

Abstracts of Current Aviation Medicine Literature

I. ACCELERATION PHYSIOLOGY

1. Concurrent Loss of Consciousness and Sino-Atrial Block During +Gz Stress.

J. E. WHINNERY, M. HAROLD LAUGHLIN, and J. R. HICKMAN, JR. *Aviation Space and Environmental Medicine*, Vol. 50, June 1979, P. 635-638, 24 Refs.

Current USAF fighter aircraft easily exceed human physiologic limits with their rapid onset of head-to-foot acceleration forces (+Gz). Sudden in-flight incapacitation caused by these increased +Gz forces could be disastrous with loss of material and human life. The physiologic mechanisms responsible for loss of consciousness (LOC) secondary to high +Gz must be fully understood so that maximum protection against it can be provided. An interesting case of an episode of LOC with concurrent sinoatrial block occurring during a relaxed rapid onset (1 G/s) centrifuge run is presented. The patient was undergoing flight medical evaluation for an episode of syncope, etiology unknown. An unusual characteristic of the patient was his high level of endurance training. The possibility of an excessive increase in vagal tone, developed by endurance training, is discussed as a probable etiology for this patient's prolonged time of incapacitation evidenced after +Gz-induced loss of consciousness.

2. Cerebral Accident Subsequent to G-Force Loading: A case Report.

J. W. ELLIS, JR. and J. S. CURRIE. *Aviation Space and Environmental Medicine*, Vol. 50, April 1979, P. 399-400. 3 Refs.

A case review of a CVA in a 57-year-old general officer due to positive G-force loading is presented, which is apparently the first such documented episode recorded in the literature. This case reflects the concern about high G-force loading seen in newer high-performance aircraft and has significance in the assignment of older individuals to high G-force environments.

3. Heat and Acute Dehydration effects on Acceleration response in man.

S. A. NUNNELEY and R. F. STRIBLEY. *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, Vol 47, July 1979, P 197-200, 20 Refs.

Though heat and dehydration each impair acceleration tolerance, interactions among these stresses have not previously been studied. Seven men were dehydrated in heat by 0, 1, and 3% of body weight before a series of +Gz, gradual-onset centrifuge runs with the capsule first 38°C, then 20°C. Heat alone raised heart rate by 6.5 beats/min independent of other stresses. Dehydration and acceleration appeared to act synergistically in raising HR. Heat lowered relaxed G tolerance by 0.3 G, dehydration tended to lower G tolerance and increased the variability of response to heat. A high-tolerance sub-group (n=4) could normally sustain +7 Gz for 60s with anti-G suit and straining, but 3% dehydration reduced mean time to 35 s. Dehydration was associated with a decrease in the loss of plasma volume at 7 G. Heat-induced tolerance loss appears similar for both gradual-and rapid-onset centrifuge profiles. In contrast, dehydration effects are greater in rapid-onset runs, evidence that normal anti-G protective mechanisms can partly counteract the effect of fluid deficit. The results are relevant for crew members of high-performance aircraft, where unexpected diminution of their normally high G tolerance can have disastrous consequences.

4. Evaluation of Assisted Positive pressure breathing on +Gz Tolerance.

R. M. SHAFFSTALL and R. R. BURTON. *Aviation Space and Environmental Medicine*, Vol. 50, August 1979, P. 820-824, 12 Refs.

The effect of both assisted and unassisted positive pressure (PPB) breathing on +Gz tolerance was evaluated. A GOR (gradual onset rate = 0.1 G/s) acceleration profile was used to evaluate five different

experimental conditions: 1) G-suit-only, 2) G suit + unassisted PPB, 3) G suit + PPB assisted by the English jerkin, 4) G suit + PPB assisted by the Canadian waistcoat, and 5) the Swedish counter-pressure garment G suit combination. Acceleration tolerances for these experimental conditions (excluding the Swedish garment) with the subjects performing M-1 manoeuvres were measured using an exhaustive ACM (Aerial Combat Manoeuvres) acceleration profile, GOR tolerances were similar for both assisted and unassisted PPB with the pressure breathing experimental conditions providing a significant GOR tolerance increase over the G-suit-only condition. Assisted PPB increased ACM tolerances over both unassisted PPB and G-suit-only conditions. It appears that assisted PPB may offer a practical method for reducing the fatigue associated with exposure to high G.

5. Cardiorespiratory assessment of decongestant—antihistamine effects on altitude, +Gz, and fatigue tolerances.

M. T. LATEGOLA, A. W. DAVIS, JR. P. J. LYNE, and M. J. BURR. *Aviation Space and Environmental Medicine* Vol. 50, February 1979, P. 101—109, 16 Refs.

Decongestants and antihistamines are known to produce effects capable of adversely modifying physiological function and psychomotor task performance. Because of relevance to safe pilot performance, the effects of single doses of two decongestant-antihistamine preparations (Compound A and Compound B), or a placebo on cardiorespiratory responses to two equally spaced +2 Gz tests during separate 2-h exposures at 388 m (1,274 ft MSL) ground level (GL) and 3810 m (12,500 ft) chamber altitude were assessed. Post-altitude fatigue was assessed by cardiorespiratory responses to submaximal bicycle ergometry. Compound A and Compound B appeared to exert no significant detrimental effects on short-duration post-altitude ergometric fatigueability. With two exceptions, all combinations of medication, altitude, and +Gz were well tolerated. Two subjects were clearly incapacitated during the first +2 Gz test under Compound A at 3810 m (12,500 ft) altitude. It is felt that the +Gz-intolerance resulted mainly from an adverse interactive effect of Compound A and altitude on vasomotor and/or chronotropic mechanisms.

II. CLINICAL AVIATION MEDICINE

6. Role of respiratory heat exchange in production of exercise-induced asthma.

E. C. DEAL, JR, E. R. McFADDEN, JR, R. H. INGRAM, JR, R. H. STRAUSS, and J. JAEGER. *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, Vol 46, March 1979, P. 467-475, 32 Refs.

We have hypothesized that it is the total heat flux in the tracheobronchial tree during exercise that determines the degree of postexertional obstruction in asthma, and have developed quantitative expressions that relate these two events. We tested this hypothesis by comparing the observed responses to exercise, while our subjects inhaled dry air at various temperatures ranging from subzero to 80° C in a random fashion, to those that we predicted would occur based upon calculations of respiratory heat exchange. We further determined if heat could be transferred from the inspired air to the mucosa so as to offset evaporative losses from the airways. The observed responses fell as air temperature was increased from -11 to +37° C and exactly matched theoretical predictions. Above 37° C, the observed response exceeded predictions, indicating that it was not possible to provide sufficient heat per se in the air to offset the vaporization of water. However, when small amounts of water vapor were added to the inspire at high temperatures, bronchospasm was virtually abolished and the response again closely matched theoretical expectations. We conclude that the magnitude of exercise-induced asthma is directly proportional to the thermal load placed on the airways and that this reaction is quantifiable in terms of respiratory heat exchange.

7. A study of the Health status of radar workers.

Z. DJORDJEVIC, A. KOLAK, M. STOJKOVIC, N. RANKOVIC, and P. RISTIC. *Aviation Space and Environmental Medicine*, Vol. 50, April 1979, P. 396-398, 11 Refs.

The health status was examined of 322 radar workers with a history of occupational exposure in a microwave field from 5-10 years. The clinical findings were compared with a control group of 220 persons. There were no statistically significant differences in clinical and laboratory findings between exposed and control group. Only some subjective complaints were

found more frequently in the exposed group than in the control. The authors' feeling is that subjective complaints in radar workers could not be ascribed only to the influence of microwaves because they could be due to other nonspecific harmful occupational factors. On the basis of the results of this work, the authors concluded that it is unlikely to expect marked harmful effects from microwaves in radar workers in normal working conditions.

8. Recurrence of myocardial infarction in an exercising population.

R. J. SHEPHARD. *British Heart Journal*. Vol. 42, August, 1979, P. 133-138, 10 Refs.

The Ontario Multi-Centre Exercise-Heart Trial is making a prospective study of 751 male subjects following well-documented episodes of myocardial infarction. Comparison is here made between the 50 participants who sustained a recurrence of their myocardial infarction, and the 701 participants who did not. Reinfarction was a little more likely with a history of multiple previous infarctions, but was unrelated to such indicators of infarct severity as symptoms, electro-cardiographic abnormalities, enzyme changes, cardiac arrest, arrhythmia, or minimum systolic blood pressure. Features noted on admission to the trial, which may have an adverse effect, include smoking history and related symptoms, residual disability, shortness of breath, and angina of effort. The main physiological warning sign was a low and decreasing cardiac output at a submaximal work load, with a compensatory widening of arteriovenous oxygen difference. With the possible exception of exercise non-compliance, none of the adverse findings is sufficiently consistent to be of value when advising individual patients.

III. ENVIRONMENTAL AVIATION PHYSIOLOGY

9. Sweating responses during heat acclimation and moderate conditioning.

E. SHVARTZ, A. BHATTACHARYA, S. J. SPERINDE, P. J. BROCK, D. SCIARAFFA, and W. VAN BEAUMONT. *Journal of Applied Physiology: Respiratory, Environmental, and Exercise Physiology*, Vol. 46, April 1979, P 675-680, 18 Refs.

Five young men underwent 8 days of heat acclimation (Bicycle ergometer; 50% $\dot{V}O_2$ max; 2h/day)

at 39.8°C db, 30.0°C wb. A control group underwent the same exercise procedure at 24°C. Local sweat rates (SR) for chest, thigh, and arm were highest on the arm and lowest on the thigh throughout acclimation. Acclimation resulted in SR increases on all three sites, thigh SR showing the largest percentage increase. Rectal temperature (T_{re}) at the onset of sweating decreased 0.49°C from day 1 to day 8. Chest and thigh SR showed higher relationships with mean body temperature (T_b) than total body SR and T_{re} at the onset of sweating. In the control group, SR decreased on all three sites. Thigh SR, which was the lowest on day 1, showed the smallest decrease so that by day 7 SR did not differ between the three sites. T_{re} at the onset of sweating decreased 0.19°C during conditioning and it correlated ($r=0.72$) with T_b . Similar relationships were found for chest and total body SR. Thus, acclimation and conditioning result in relatively more SR on the limbs than on the torso, but these changes are less related to T_b than torso SR. Sweating sensitivity increases during both procedures, but its contribution to heat acclimation is minor.

10. Cockpit thermal stress and aircrew thermal strain during routine Jaguar operations.

T. M. GIBSON, L. A. COCHRANE, M. H. HARRISON, and P. W. RIGDEN. *Aviation Space and Environmental Medicine*, Vol. 50, Aug. 1979, P. 808-812, 11 Refs.

Thermal data have been obtained from Jaguar aircraft flying routine, warm-weather operations in Sardinia. These data have been analysed in terms of the ambient and cockpit wet bulb globe temperatures (WBGT) and the mean body temperature (T_b) of the pilot. In contrast to similar data previously obtained from Harrier and Buccaneer aircraft, no interrelationships could be demonstrated between ambient WBGT at ground level and either cockpit WBGT or pilot T_b . Relationships which could be described by equations of negative slope were obtained between T_b and sortie time and between cockpit WBGT and sortie time. A model has been derived for predicting aircrew thermal strain in the Jaguar from cockpit temperature and sortie time.

11. Physiologic and performance measurements in simulated airborne combined stress environments.

J. S. BOWMAN and H. J. VON BECKH.

The Naval Air Development Center's Human Centrifuge was used to assess the effects of repeated exposures to a simulated Air Combat Maneuvering (ACM) environment on various measures of physiological function and psychomotor performance. The environment consisted of a realistic ACM profile that included associated noise, high speed/stall buffet conditions, and increased intra-cockpit temperatures. The effects of varying the subject's seatback angle, as a function of the environment, was also measured. Analysis of the various physiological and performance data revealed the following: (1) heart rate was negatively correlated with tracking accuracy under the combined stress conditions of this study, (2) test conditions that included acceleration and buffet resulted in a significant decrement in tracking accuracy, (3) the addition of increased intra-cockpit temperatures, when combined with acceleration and/or buffet, produced a significant decrease in tracking accuracy, (4) increasing the seatback angle from the vertical partially ameliorated the effects of the other stressors. Details of these findings, as well as results of various biochemical analyses, are discussed.

IV. HIGH ALTITUDE PHYSIOLOGY

12. Ventilatory response to steady-state exercise in Hypoxia in Humans.

D. C. FLENLEY, H. BRASH, L. CLANCY, N. J. COOKE, A. G. LEITCH, W. MIDDLETON, and P. K. WRAITH, *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, Vol. 46, March, 1979, P. 438-446, 37 Refs.

The linear relationship between minute ventilation (V_E) and CO_2 output (V_{CO_2}) was steeper in 9 of 10 healthy subjects, when treadmill walking was carried out breathing 14% oxygen than when breathing air. This confirmed that the ventilatory response to modest exercise was usually potentiated by mild hypoxia. Arterial oxygen saturation did not significantly correlate with V_E in seven healthy subjects, walking, breathing air or 14% oxygen; whereas there was a significant correlation between V_E and calculated mixed venous saturation in five of these subjects. Transient relief of hypoxia, when breathing 14% oxygen, by five breaths of 30% oxygen both at rest and during walking, reduced ventilation more at

higher levels of exercise. This indicated that the peripheral chemoreceptor response to a given level of arterial desaturation was enhanced by exercise. Directly measured femoral venous saturation was correlated with V_E in another three subjects, and there was also a close, but curvilinear, relationship between V_E and femoral venous lactate concentrations during similar exercise, when breathing 21 or 14% oxygen. We suggest that receptors in working muscle could be sensitized by muscular hypoxia during exercise when breathing 14% oxygen, and thus contribute to the potentiation of the peripheral chemoreceptor stimulation of exercise ventilation by hypoxia.

13. Pattern and mechanism of airway response to hypocapnia in Normal subjects.

C. F. O'GAIN, M. J. HENSLEY, E. R. McFADDEN, JR., and R. H. INGRAM, JR, *Journal of Applied Physiology: Respiratory Environmental and Exercise Physiology*, Vol. 47, July 1979, P. 8-12, 22 Refs.

We examined the bronchoconstriction produced by air-way hypocapnia in normal subjects. Maximal expiratory flow at 25% vital capacity on partial expiratory flow-volume (PEFV) curves fell during hypocapnia both on air and on an 80% helium 20% oxygen mixture. Density dependence also fell, suggesting predominantly small airway constriction. The changes seen on PEFV curves were not found on maximal expiratory flow-volume curves, indicating that inhalation to total lung capacity substantially reversed the constriction. Pretreatment with a β -sympathomimetic agent blocked the response, whereas atropine pretreatment did not, suggesting that hypocapnia affects airway smooth muscle directly, not via cholinergic efferents.

14. Investigation of a simple, retrospective test for in-flight hyperventilation.

T. M. GIBSON, *Aviation Space and Environmental Medicine*, Vol. 50, June 1979, P. 609-613, 12 Refs.

This experiment was designed to study the feasibility of using a single rebreathing estimate of mixed venous carbon dioxide tension ($PvCO_2$) as a simple field test for hyperventilation in pilots. The results confirmed that the fall of end tidal carbon dioxide tension ($P_{ET}CO_2$) during hyperventilation and rise

during recovery was exponential. The results also showed that the relationships between P_vCO_2 and $P_{ET}CO_2$ values during the unsteady states of carbon dioxide washout and accumulation may be described as a loop which encloses the theoretically derived line for the steady-state relationships. The deviation from the steady-state line appears on theoretical consideration to be directly proportional to carbon dioxide elimination rate, and indirectly proportional to cardiac output. Because of the exponential recovery, and because one value of P_vCO_2 could correspond to a range of values of $P_{ET}CO_2$, it is concluded that a field test for hyperventilation based on a single rebreathing estimate of P_vCO_2 would, not be of value. The finding of a low value of P_vCO_2 would, however, be an indication that hyperventilation had taken place.

15. Mechanical vs. Ischaemic Mechanisms for Decompression sickness.

B. A. HILLS. *Aviation Space and Environmental Medicine*, Vol. 50, April 1979, P. 363-367. 25 Refs.

We used 20 kangaroo rats to investigate the effect of exposure to low oxygen levels (0.11 Atm O_2 inspired partial pressure) prior to decompression from a steady-state condition. This hypoxia was found to afford significant protection against limb bends as simulated in those animals by tail biting. Yet, it potentiated neurologic symptoms compared with a control exposure on air with the same level of nitrogen supersaturation. However the incidence of simulated limb bends in the same animals was the same with hypoxia as with another control exposure at a pressure estimated to give extravascular bubbles of the same size upon decompression. The results are, therefore, consistent with a simple mechanical basis for limb bends, but are difficult to explain by any ischaemic mechanism since a general hypoxia exacerbates any pain produced by oxygen deficiency in the tissues. However, the reverse may be true for some forms of neurologic decompression sickness and the two such cases reported here are consistent with that view, although not statistically significant.

16. Caloric and exercise requirements of space flight: Biostereometric results from Skylab.

M. W. WHITTLE. *Aviation Space and Environmental Medicine*, Vol. 50, February 1979, P. 163-167, 9 Refs.

The biostereometric study of the Skylab astronauts used stereophotogrammetry to make accurate three-dimensional measurements of body form, from which regional and total body volumes were derived. Volume changes in the thighs and calves, over the course of the flight, showed a high correlation with inflight exercise on the bicycle ergometer, and suggested that an exercise level of 80-100 W-min/d/kg lean body mass would be necessary to prevent inflight muscle atrophy. The bicycle ergometer is thus a relatively inefficient means of preventing leg muscle atrophy. Inflight caloric intake showed a high correlation with the change in volume of the buttocks, the abdomen, and the body as a whole, and suggested that a caloric intake of 47-51 kcal/d/kg lean body mass would be necessary to prevent a change in body fat. Only one of the astronauts exceeded this range and gained body fat; the group as a whole showed a mean fat loss of 1.2 kg.

V. PSYCHOLOGY AND NEUROPSYCHIATRY

17. Why is telling right from left more difficult than telling above from below?

R. H. MAKI, C. A. GRANDY, and G. HAUGE. *Journal of Experimental Psychology: Human Perception and Performance*, Vol. 5, February, 1979, P. 52-67, 18 Refs.

Adults take longer to judge the locations of horizontal stimuli than to judge the locations of vertical stimuli. In order to determine the source of this difficulty with the horizontal dimension, the congruity between the locations of stimuli and verbal descriptions was judged in a reaction time (RT) task. Because bilateral symmetry of the nervous system may be related to the difficulty with horizontal stimuli, this was varied by using right-handed, left-handed, and ambidextrous subjects. However, this variable produced no significant effects in the RT task. Horizontal stimuli took longer than vertical stimuli whether the verbal description was encoded before or during the RT periods, suggesting that label encoding is not the entire source of the effect. However, when the verbal labels were eliminated entirely by having subjects learn and use stimulus-letters pairs, horizontal stimuli did not take longer than vertical stimuli. This suggests that perception of the stimulus is not the cause of the difficulty. Together, the experiments indicated that comparing horizontal labels to stimuli is the largest source of the difficulty in telling right from left. Reasons why adults have such a problem were discussed.

18. Relation between perceived depth and perceived motion in uniform flow fields.

A. B. McCONKIE. *Journal of Experimental Psychology: Human Perception and Performance*, Vol. 5 August, 1979, P. 501-508, 17 Refs.

Three experiments are reported that examined the nature of the perceptual linkage between perceived depth and perceived motion in bidirectional uniform velocity fields. In such displays there is systematic misperception of both the speeds and directions of motion of visual objects. It was found that the speed and the direction of perceived motion were related to objective velocity by the addition of a uniform velocity component across the visual field. It is proposed that this uniform component may be the result of compensation for incorrectly registered ocular rotation and that such an account may also apply to classical center-surround induced motion effects.

19. Psychiatric aspects of adaptation to long submarine mission.

B. B. WEYBREW and E. M. NODDIN. *Aviation Space and Environmental Medicine*, Vol. 50, June 1979, P. 575-580, 23 Refs.

The case histories of 261 submariners disqualified psychiatrically for further submarine duty revealed that the major symptomatology was emotional in nature, with character pathology second in frequency. The latter pathology resulted in disqualification much earlier than the former, a fact indicative of effective neurotic defenses. The submariners who show these slow-developing neurotic symptoms appear to be reacting maladaptively to the stresses of the 60-d submarine patrols. Some etiological factors appear to be related to the role a man occupies within the crew, to the nature of the mission itself and perhaps, to the length of the submarine patrols.

20. Individual differences in the human electroencephalogram during quiet wakefulness.

H. VANDIS, M. CORNER, R. DAPPER, G. HANEWALD and H. KOK. *Electroencephalography and Clinical Neurophysiology*, Vol. 47, July, 1979, P. 87-94, 24 Refs.

Biweekly EEGs (01-C3 leads) were recorded under relaxed conditions with the eyes open, from

10 young female subjects throughout the menstrual cycle, and from 2 male subjects. The records were subjected to broad-band frequency analysis of successive 30 sec epochs, during sessions lasting 10 min. Statistical analysis showed that for all amplitude measures, absolute and relative, the variance between different individuals was significantly greater than between repeated measurements in the same individual. The individual differences were expressed in the form of characteristic amplitude profiles for the classical EEG frequency bands. The variance of each subject's profile could be reduced by using a 'percentage' amplitude score instead of the absolute values. The individuality of EEG patterns expressed itself also in the ratios between the activities at specific frequencies: a given ratio could be virtually invariant in one or two persons while being highly inconsistent in other subjects. No particular pattern could be discerned in these differences. The present results confirm the existence of a sufficient degree of EEG reproducibility, at least in normal young women, to justify speaking of characteristic individual 'baseline' patterns during quiet wakefulness. It will be worthwhile now to investigate if deviations occur from such baselines which might be of importance in psychiatric diagnosis.

21. Minute eye movement during sleep.

D. COAKLEY, R. WILLIAMS, and J. MORRIS. *Electroencephalography and Clinical Neurophysiology*, Vol. 47, August, 1979, P. 126-131, 23 Refs.

The minute eye movements of 4 sleeping subjects were studied with a piezo-electric strain-gauge transducer. The frequency and amplitude of ocular microtremor activity diminished during sleep. Activity increased after auditory stimulation and with the appearance of a K complex in the EEG. The ocular microtremor activity also increased with the onset of rapid eye movement (REM). Low amplitude 'micronystagmoid' movements were observed at intervals throughout sleep. In contrast to the changes observed during sleep, ocular microtremor activity did not diminish during hypnosis.

The transducer was far more sensitive than the conventional EOG recording system.

22. Television epilepsy—the role of pattern.

A. J. WILKINS, C. E. DARBY, C. D. BINNIE, S. B. STEFANSSON, P. M.

JEAVONS, and G. F. A. HARDING, *Electroencephalography and Clinical Neurophysiology*, Vol. 47, August 1979, P. 163-171, 11 Refs.

Patients with photosensitive epilepsy were asked to view normally functioning 625 line televisions while the EEG was monitored. In the first of two studies paroxysmal EEG activity was reliably induced by television at a viewing distance related to a patient's sensitivity to intermittent photic stimulation (IPS); patients who were sensitive to diffuse IPS at 50 Hz were sensitive to television at greater viewing distances than those who were not. No such relationship was obtained with patterned IPS. On the other hand, patterned IPS was generally more epileptogenic than diffuse IPS was with the same luminance. In the second study, where the angular subtense of the television screen and the subtense of its lines were manipulated independently, the conclusive response was found to be a function of both factors, the relative contribution of each depending on the viewing distance at which the patient was sensitive. For patients sensitive at normal viewing distances, where 50 Hz diffuse flicker appeared to be responsible for the induction of paroxysmal activity was closely related to the subtense of the screen. For patients sensitive only at closer viewing distances the probability was influenced not by the subtense of the screen but by the subtense of its lines, suggesting that the paroxysmal activity was induced by the 25 Hz pattern alternation produced by the scan. A television with a small screen was considerably less epileptogenic than one with a large screen for all patients, presumably due to the reduced contribution of both diffuse flicker and pattern alternation.

23. Relation of frequency analysed EEG to monitoring behaviour.

R. E. TOWNSEND & I. G. JOHNSON
Electroencephalography and Clinical Neurophysiology, Vol. 47, September, 1979, P. 272-279, 16 Refs.

Two experiments examined the relation of prestimulus electroencephalographic (EEG) frequency to choice RT. Based on previous studies, initial analysis was concerned with 3-7 c/sec activity. In well-rested subjects (Exp. 1), trial-by-trial analyses indicated large variations in prestimulus EEG activity which were unrelated to RT and large variations in RT which were unrelated to prestimulus EEG. In Exp.

2, subjects were deprived of sleep for 1 night and within-subject comparisons made between RT and EEG activity immediately preceding the 10 shortest and 10 longest RT trials, and 10 trials where the subject failed to respond. Significant univariate correlations were found, largely between RT and the frequencies in the 15-20 c/sec range of EEG activity and not in the 3-7 c/sec activity. A multiple regression analysis using up to 5 EEG frequencies indicated significant correlations of prestimulus EEG activity with RT; but with considerable subject-to-subject variability in the EEG frequencies contributing to the multiple R. The overall results suggest that there can be considerable variation in EEG activity which is unrelated to performance, when the EEG fluctuations are secondary to changes in arousal which, in turn, affect performance.

24. A comparison of EEG activity in the left and right cerebral hemispheres by power spectrum analysis during language and non-language tasks.

J. D. GRABOW, A. E. ARONSON, K. L. GREENE & K. P. OFFORD, *Electroencephalography and Clinical Neurophysiology*, Vol. 47, October, 1979, P. 460-472, 23 Refs.

In 10 female subjects, power-spectrum analysis was performed on the alpha activity elicited during the resting state, 4 right hemispheric tasks, and 3 left hemispheric tasks. The data were treated in 3 ways: approach 1, comparing the right and left hemispheric alpha activity; approach 2, comparing the right and left hemispheric alpha activity adjusted for the resting state; and approach 3, comparing the right and left hemispheric alpha activity adjusted for the previous task. Approaches 1 and 2 revealed few significant differences in the alpha activity of the hemispheres, but approach 3 provided data that better fit the theory of decreased power spectrum or attenuation of activity in the activated hemisphere. Thus, approach 3 may be useful in developing an electroencephalographic test for determining cerebral dominance for language.

VI. AVIATION OTOLARYNGOLOGY

25. Anatomical effects of sudden middle ear pressure changes.

A. AXELSSON, J. MILLER & M. SILVERMAN, *The Annals of Otolaryngology and Laryngology*, Vol. 58, May-Jun 1979, P. 368-376, 14 Refs.

Acute middle ear (ME) and inner ear changes following brief unilateral phasic ME pressure changes (upto ± 6000 mm H₂O) were studied in the guinea pig. Middle ear findings included perforation of the tympanic membrane, serious and serosanguinous exudate and hemorrhage of tympanic membrane and periosteal vessels. Changes were related to magnitude of applied pressure. Perforation and hemorrhage were more commonly seen with negative rather than positive pressure. Air bubbles behind the round window were seen with positive pressures. Occasional distortion, but never perforation of the round window, was noted. Hemorrhage of the scala tympani was observed with both positive and negative pressures; scala vestibuli hemorrhage was found with negative ME pressure. In some instances pressure direction and magnitude related changes were seen in the contralateral ear.

26. Response of Nasal airway resistance to Hypercapnia and Hypoxia in man.

T. V. McCAFFERY, & E. B. KERN. *The Annals of Otolaryngology, Rhinology and Laryngology*, Vol. 58, March-April 1979, P. 247-252. 9 Refs.

The response of nasal airway resistance (R_n) to various degrees of hypoxia and hypercapnia was measured in six subjects using active posterior mask rhinomanometry. All resistances were computed during expiration at the flow rate of 0.5 liter/sec. Hypercapnia, induced by breathing gas mixtures of various contents of carbon dioxide, significantly decreased R_n ($P < 0.05$, Wilcoxon signed rank test). The reduction in R_n was proportional to the inspired partial pressure of carbon dioxide over a range of 0 to 50 torr. Breathing gas mixtures of high and low contents of oxygen produced no significant change in R_n ($P > 0.05$, Wilcoxon signed rank test). These results indicate that the nasal airway is actively involved in the respiratory response to hypercapnia but not to moderate hypoxia.

27. Influence of age on results of vestibular function tests—Review of literature and presentation of caloric test results.

G. MULCH & W. PETERMANN. *The Annals of Otolaryngology, Rhinology and Laryngology*, Vol. 58, Supplement 56, March-April 1979. P. 1-17, 35 Refs.

Following a bibliographic review of currently known, age-dependent morphological and functional

changes of the vestibular and auditory system, results are presented of our investigations concerning the influence of age on the outcome of the caloric test on 102 healthy subjects from six age groups ranging between the ages of 11 and 70 years. They prove, without any doubt, that the absolute values of nystagmic parameters in the caloric test are dependent upon age; but not in such a way that the intensity of reaction decreases with advancing age. On the contrary, they indicate that in awake, healthy subjects of middle and late middle-age, the most intensive reactions occur (maximum slow phase velocity, maximum amplitude, maximum frequency, total numbers of beats). In addition, based on the statistical analysis, it seems probable that the extent of the side difference of excitability depends upon age. Individuals in their middle years show side differences to a considerably lesser degree than children and elderly subjects. These represent findings which, to our knowledge, are reported here for the first time. Provided our results gain further substantiation, standard values for a true quantitative evaluation of the caloric test could only be determined as in the audiometric functional tests on the basis of larger test series of healthy subjects belonging to different age groups.

28. Estimated body rotation as a predictor of motion sickness susceptibility.

A. J. GUNDRY *Aviation Space and Environmental Medicine*, Vol. 50, Sep 1979, P. 917-920, 14 Refs.

We rotated 36 blindfolded subjects in yaw between 30° and 135° and asked them to estimate the angular displacement they had experienced. An index of a subject's "receptivity" was obtained by calculating the slope of the line relating perceived to actual displacement; his susceptibility to motion sickness was determined by a questionnaire. The product moment correlation between these two measures was not significant, a result which conflicts with the receptivity hypothesis. It is suggested that "adaptability" rather than "receptivity" may be the more important determinant of susceptibility to motion sickness.

VII. AVIATION OPHTHALMOLOGY

29. A new test of visual acuity using a holographic phase grating and a laser.

T. W. SMITH, P. W. REMIJAN, W. REMIJAN, H. E. KOLDER, & J. SNYDER.

Archives of Ophthalmology, Vol. 97, April 1979, P. 752-754, 5 Refs.

A new visual acuity testing device is able to determine a specific visual acuity of the retina even in the presence of opacities of the ocular media, such as a cataract. This is achieved by forming two spatially coherent, quasimonochromatic point sources near the nodal point of the eye. The two spherical waves that emanate from the point sources interact to produce a pattern of stripes on the retina. The intensity of the pattern is easily varied. More importantly, the pattern can be projected over different-sized retinal areas corresponding to visual fields of 0.5 to 15° in diameter. The device may be useful for vision research and preoperative assessment of visual potential.

30. Retinal rivalry in functional amblyopia.

T. LAWWILL, & G. MEUR, *Archives of Ophthalmology*, Vol. 97, June 1979, P. 1100-1102, 6 Refs.

Thirteen patients with varying degrees of amblyopia were examined for perception of retinal rivalry with the use of the phase difference haploscope. Visual acuity was varied in the fixing eye by the addition of plus lenses, equalizing ocular dominance. Retinal rivalry could be detected over wide ranges of visual acuity disparity by amblyopic patients with visual acuity better than 20/50. Rivalry could not be detected, however, by patients with less than 20/50 visual acuity in their amblyopic eye.

31. Internal ophthalmoplegia after argon laser panretinal photocoagulation.

G. D. ROGELL, *Archives of Ophthalmology*, Vol. 97, May 1979, P. 904-905, 7 Refs.

Internal Ophthalmoplegia was found in eight eyes of four patients with juvenile onset diabetes. All eight eyes had received argon laser panretinal photocoagulation (PRP) for proliferative diabetic retinopathy. Internal ophthalmoplegia was not found in any of the 14 eyes of seven patients with juvenile diabetes who had not had photocoagulation treatment. This group included one patient in whom internal ophthalmoplegia was present after treatment. Laser injury to the short ciliary nerves, as they course anteriorly on the inner surface of the sclera, is the

probable cause of internal ophthalmoplegia in these patients. To my knowledge, this complication has not been reported previously, but it appears to be a common side effect of PRP.

32. Amblyopia: the need for a new approach.

R. M. INGRAM, *British Journal of Ophthalmology*, Vol. 63, April 1979, P. 236-237, 7 Refs.

Follow-up of a series of 221 children identified by the present methods of screening, and presenting consecutively with squint and/or amblyopia, shows that there has been no demonstrable improvement in the overall incidence and severity of amblyopia 3 or more years later. A new approach to the problem is required, and this might be based on the identification and treatment of amblyopia during the 'sensitive period'.

33. A simple method of detecting abnormal retinal correspondence.

A. PORTER, *British Journal of Ophthalmology*, Vol. 63, May 1979, P. 353-354, 4 Refs.

A method is described of determining the state of retinal correspondence by means of an ordinary streak retinoscope used to produce a modified after-image test.

VIII. ESCAPE AND SURVIVAL

34. Spinal injuries in the F/FB-III crew escape system.

L. E. KAZARIAN, K. BEERS, & J. HERNANDEZ, *Aviation Space and Environmental Medicine*, Vol. 50, Sep. 1979, P. 948-957, 1 Ref.

During the years 1970-75, a larger than expected number of aircrewmembers, forced to use the F/FB-111 crew escape module, experienced acute spinal trauma during otherwise uneventful ejection. This trend in the incidence and severity of F/FB-111 aircrew spinal injuries attracted considerable attention and stimulated extensive inquiry concerning the etiology of the trauma in order to implement appropriate corrective measures. In response to the expressed concern, an investigation was initiated to analyze the biodynamic pathogenic mechanism associated with ejection in the F/FB-111 crew escape module. The purpose of this retrospective investigation is

to identify the frequency and severity of spinal trauma in the F/FB-111 crew escape module and to shed additional light on the patterns and severity along with the orthopaedic biomechanics of spinal injury.

35. Biodynamic effects of canopy loss in the TF-15 aircraft.

W. F. KENDALL, JR., and R. C. HILL.
Aviation Space and Environmental Medicine, Vol. 50, April 1979, P. 338-342, 3 Refs.

In-flight canopy loss in high-speed fighter or trainer aircraft poses serious aeromedical problems for the crew-members. To assess these problems in the TF-15, a series of canopy-off tests were conducted. Preliminary phases of the test consisted of a taxi and a flight test up to 485 knots with a pilot in the front seat and an instrumented dummy in the back seat. Upon evaluation of these results, a taxi phase and a flight phase were conducted with a pilot in the front seat and a live subject in the back seat. Maximum air-speed attained was 410 knots. The front crew-member experienced no serious control or medical problems during all phases. The back crew member did experience problems such as loss of communications, loss of vision, helmet lift, high frequency head buffet, and exhalation difficulties. Airspeed, seat height, and body position had the greatest effect on the severity of the windblast. Angle of bank, angle of attack, and acceleration had little effect. The aft crewmember was able to significantly decrease windblast effects by leaning forward and pulling his head and helmet forward and down with his hand.

IX. ERGONOMICS

36. Prediction of endurance time for alternating workload tasks.

S. DEIVANAYAGAM and M. M. AYOUB,
Ergonomics, Vol. 22, March, 1979, P. 279-290, 14 Refs.

Endurance is the ability to sustain or persist in an activity continuously. This paper describes an attempt to develop a satisfactory means of predicting in advance the endurance time limit of an individual engaged in a physical task of alternating work load nature. Under moderate to heavy muscular work the endurance of a worker is related to the rate of energy output required to perform the task. Further, it has also been observed that even under a fixed

workload demand, the energy output level of the worker tends to increase gradually with time. The above two criteria were taken into consideration in developing the predictive models described here. A series of experiments with subjects walking on motor-driven treadmill while being monitored for oxygen intake and other physiological parameters, was conducted to obtain necessary data for the models and to verify the accuracy of the models. These models, it is felt have considerable practical value with possible applications in industry, the military, sports and other areas.

37. Tracking-task performance during heat stress simulating cockpit conditions in high performance aircraft.

S. A. NUNNELEY, P. J. DOWD, L. G. MYHRE, R. F. STRIBLEY & R. C. MCNEE, *Ergonomics*, Vol. 22, May, 1979, P. 549-555, 19 Refs.

Heat stress can be a significant problem in high performance aircraft, where it has a measurable physiological impact on aircrew and may alter the learning curve for novel tasks. In these experiments nine men were trained to plateau performance on a compensatory tracking task. They were then tested at the end of 2h exposures to the following conditions (T_{db}/T_{wb} , °C) Control (C) 25/ambient, Warm (W) 35/26 and Hot (H) 40/30. For W and H, globe temperature was raised to 12°C above T_{db} by infrared lamps. While W was physiologically compensable, H was near the upper limit of tolerance, as shown by steadily rising heart rate, elevated rectal temperature and 1.4kg mean weight loss. The simplest tracking task showed a small but statistically significant improvement in time on target with heat, while two more difficult tasks showed no change. Human operator modelling supported these findings. Discussion relates these results to actual cockpit conditions and the literature of performance in heat.

38. The analysis of the operator's activities in the man-machine system.

B. F. LOMOW, *Ergonomics*, Vol. 22, June, 1979, P. 613-619, 2 Refs.

The analysis of man-machine systems aimed at first at the optimization of displays and controls to create better working conditions. The general approach was then machine-centred. Gradually it

appeared necessary to reverse this attitude into a man-centred approach. Instead of analysing man as an operator it seems now indispensable to study the operator as a man which implies an anthropological approach.

The structure of the operator's activities has to be examined. In this connexion it is important to take into account his vision of the situation resulting from the implementation of his work. The operator has to be considered as a whole, as a complete system receiving information not only from the object he is working at but also through different channels connecting him with the environment as well as from signals coming from himself. Sometimes these non-instrumental signals achieve a greater-importance than the instrumental ones. However, the drafting of a comprehensive psychological theory of human activity taking fully into account its structure needs further studies.

39. The influence of low frequency vibration on pilot performance (as measured in a fixed base simulator).

A. M. STAVE, *Ergonomics*, Vol. 22, July, 1979, P. 823-835, 11 Refs.

This report describes a study on the effects of low frequency vibration on pilot performance. Army pilots acted as subjects and flew simulated helicopter

missions in a realistic fixed base simulator environment. While flying the two hour missions pilots were exposed to vibration stimuli varying in frequency from 6 to 12 Hz and in amplitude from ± 0.1 to $\pm 0.3g$ (measured at the floor). Measurements were taken on the vibration transmissibility of the pilot's seat so that the vibration actually felt by the subject could be determined.

Missions involved transporting external loads in a simulated logistics environment. Performance was evaluated by measuring flight path deviations from prescribed en route, approach and hover parameters.

The vibration stimuli used did not degrade performance. In fact, performance tended to improve with increased stress. It is hypothesized that this trend was due to motivation, i.e. as subjects felt the onset of fatigue they compensated by working harder and thus tended to improve their performance.

On about 6% of their scores pilots exhibited sudden lapses in their ability to respond to display indications. This resulted in poor scores in the midst of otherwise normal data. These lapses are probably of very short duration (seconds in length) and seem to occur randomly. This same effect was also observed in a previous study by the author. It may be possible that lapses of this type are related to so called 'pilot error' accidents. Further research is needed to verify this.