response Condi-  
tions.

11/17/71

W. J. Oosterveld, A. Graybiel, and D. B. Cramer

Abstract:

Twenty-four healthy men, 22 to 25 years of age, were exposed to stressful accelerations in a rotating room until acute mild motion sickness was elicited. Thirteen subjects in one group were exposed first with eyes open and later with eyes covered; the reverse order was used with the remaining eleven in the other group. The stressful accelerations were generated by requiring the subject to execute 120 standardized head movements at each 1-rpm increase in angular velocity until the desired endpoint was reached. This endpoint was 12 units on a scale where a score of 15 points represented the highest level of mild motion sickness and a score of 16, the lowest level of frank motion sickness. In the 48 experimental trials the average was 12.2 points when the endpoint was reached, and the range was 10 to 16 points. Thus, the terminal angular velocity required to achieve a given endpoint furnished a single value for comparing susceptibility between and among subjects; the range was 4 to 14 rpm.

When susceptibility to motion sickness with eyes open and covered is compared, 19 subjects were more susceptible with eyes open, three with eyes covered, and in the remaining two susceptibility was the same. The maximum difference in velocity between trial 1 and 2 was 7 rpm when susceptibility was greater with eyes open and 3 rpm when it was greater with eyes covered; the means, respectively, were 3.2 and 2.0 rpm. Among subjects manifesting greater susceptibility with eyes open than covered the group differences were small, indicating little or no adaptation effects. The findings are discussed mainly on the basis that vision may act also to decrease susceptibility under the stimulus conditions described.

NASA T-81633 and L-43518  
NAMRL-1150  
(AD 744 933)

Altered Susceptibility to Motion  
Sickness as a Function of Sub-  
gravity Level.

11/23/71

E. F. Miller II and A. Graybiel

**Abstract:**

Large interindividual differences among 74 normal subjects in the change in susceptibility to motion sickness with effective lifting of the normal g-load by parabolic flight maneuvers were recorded with high test-retest reliability. Most subjects, who were required to make standardized head movements while seated in a chair rotating at a constant speed, demonstrated either a substantial increase or a decrease in susceptibility, in confirmation of a previous study, while a few appeared to be more or less unaffected by the 1 g to 2 g gravitational change. A similar test procedure conducted with eighteen of the subjects at lunar- and Martian-gravity levels revealed further interindividual differences in susceptibility as a function of g-level. The subjects with gravity-dependent susceptibility revealed: 1) a progressive change in susceptibility as a function of g-load in either the positive or negative direction that was characteristic of the individual, 2) a susceptibility level that appeared to be maintained at the fractional g-load, and 3) immunity to motion sickness at all g-levels tested below the Earth standard. The case history as well as ground-based functional and provocative tests of normal subjects proved to be inadequate in predicting susceptibility to motion sickness under subgravity conditions.

NASA T-81633 and L-43518  
NAMRL-1151  
(AD 738 434)

Goggle Device for Measuring the Visually  
Perceived Direction of Space.

11/30/71

E. F. Miller II and A. Graybiel

**Abstract:**

A detailed description is given of a miniature line-target system that is illuminated by a radioactive source, collimated, and provided with suitable scales to indicate its position within the roll and pitch planes. These components are assembled in a light-weight goggle that can be precisely positioned by means of a biasboard attachment. Uses of the goggle in the measurements of the perceived direction of space under ordinary and extraordinary test conditions are illustrated. Modifications are suggested that can extend its usefulness.

NASA T-81633 and L-43518  
NAMRL-1154  
(AD 737 220)

Ocular Counterrolling Measured During  
Eight Hours of Sustained Body Tilt.

1/4/72

E. F. Miller II and A. Graybiel

Abstract:

Adaptation of otolith organ activity was investigated by monitoring the ocular counterrolling response of four normal individuals and three persons with severe bilateral loss of labyrinthine function. Several eye photographs were recorded every 30 minutes during a period of 8 hours in which the subject was held in a lateral tilt ( $60^\circ$ ) position. The recorded eye roll position varied to an expected small extent within each test session; this variation about a given mean roll position was similar among the test sessions for all subjects. The mean roll position, on the other hand, changed from session to session in substantial amounts, but these changes appeared to be random with respect to time and among subjects. Furthermore, the intersessional variation in the mean torsional eye position of the normal subjects was equivalent to that of the labyrinthine-defective subjects who displayed little or no counterrolling. These results suggest that the human counterrolling response is maintained either by essentially nonadapting macular receptors or by extremely fine movements of the head in the gravitational field, such as may have been allowed by the biteboard/headrest restraint system used in this study, which served as an everchanging accelerative stimulus.

NASA L-27432  
NAMRL-969  
(AD 744 930)

Rhesus Monkey Heart Rate During Exercise

4/18/72

J. de Lorge and J. S. Thach, Jr.

Abstract:

Three rhesus monkeys were implanted with ECG telemeters and performed a calisthenic exercise requiring complete arm extension above their heads and below their knees. The animals were unrestrained and confined to a large box. The exercise was programmed to produce food pellets on various reinforcement schedules. Heart rate samples were obtained both during sleep and high rates of activity. Two animals provided exercise data and one animal provided data without the exercise task. Highest heart rates were seen in the two exercise animals. No differences in maximum heart rates were related to the different reinforcement schedules. In most instances heart rates were twice those of resting heart rates for

5 minutes or longer. Occasionally, heart rates were three times the resting rates for at least 2 minutes. The resting heart rates from all three animals were generally lower than those reported in previous literature as normal rates in the rhesus. During the fixed-interval reinforcement schedule there was a correlated increase in heart rate along with the increase in response rate.

DOT-FA-SS-71-10  
NAMRL-1159  
(AD 743 482)

Comparative Evaluation of Exposure  
Distributions for Air Travelers and  
Radiation Workers.

2/25/72

H. J. Schaefer

Abstract:

Radiation workers contribute 0.48 millirem/year per capita of the total U. S. population. Air travelers exposed to increased environmental radiation levels at altitude contribute 0.54 millirem/year. However, the two respective distributions differ greatly in all other parameters; namely, number of individuals involved, magnitude and spread of individual exposure, and skewness. While the distribution for radiation workers centers heavily on near-zero exposures and reaches out to large excursions in rare cases of accidents, the one for air travelers shows a narrow spread, excludes excursions completely, and does not constitute an additional radiation risk.

Special Reports

(NAMI) 71-1  
(AD 735 100)

Factors Related to the Retention  
of Naval Flight Surgeons.

8/26/71

W. F. Moroney and R. M. Bale

**Abstract:**

Due to the demand for Navy flight surgeons and the undesirable low retention rate among Navy flight surgeons, two independent studies to identify factors relevant to the retention of flight surgeons were initiated.

Study I: The academic performance and biographical data obtained from 424 flight surgeons who underwent flight-surgeon training between January 1962 and February 1966 were examined. The analysis revealed the following "profile" for career physicians: The physician was probably an officer of the regular Navy when he entered the flight-surgeon program, had served a Navy Internship, and had some previous military experience. It was also noted that most individuals who, upon admission to the flight-surgeon program, reported no career interest, served only the required tour. However, only one third of those who expressed career interest served more than one tour.

Study II: A questionnaire was designed to determine those reasons why physicians leave flight-surgeon status yet remain on active duty in the Navy but in other specialties. This aspect was selected because this unique group apparently had not rejected the military but had decided to specialize in an area other than aerospace medicine. One hundred and seventy-one physicians responded, for a return rate of 72.1 per cent. In order of reported importance, the reasons listed by the respondents for leaving flight-surgeon status were: limited professional development, foresaw a future of administrative duties, poor senior-officer leadership, limited patient contact, excessive sea duty, desired residency in another specialty, and family reasons. The majority (83.6%) of the respondents indicated that they would have accepted duty as a career flight surgeon if the opportunity to select and function in an area other than aerospace medicine had been available to them.

The respondents were also requested to make selected rankings. They ranked senior flight surgeons significantly higher than other physicians as military officers but lower as physicians. Recommendations made by the respondents included: permit flight surgeons to pursue clinical specialties other than aerospace medicine; differentiate between nonresidency-trained flight surgeons and flight surgeons who have completed residencies in aerospace medicine; increase opportunities for professional development by means of seminars, refresher training, and meetings.

(NAMI) 71-2

An Examination of Selected Characteristics  
of Career Naval Flight Surgeons: Attitudes,  
Motivations, and Needs.

9/23/71

E. York, W. F. Moroney, and R. M. Bale

Abstract:

This study was undertaken to identify the attitudes, motivations, and needs of career naval flight surgeons (FSs). A questionnaire was distributed to career FSs (i.e., those on active duty as a FS for five years or more). Eighty-four of the 132 FSs who received the questionnaire responded, for a return rate of 63.6 per cent.

The most crucial finding was the large amount of role confusion within the FS community. There is a definite need for the development of a unique flexible model for career FSs. Such a model must include the development of several alternate career pathways.

Additional findings include: 1) Most career FSs (80%) had had prior military experience; indeed, 37 per cent had been general medical officers (GMO). Efforts to recruit active duty GMOs for FS training should be encouraged. 2) The decision to become a career FS is made most often during the first or second tour as a FS. Active selective recruiting should be done during these tours. 3) Career FSs desire a decrease in administrative duties and show individual preferences for duties involving preventive medicine, clinical medicine, research, teaching, and professional meetings. Such concepts should be included in the development of a model for career FSs.

(NAMRL) 72-1

Nosematosis in a Squirrel Monkey  
(Saimiri sciureus): First Reported  
Case.

1/24/72

R. J. Brown, D. K. Hinkle,  
W. P. Trevethan, J. L. Kupper  
and A. E. McKee

Abstract:

A 2-month old squirrel monkey (Saimiri sciureus) succumbed following a month of frequent petit mal seizures. At autopsy the only gross abnormality was a separation of the parietal suture line of the cranium. Hematoxylin and eosin stains revealed multiple focal glial nodules throughout the brain. Granulomatous hepatitis and nephritis were also present. These lesions were not typical of any reported disease in the squirrel monkey.

Special stains for mycosis, tuberculosis, and toxoplasmosis were unrewarding. The bacterial stains, however, revealed gram positive, slightly curved bacilli typical of the protozoal parasite Nosema cuniculi. Electron microscopy also revealed the Nosema organism. Nosema causes a clinically silent granulomatous encephalitis and meningitis in rabbits, rats and mice, and occasionally in other animals including man. The authors believe this to be the first case of nosematosis in the squirrel monkey.

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