Abstracts of Current Aviation Medicine Literature

I. ACCELERATION PHYSIOLOGY

1. Regional Coronary Blood Flow at Rest and During High Sustained + Gz in a Miniature Swine With Subclinical, Ischaemic, Coronary Heart Disease Due to Coronary Stenosis.

M. HAROLD LAUGHLIN, WILLIAM M. WITT, JOHN W. BURNS and JOHN T. YOUNG. *Aviation Space and Environmental Medicine*, Vol. 49, November 1978, P. 1308-1313, 21 refs.

New-generation high-performance aircraft can produce levels of high sustained +Gz which may exceed man's physiological capacity to withstand such stress. The severity of this stress has led to concern that sudden incapacitation due to coronary heart disease could occur during high sustained +Gz. This report presents results obtained from an apparently asymptomatic miniature swine with a severe stenosis of the left anterior descending branch of the left coronary artery. Regional coronary blood flow was measured with the radiolabeled microsphere technique using 9 ± .08 m diameter microspheres. Under resting conditions, myocardial blood flow was marginally depressed in the areas distal to the coronary stenosis. When the animal was exposed to + 7 Gz, a large portion of the heart became acutely ischemic due to a redistribution of coronary blood flow. After 49 sec of exposure to — 7 Gz, the animal developed fatal ventricular fibrillation. Histologically, the areas of myocardium supplied by the stenosed vessel showed a variety of ischaemia-induced leisons, including infarction and patchy myocardial fibrosis.

2. Incapacitation Time for + Gz—Inducted Loss of Consciousness.

JAMES E. WHINNERY, and ROBERT M. SHAFFSTALL. *Aviation Space and Environmental Medicine*, Vol. 50, January 1979, P. 83-85, 13 refs.

Everyone is susceptible to +Gz induced loss of consciousness (LOC) upon exceeding his G tolerance. With more operational high-performance aircraft having high-G onset rates, one can anticipate a greater likelihood of LOC during aerial combat maneuvers. Estimates of the time of incapacitation caused by pure +Gz are particularly important in aiding accident investigation teams, who have been tasked to recreate aircraft incidents and accidents, and also to aeromedical clinicians investigating alterations in aircrew consciousness for unknown reasons. LOC due to pure +Gz on the USAF School of Aerospace Medicine (USAF-SAM) centrifuge causes a mean time of incapacitation of 15.0 sec with a range from 9.0 to 20.5 sec. This represents the minimum or lower limit of incapacitation under the ideal conditions of returning immediately to a + 1 Gz environment. In an operational multistress aircraft, conditions may not be nearly so ideal, requiring longer periods before a pilot can initiate the recovery sequence. Loss of consciousness was found to occur very suddenly, and even experienced subjects were sometimes unable to recognize either its onset or overall occurence. The rationale for training pilots on a centrifuge is discussed.

3. SPH-4 Helmet Damage and Head Injury Correlation.

BRUCE A. SLOBODNIK, *Aviation Space and Environmental Medicine*, Vol. 50, February 1979, P. 139-146, 10 refs.

Human tolerance to head impact was assessed by correlating the force levels required to duplicate damage seen in 14 SPH-4 aviator helmets retrieved from U.S. Army helicopter crashes with resulting head injury. Head injury occurred at peak acceleration levels far below 400 F, which is the value currently used by the U.S. Army as the pass-fail criterion in evaluating the impact attenuation performance of prospective aircrew helmets. Concussive head injuries occurred below Severity Index values of 1500 and below Head Injury Criterion values of

1000. These are considered concussive threshold values by the National Operating Committee on Standards for Athletic Equipment and by the Department of Transportation, respectively. Because peak transmitted force was the best estimator of the Abbreviated Injury Scale values assigned to the 14 cases, it may be a more effective criterion to use in the evaluation of helmet impact attenuation performance than is peak G, Severity Index, or Head Injury Criterion.

4. Relaxed Gz tolerance in healthy men: effect of age.

DAVID H. HULL, ROGER A. WOLTHUIS, K. K. GILLINGHAM and JOHN H. TRIEBWASSER, *Journal of Applied Physiology*, Vol. 45, October, 1978, P. 626-629, 12 refs.

Fifty-three healthy US Air Force aircrewmen, 26-55 years old, volunteered for a centrifuge study designed to determine the effect of age on relaxed +Gz tolerance. Each was subjected to G forces of gradual and rapid onset, with G tolerance determined by standardized contraction of peripheral visual fields. Of the subject characteristics studied, only age was positively correlated with rapid-onset G tolerance; both age and weight were positively correlated with gradual-onset G tolerance. A combination of age and weight gave a stronger positive correlation with G tolerance (rapid- and gradual-onset) than did either characteristic alone. No significant negative correlations were observed. We conclude that aging may offer some protection from G stress; there is no evidence that aging leads to a decrement in G tolerance.

5. Distribution of pulmonary ventilation and perfusion during short periods of weightlessness.

DAVID B. MICHELS and JOHN B. WEST, *Journal of Applied Physiology*, Vol. 45, December 1978, P. 987-998, 26 refs.

Information on distributions of pulmonary ventilation and perfusion was obtained from four subjects on board a Learjet during 112 weightless periods lasting upto 27 s each. Zero gravity (G) was obtained during all or part of each test by varying the aircraft flight profile. Single-breath N_2 washouts were performed with the test inspiration containing an initial bolus of argon at residual volume (RV). When the test inspiration was at O G, and the washout at O G or greater, the terminal rises and the cardiogenic oscillations in both N_2 and argon were small and often absent. If instead the test inspiration was at 1 G with the washout at O G, the terminal rises were again small or absent but the cardiogenic oscillations for N_2, but not argon, were also nearly eliminated by performing just the preliminary exhalation to RV at O G with the test inspiration and washout following at 1 G. Alveolar plateaus for N_2 sloped upward at O G apparently due to montopographical inequalities of ventilation. In further tests during air breathing, recordings were made of expired partial pressure of oxygen (P_{O_2}) and carbon dioxide (P_{CO_2}) following a brief hyperventilation and a 15-s breath hold. These recordings revealed marked cardiogenic oscillations in P_{O_2} and P_{CO_2} at 1 G that were enhanced at 2 G but almost eliminated at O G. The results suggest that virtually all the topographical inequality of ventilation, blood flow, and lung volume seen under 1-G conditions are abolished during short periods of O G.

II. CLINICAL AVIATION MEDICINE

6. Precordial exercise mapping: improved diagnosis of coronary artery disease.

KIM FOX, ANDREW SELWYN and JOHN SHILLINGFORD, *British Medical Journal*, Vol. 2, 9 December 1978, P. 1596-1598, 17 refs.

Surface mapping of the exercise electrocardiogram (ECG) provides a measure of the precordial area, severity, and time course of ST-segment changes occurring after exercise. Sixteen-lead isopotential surface maps were recorded before and after exercise in 109 patients with probable angina who subsequently underwent coronary arteriography. In addition, exercise ECGs with three orthogonal leads were obtained in 53 of these patients, and with a single unipolar chest lead in all 109. Of the 109 patients, 85 had significant (>70%) narrowing of at least one major coronary artery. The sensitivities of the precordial surface mapping, orthogonal leads, and single chest lead (V5) when compared with the findings at coronary arteriography were 95%, 68%, and 64% respectively, while the specificities of the three lead systems did not differ significantly.

The technique of precordial surface mapping after exercise may easily be applied in clinical practice and requires only conventional equipment available in most hospitals. It effectively aids diagnosis of coronary artery disease.

7. Prevalence of three major risk factors in random sample of men and women, and in patients with ischaemic heart disease.

T. B. S. DICK and M. C. STONE, *British Heart Journal*, June 1978, Vol. 40, P. 617-626.

A random sample of 283 men and 250 women between the ages of 30 and 69 years has been investigated for the three coronary risk factors — smoking, hyperlipoproteinaemia, and hypertension, and 146 men and 87 women with ischaemic heart disease have undergone a similar investigation.

Smoking and hyperlipoproteinaemia are significantly more common in both men and women in ischaemic heart disease groups but hypertension is not substantially different. The prevalence of any one of these three risk factors is the same in the random sample and ischaemic heart disease groups, but the prevalence of two or more factors is significantly greater in the ischaemic heart disease groups. The absence of all three risk factors is commoner in the random sample.

The prevalence of smoking is far greater in men with ischaemic heart disease than in the equivalent female patients, whereas the prevalence of hyperlipoproteinaemia is significantly greater in women.

Young men in the random sample have a significantly greater prevalence of all three factors than young women, but in the whole age range cigarette smoking is the only factor significantly greater in men than in women. In the whole random sample 24 per cent of men and 9 per cent of women have two or more risk factors.

In men the combination of smoking with either of the other two factors is significantly more common in the ischaemic heart disease group, but the combination of hypertension plus hyperlipoproteinaemia is not. In women, however, hypertension plus hyperlipoproteinaemia is the commonest combination and is significantly more common in the ischaemic heart disease group. In the random sample the combination of cigarette smoking with one or both of the other two factors is 7 times more common and smoking plus hypertension 25 times more common in men than in women.

Types II a and IV hyperlipoproteinaemia are more common in both men and women with ischaemic heart disease than in their random samples, but Type II b is significantly increased only in women with ischaemic heart disease.

It is suggested that reporting the prevalence of a single risk factor without knowing what other factors are present can be misleading. Our data suggest that a substantial part of the preponderance of ischaemic heart disease in men relates to their greater prevalence of major risk factors in the younger age range, and particularly to the greater prevalence of moderately heavy cigarette smoking in combination with one or more of the other factors.

8. A co-operative trial in the primary prevention of ischaemic heart disease using clofibrate.

Report from the Committee of Principal Investigators, *British Heart Journal*, Vol. 40, October 1978, P. 1069-1118.

A double blind intervention trial was started in 1965 to test the hypothesis that the incidence of ischaemic heart disease in middle-aged men can be reduced by lowering raised serum cholesterol levels. It was carried out in 5 European centres Edinburgh, Budapest, and Prague. Serum cholesterol was to be lowered by the drug clofibrate (ethyl chlorophenoxyisobutyrate) which was considered to be free from serious side effects.

Studies were carried out on 15745 males, aged 30 to 59 at entry, for an average of 5.3 years, accumulating 83534 years of experience. The treatment group, of about 5000, Group I, was a randomly chosen half of the men in the upper third of the serum cholesterol distribution in some 30000 volunteers. The comparable control group, Group II, comprised the other 5000 men of the upper third of the cholesterol distribution, and these were given a placebo. A further control group, Group III, of 5000 men, was selected randomly from the lower third of the cholesterol distribution. These numbers were chosen in order to be 90 per cent certain of detecting a 30 per cent reduction in the incidence

of ischaemic heart disease should this occur. Subjects with manifest heart or other major disease were excluded from the trial. No attempt was made to correct other 'risk factors' for IHD, but their presence was monitored and considered in the analysis. Investigators and participants in the trial were unaware of the groups to which individual men belonged.

A mean reduction of approximately 9 per cent of the initial serum cholesterol levels was achieved in the treatment group (ranging from 7 to 11%, in the 3 centres); this was less than the 15 per cent fall expected. In Edinburgh, during treatment, serum triglyceride concentrations in Group I resembled those naturally occurring in Group III.

The incidence of IHD was lower by 20 per cent in the clofibrate group compared with the high cholesterol controls ($P<0.05$); this fall was confined to non-fatal myocardial infarcts which were reduced by 25 per cent. The incidence of fatal heart attacks was similar in the 2 high cholesterol groups and there was no significant difference in the incidence of angina. Group III showed substantially lower rates of ischaemic heart disease.

The reduction of myocardial infarction in the clofibrate-treated group was greatest in men with the highest levels, and greatest reduction in serum cholesterol. Men with a substantial reduction of cholesterol concentration, who smoked, and also had above average blood pressure levels showed the most benefit.

The numbers of deaths, and crude mortality rates from all causes in the clofibrate-treated group significantly exceeded those in the high cholesterol control group ($P<0.05$), though the age-standardised mortality rates did not differ significantly between the 3 groups. The numbers of death from 'other vascular causes' and from 'accidents' as well as IHD were similar in Groups I and II. Excluding these, the excess of deaths in the clofibrate-treated over the high cholesterol control group was 77v47 ($P<0.01$). The subgroup with the greatest proportionate excess of deaths is that of conditions related to the liver, the biliary, and intestinal systems, with 19 deaths in Group I v 7 in Group II ($P<0.05$). Deaths from these conditions were commoner, however, in Group III than in Group II (age-standardised rates for the 3 groups being 0.75, 0.17, and 0.65, respectively), and it is possible that Group II had fortuitously low rates. The cholesystectomy rate for gall stones was higher in Group I than in Group II and III ($P<0.001$).

The results of the trial confirm the basic hypothesis that reduction of high serum cholesterol levels, even in middle-age, can reduce the incidence of IHD. However, the fact that clofibrate increases the incidence of gall stones, and the possibility that it may have even more serious local pathological consequences, indicate that it cannot be recommended as a lipid-lowering drug for community-wide primary prevention of ischaemic heart disease.

9. Myocardial infarction among men below age 40.

R. BERGSTRAND, A. VEDIN, C. WILHELMSSON, J. WALLIN, H. WEDEL, and I. WILHELMSEN, *British Heart Journal*, Vol. 40, July 1978, P. 783-788.

Studies were made in Goteborg over a period of 6 years of all cases of acute myocardial infarction diagnosed among men below the age of 40. Thirty-six cases were registered and 8 of these died outside hospital. Three patients died early during the hospital stay. The remaining 25 patients were compared with a random sample from the general population in Goteborg with respect to conventional risk factors. Smoking, and high plasma cholesterol values were dominating findings among the patients, whereas there was no significant difference in blood pressure levels.

Coronary angiography was performed in 18 patients of whom 2 showed normal coronary arteries and left ventricular angiograms. These 2 patients were the only ones free from risk factors. Of the remaining16 patients, 10 had only one vessel affected.

10. Coronary and myocardial metabolic effects of combined glyceryl trinitrate and propranolol administration. Observations in patients with and without coronary disease.

STEVEN J. SCHANG, JR. and CARL J. PEPINE, *British Heart Journal*, Vol. 40, November 1978, P. 1221-1228.

Coronary haemodynamic and metabolic effects

of propranolol and glyceryl trinitrate were studied in 12 patients with coronary artery disease and 5 without coronary heart disease, at rest and during tachycardia stress. Propranolol-associated reductions in indices of myocardial oxygen demand, left ventricle work, tension time, and left ventricle utilisation ($LVVO_2$) were reversed when heart rate was controlled by atrial pacing. Adding glyceryl trinitrate at rest also restored heart rate but decreased the left ventricular work index and tension time index as coronary resistance declined paradoxically. Tachycardia-related increases in tension time index and $LVVO_2$ were unchanged after propranolol, and ischaemia (angina, ST depression, and reduced lactate extraction) was not altered in most of the patients. During tachycardia, the addition of glyceryl trinitrate decreased the tension time index and $LVVO_2$; angina recurred in only 4 patients, and ST depression and lactate extraction improved. Similar haemodynamic changes occurred in the patients with normal coronary arteries.

In contrast with propranolol administered alone, propranolol plus glyceryl trinitrate enchances tachycardia tolerance and prevents tachycardia-induced manifestations of ischaemia. This action is attributed to glyceryl trinitrate-associated improvement in the adequacy of myocardial perfusion.

11. Randomised study of six beta-blockers and a thiazide diuretic in essential hypertension.

R. G. WILCOX, *British Medical Journal*, 1978, Vol. 2, P. 383-385, 8 refs.

Atenolol was compared with five other beta-blockers and a thiazide diuretic in a randomised cross-over trial of once-daily treatment of essential hypertension. Atenolol was significantly better at reducing resting and exercise blood pressures at 24 hours than any of the other drugs and had a low incidence of side effects. Both timolol and acebutolol had a significant hypotensive effect at 24 hours and a low incidence of side effects, suggesting that further increases in dosage might be effective and well tolerated. Labetalol proved ineffective when given once daily, and the high incidence of side effects, equalled only by pindolol, would probably prohibit further increases in dosage. Bendrofluazide was equal or superior to all the beta-blockers except atenolol at reducing resting blood pressure, and its cheapness still makes it an agent of first choice in mild or moderate essential hypertension.

12. Sympathetic Nervous System and Blood Pressure Control in Essential Hypertension.

J. H. PHILIPP, A. DISTLER and U. CORDES, *The Lancet*, Vol. II, 4 November 1978, P. 959-963, 20 refs.

In normotensive subjects an inverse correlation was observed between an index of sympathetic nervous activity (the plasma-noradrenaline concentration during physical exercise) and reactivity to exogenous noradrenaline. This relationship was invariably disturbed in age-matched patients with essential hypertension. Multiple-regression analysis revealed a highly significant correlation between the combination of both factors and the height of mean arterial blood pressure ($r = 0.91$). The findings suggest that sympathetic nervous activity and pressor response to nor-adrenaline together form an important determinant of the arterial blood-pressure level. An inverse relationship could be demonstrated between plasma-renin concentration and pressor response to angiotensin II in normotensives, and this relationship was unchanged in hypertensive patients. Therefore angiotensin II does not appear to contribute directly to high blood-pressure.

13. Effects of propranolol and metoprolol on the peripheral circulation.

P. D. Mc SORLEY and D. J. WARREN, *British Medical Journal*, Vol. 2, 9th December 1978, P. 1598-1600, 10 refs.

The effects of single doses of propranolol and metoprolol on skin temperature and skin and muscle blood flow were compared in 10 normal subjects and four patients with essential hypertension. In normal subjects the mean skin temperature fell by 1.30 ± 0.62°C 90 minutes after 80 mg propranolol and 0.15 ± 0.05°C after 100 mg metoprolol. Skin blood flow and resting muscle blood flow were not affected by metoprolol but fell significantly after propranolol. Both drugs reduced post-exercise muscle hyperaemia, more by propranolol than metoprolol. Similar changes were seen in the hypertensive patients.

Propranolol should be used with care in patients with known vascular disease.

14. Baroreflex sensitivity in hypertension during beta-adrenergic blockade.

R. T. KREDIET and A. J. DUNNING, *British Heart Journal*, Vol. 41, January 1979, P. 106-110.

Baroreceptor function was measured in 18 patients with essential hypertension by plotting the change in pulse interval against a phenylephrine-induced transient rise in systolic blood pressure. The influence of propranolol (160 mg daily for at least 4 weeks) on this function and on heart rate after maximal exercise was studied and correlated with the plasma propranolol level. In 13 out of the 18 patients only baroreflex resetting occurred with no change in sensitivity during propranolol administration. A definite correlation was found between the degree of beta-adrenergic blockade, expressed as the reduction in maximal exercise heart rate and the change in mean arterial pressure. No relation could be shown between plasma propranolol steady state levels and these changes. The fall in blood pressure during beta-adrenergic blockade with a low dosage of propranolol apparently does not depend on changed baroreflex sensitivity, but on the intrinsic action of this drug on beta-receptors.

15. Relation of high-density lipoprotein cholesterol concentration to type of diabetes and its control.

A. L. KENNEDY, T. R. J. LAPPIN, I. D. LAVERY, D. R. HADDEN, J. A. WEAVER and D. A. D. MONTGOMERY, *British Medical Journal*, 1978, 2, 1191-1194, 22 refs.

Serum cholesterol and high-density lipoprotein (HDL) cholesterol concentrations were measured in 192 diabetics (91 with juvenile-onset and 98 with maturity-onset diabetes) and 177 non-diabetic controls. Hb A_{1c}, an index of blood sugar control, was also measured in the diabetics. Serum cholesterol concentrations were similar in all the diabetics and controls, but HDL cholesterol concentrations were lower in patients with maturity-onset diabetes than in those with juvenile-onset diabetes and controls. There was no correlation in diabetics between HDL cholesterol and Hb A.

We conclude that HDL cholesterol concentrations are abnormally low in patients with maturity-onset diabetes but essentially normal in those with juvenile-onset diabetes. They are not related to diabetic control.

16. Aspirin Stimulates Insulin and Glucagon Secretion and Increase Glucose Tolerance in Normal and Diabetic Subjects.

PIERO MICOSSI, ANTONIO E. PONTIROLI, STEVEN H. BARON, RAUL C. TAMAYO, FRIEDA LENGEL, MAURIZIO BEVILACQUA, UMBERTO RAGGI, GUIDO NORBIATO and PIERO P. FOA, *Diabetes*, Vol. 27, December 1978, P. 1196-1201, 73 refs.

Normal subjects and patients with adult-onset diabetes received 10 gm. of aspirin in four days. On the fourth day, the fasting serum glucose and the glucose response to oral glucose were decreased in both groups. These changes were associated with increased levels of serum insulin and pancreatic glucagon, although the glucagon responses to oral glucose were unchanged. In the diabetic patients, aspirin therapy was followed by a decreased glucose response to I.V. glucose and by the appearance of an early insulin peak, which could not be demonstrated before treatment. Aspirin did not affect the I.V. glucose tolerance in normal subjects, although it did enhance the early insulin peak. A decrease in the fasting levels of free fatty acids was noted in both groups, whereas the fasting level of triglycerides decreased only in the diabetic patients. Cholesterolemia did not change in either group. A few preliminary observations indicate that, in normal subjects, ibuprofen and ketoprofen, two other presumed prostaglandin inhibitors, did not affect fasting glycemia, glucose tolerance, or the insulin response to glucose. No changes were noted after the administration of placebo.

17. Controlled clinical Trial of Five Short-course (4-month) Chemotherapy Regimens in Pulmonary Tuberculosis.

First Report of 4th Study, EAST AFRICAN and BRITISH MEDICAL RESEARCH COUNCILS, *The Lancet*, Vol. II, 12 August 1978, P. 331-338, 26 refs.

Five 4 mo regimens of chemotherapy for tuberculosis are compared. The two regimens in which rifampicin was given throughout the 4 mo were associated with bacteriological relapse rates of 8% in the first 6 mo after stopping chemotherapy, but

the three regimens in which rifampicin was given for only the first 2 mo had relapse rates of 24–32%. There was no evidence that the addition of pyrazinamide in the second 2 mo of chemotherapy reduced the bacteriological-relapse rate. Removal of the streptomycin from the first 2 mo appeared to reduce the bactericidal and sterilising activity of the regimen, although the differences were not statistically significant. The incidence of adverse reactions was very low with all five regimens.

18. An interactive data management and analysis system for clinical investigators.
G. F. GRONER, M. D. HOPWOOD, N. A. PALLEY, W. L. SIBLEY, W. R. BAKER, T. G. CHRISTOPHER and H. K. THOMPSON, JR., *The Journal of Laboratory and Clinical Medicine*, Vol. 92, September 1978, P. 325-340, 11 refs.

An interactive minicomputer-based system has been developed that enables the clinical research investigator to personally explore and analyze his research data and, as a consequence of these explorations, to acquire more information. This system, which does not require extensive training or computer programming, enables the investigator to describe his data interactively in his own terms, enter data values while having them checked for validity, store time-oriented patient data in a carefully controlled on-line data base, retrieve data by patient, variable, and time, create subsets of patients with common characteristics, perform statistical analysis and produce tables and graphs. It also permits data to be transferred to and from other computers. The system is well accepted and is being used by a variety of medical specialists at the three clinical research centres where it is operational. Reported benefits include less elapsed and nonproductive time, more thorough analysis of more data, greater and earlier insight into the meaning of research data, and increased publishable results.

III. HIGH ALTITUDE PHYSIOLOGY

19. Effects of time and vasoconstrictor tone on O_2 extraction during hypoxic hypoxia.
STEPHEN M. CAIN, *Journal of Applied Physiology*, Vol. 45, August 1978, P. 219-224, 15 refs.

To test the role of peripheral vasoconstrictor tone in the efficient use of a limited O_2 supply, three groups of anesthetized dogs were ventilated with 9.1% O_2 until circulation failed. Two groups were a-blocked with phenoxybenzamine and one of those was volume expanded with dextran to restore blood pressure. After O_2 uptake was lowered in hypoxia, O_2 uptake was linearly related to O_2 delivery (cardiac output X arterial O_2 content) with $r = 0.94$. The slope of that line was mathematically identical to the extraction ratio and it increased from 0.51 at 10 min to 0.87 at the end of hypoxia ($r=0.99$). In both a-block groups O_2 extraction remained constant with time, and O_2 extraction in each a-block group was significantly less ($P<0.01$) than in the unblocked group. As further evidence of better O_2 extraction mixed venous partial O_2 pressure was significantly less in the unblocked group, 6.2 ± 3.4 Torr vs. 10.6 ± 3.2 and 9.9 ± 2.4 Torr with a-block ($P<0.01$). Results after a-block indicated that a vigorous vasoconstrictor tone during hypoxia conserved O_2 by promoting greater extraction by the tissues.

20. Blood flow and relative tissue PO_2 of brain and muscle : role of carotid chemoreceptors.
JUDITH A. NEUBAUER, RUTH S. FELDMAN, JONG TEH HUANG, JAKOB VINTEN JOHANSEN and HARVEY R. WEISS, *Journal of Applied Physiology*, Vol. 45, September 1978, P. 419-424, 18 refs.

The effects of inspiration of low O_2 and/or high CO_2 gas mixtures on relative tissue Po_2 and perfusion of brain and muscle were studied in 60 pentobarbital-anesthetized spontaneously respiring rats. These animals were studied in intact condition, after administration of phenoxybenzamine hydrochloride, 2 mg/kg, or after bilateral denervation of their carotid bodies. In the intact rats, the relative tissue Po_2 ratio of biceps brachii to cerebral white matter always decreased after exposure to the above gas mixtures. This indicated a better maintenance of O_2 supply to demand in the brain than in muscle. After either carotid denervation or alpha adrenergic blockade, this change in the ratio was no longer significant. Further, cerebral blood flow responses to these gas mixtures were attenuated (avg + 5.3%) compared to previous work in intact rats. It is concluded that the brain is best protected against hypoxia and/or hypercapnia when the carotid chemoreflex is intact.

21. Cardiorespiratory Assessment of Decongestant-Antihistamine Effects on Altitude, +Gz, and Fatigue Tolerances.

MICHAEL T. LATEGOLA, AUDIE W. DAVIS, JR., PEGGY J. LYNE and MARY J. BURR, *Aviation Space and Environmental Medicine*, Vol. 50, February 1979, P. 101-109.

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 (12500 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.

22. Effects of Altitude and Two decongestant-Antihistamine Preparations on Physiological Functions and Performance.

E. A. HIGGINS, W. D. CHILES, J. M. McKENZIE, A. E. JENNINGS, G. E. FUNKHOUSER, and S. R. MULLEN, *Aviation Space and Environmental Medicine*, Vol. 50, February 1979, P. 154-158, 9 refs.

Fourteen men were studied to determine the combined effects of two altitudes — 388 and 3810 m or 1,274 and 12,500 ft — and three preparations — lactose placebo, Compound A (Actifed), and Compound B (Dristan). Subjects reported least attentiveness with A and greatest with placebo. Fatigue increased significantly with time while energy, interest, and attentiveness decreased. The Multiple Task Performance Battery (MTPB) showed no effects of altitude, drugs, or time on overall performance; however, performance declined with time in several tasks, while problem solving improved. Subjects enjoyed the problem-solving tasks and may have given them preference as levels of interest declined. Though the MTPB overall composite scores did not change significantly, physiological parameters and subjective evaluations indicate that type of compound and time after ingestion are important. Declines in energy and attentiveness 2.5 h after ingestion could result in neglect of important although routine — tasks. Hypoxia might enhance this effect and consequences might be worse in subjects whose medical conditions require these drugs.

23. A study on the valsalva manoeuvre in young healthy subjects.

I. PICORNELL-DARDER, J. L. CARRASCO, J. C. ROSTAIN and R. NAQUET, *Electroencephalography and Clinical Neurophysiology*, Vol. 45, November 1978, P. 653-564, 19 refs.

The Valsalva manoeuvre was performed by 2 groups of young healthy male subjects: novice divers and professional divers. The electrophysiological features of this manoeuvre are summarized and the results of the test are correlated with subject age, motivation and FEV_1/VC coefficient (forced expiratory volume sec/vital capacity). Positive test results (fainting caused by the Valsalva manoeuvre) increased with subject motivation (novice divers), FEV_1/VC coefficient and decreasing subject age. The various hypotheses proposed to account for fainting caused by the Valsalva manoeuvre are discussed with respect to these data. The implications of Valsalva positivity in young divers are discussed.

IV. AVIATION NEUROPSYCHIATRY

24. Performance, Mood, and Clinical Symptoms in Men Exposed to Prolonged, Severe Physical Work and Sleep Deprivation.

PER KRISTIAN OPSTAD, ROALD EKANGER, MORTEN NUMMESTAD and NILS RAABE, *Aviation Space and Environmental Medicine*, Vol. 49, September 1978, P. 1065-1073, 26 refs.

There were 11 young men who participated in strenous combat courses of 4 d (course I) or 5 d

(course II), almost without sleep. They were tested and examined clinically each morning. Groups 1 and 2 had no organized sleep, whereas groups 3 and 4 got 3 and 6 h, respectively, in the middle of each course. Substantial impairment was observed in all tests, as well as clinical symptoms toward the end of the courses for groups 1 and 2. In the vigilance test, the reaction time task, the code test, and the profile of mood-state, significant impairment was observed even after 24 h. Complaints of symptoms came first. Disturbance of senses and behaviour appeared later. Group 4 had significantly better results than groups 1 and 2 in clinical symptoms and all tests, except the positive-score in mood state. Group 3 occupied an intermediate position. Corresponding results were obtained in the two separate courses. In the morning following the course, recovery after 4 h of sleep was less extensive for course II than course I participants.

25. Sustained operations and Sleep Deprivation : Effects on Indices of Stress.

R. P. FRANCESCONI, J. W. STOKES, L. E. BANDERET and D. M. KOWAL, *Aviation Space and Environmental Medicine*, Vol. 49, November 1978, P. 1271-1274, 19 refs.

Two groups of highly-trained and motivated military personnel were deprived of sleep while sustaining performance of their assigned military tasks in a laboratory simulation ; one team (I) was sleep deprived for 48 h while the second team (II) was deprived of sleep for two consecutive 39 h periods separated by a 33 h rest interval. Six-hour urine samples were collected on a 24 h basis after an appropriate control period for each team. During sleep deprivation, each team performed its functions as an artillery fire direction center (FDC) in response to a sustained simulated combat scenario. Results suggested that anticipation and perception of the experimental situation affected the common urinary indices of stress. For example, team I, informed that they might be required to sustain operations for 86 h, had significant increases in both urinary 17 hydroxycorticosteroids (17-OHCS) ($p<0.01$, 36 h) and total catecholamines ($p<0.01$, 24 h). Alternatively, team II, realizing that each of their sustained operations challenges would not exceed 42 h, had significantly decreased 17-OHCS due largely to decrements in the usually high outputs recorded between 0600–1200 hours (*e.g.* $p<0.025$, 30 h). Analogously, total catecholamines were significantly reduced after 24 ($p<0.02$) and 30 ($p<0.05$) h. We conclude from these studies that, under these conditions, generally similar effects are noted for sympathicoadrenomedullary and adrenocortical activity. Further, the responses are affected by situational uncertainty as well as apparent cumulative fatigue.

26. Long-Term Effects of Traumatic War-Related Events on Sleep.

PERETZ LAVIE, ALBERT HEFEZ, GILA HALPERIN and NANIEL ENOCH, *The American Journal of Psychiatry*, Vol. 136, February 1979, P. 175-178, 12 refs.

Eleven patients who had combat neuroses resulting from the 1973 Yom Kippur War and complained of sleep disturbances were studied in a sleep laboratory. Sleep-onset insomniacs, dream-interruption insomniacs, and pseudoinsomniacs were differentiated on the basis of electrophysiologic recordings. Compared with normal controls who actively participated in the Yom Kippur War, patients showed significantly longer sleep latencies, lower sleep efficiency indices, lower percentage of REM sleep and longer REM latencies.

V. AVIATION OTOLARYNGOLOGY

27. Spatial Disorientation in General Aviation Accidents.

WILLIAM R. KIRKHAM, WILLIAM E. COLLINS, PAULA M. GRAPE, JAMES M. SIMPSON and TERRY F. WALLACE, *Aviation Space and Environmental Medicine*, Vol. 49, September 1978, P. 1080-1086, 20 refs.

Spatial disorientation (SD) was the third highest "cause" of fatal accidents in small, fixed-wing aircraft and closely related to the second highest "cause" — "continued VFR flight into adverse weather." SD was a cause or factor in 16% of all fatal accidents. When SD was ascribed as a cause or factor in an accident, 90% of the time that accident involved fatalities. Small, fixed-wing aircraft under 12,500 lb (570 kg) accounted for 97.3% of all SD accidents. Inclement weather was associated with 42% of all fatal accidents, and SD was a cause

or factor in 35.6% of these. Flight was initiated into and continued into adverse weather in 19.7 and 68.7%, respectively, of SD weather-related fatal accidents. Fog (56.8%) and rain (41.8%) were the most prevalent adverse weather conditions. These and other data attest to the importance of this psychophysiological phenomenon in flight safety.

28. Motion Sickness Susceptibility: A Retrospective Comparison of Laboratory Tests.

J. MICHAEL LENTZ and FRED E. GUEDRY, JR., *Aviation Space and Environmental Medicine*, Vol. 49, November 1978, P. 1281-1288, 14 refs.

A test battery designed primarily to assess vestibular function has been used for several years to evaluate individuals referred to our laboratory. Because some of the test conditions have proved to be nauseogenic to some individuals, methods of assessing disturbance during these procedures have been used to pursue a second goal, *viz.*, the estimation of motion sickness susceptibility. This report, which focuses on the latter goal, is a retrospective comparison of results on three tests obtained from two groups of subjects, one of which was a group of Navy and Marine aviation personnel who had suffered multiple attacks of airsickness. Results from three laboratory tests of motion sickness susceptibility indicated that there are substantial differences between the airsick group and the unselected comparison group on observer ratings and individual self-ratings of motion sickness symptoms. The provocative stimuli in each laboratory test, as well as suggestions concerning how multiple tests may prove effective in predicting motion sickness, are discussed.

29. Caloric Vestibular Test with the Use of Air.

A. J. GREVEN, W. J. OOSTERVELD, W.J.A.C. RADEMAKERS and R. VOORHOEVE, *The Annals of Otology Rhinology and Laryngology*, Vol. 88, Jan.-Feb. 1979, P. 31-35, 15 refs.

In a group of 28 test subjects the vestibular caloric test was performed with the aid of two different methods. In the first method the ears were irrigated for 30 sec with water with a temperature of 30°C and 44°C, in the second method the ears were subjected to an airstream with a temperature of 30°C and 44°C and later on with an airstream with a temperature of 20°C and 50°C. The wet method proved to be a significant stronger stimulus than the dry method. The authors conclude that the water irrigation is the method of choice for the caloric test. The dry method is only useful when the wet method is undesirable.

VI. AVIATION OPHTHALMOLOGY

30. Scaling of Visual Acuity Measurements.

GERALD WESTHEIMER, *Archives of Ophthalmology*, Vol. 97, February 1979, P. 327-330, 16 refs.

Comparison of visual acuity measurements under different conditions (*e.g.*, age, refractive error, disease progress, recovery from injury) depends crucially on the scale applied to values of the minimum angle of resolution. Four kinds of scales are examined: the minimum angle or resolution (MAR) in linear, logarithmic, exponential, and reciprocal measures. To help construct an equal-discriminability scale for visual acuity, the standard errors of the mean minimum angle of resolution in five different retinal locations were determined experimentally in two observers. Because of the ratio of standard error/mean was found to be nearly a constant, the logarithmic scale of MAR is recommended for adoption as a standard for visual acuity: in it the just noticeable differences in acuity are everywhere equal on the scale.

31. Comparison of the Visual Perception of a Runway Model in Pilots and Nonpilots During Simulated Night Landing Approaches.

HENRY W. MERTENS, *Aviation Space and Environmental Medicine*, Vol. 49, September 1978, P. 1043-1055, 30 refs.

Relative motion parallax, a cue that can contribute to visual judgements of glide path angle, was studied for its effect on simulated nighttime approaches in two experiments: (1) 16 pilots and 16 nonpilots adjusted the slant of a model runway to make it appear horizontal under nighttime conditions on both dynamic trials, as the model approached them, and on static trials, with the model stationary; (2) 12 pilots and 12 nonpilots perform-

ed the same task in dynamic trials while viewing the model in a dark field as before, and while viewing the model within a window which provided a stable visual frame of reference. Neither flying experience nor the visual frame of reference enhanced sensitivity to relative motion parallax. However, some errors were smaller in pilots, indicating that flying experience enhances other runway image cues. Direct judgements of approach angle magnitude indicated overestimation by an approximate factor of 2. These findings indicate large visual illusions in the nighttime situation and suggest that the ineffectiveness of relative motion parallax may be an important part of night approach problems.

VII. OXYGEN THERAPY

32. Radiotherapy and Hyperbaric Oxygen.

Report of a Medical Research Council Working Party, *The Lancet*, Vol. II, 21 October 1978, P. 881-884, 12 refs.

The M.R.C. Working Party has coordinated randomised clinical trials to assess hyperbaric oxygen as a sensitiser in radiotherapy. 1669 patients were registered in these studies between 1963 and 1976. Hyperbaric oxygen significantly improved both survival and local tumour control after radiotherapy for head-and-neck tumours and for advanced carcinoma of the cervix. In carcinoma of the bronchus there seemed to be some improvement in survival but this was not statistically significant. In carcinoma of the bladder hyperbaric oxygen has shown no benefit. Centres already equipped with hyperbaric chambers should continue to use them for those types of tumour shown to benefit. Since hyperbaric oxygen treatment makes great demands on medical and other staff extension of its use must await comparison with other methods for improving radiotherapy which are now being evaluated.

VIII. HUMAN ENGINEERING

33. Determination of the Spatial Reach Area of the Arms for Workplace Design Purposes.

EWA NOWAK, *Ergonomics*, Vol. 21, 7, July 1978, P. 421-507.

This work concerns the determination of the spatial reach area of arms. Methodology of studies was devised and experimental apparatus constructed. The measurements covered a representative sample, consisting of 226 men and 204 women, aged from 18 to 65 years, working in Warsaw factories. The results, expressed as percentile values and presented in tables and diagrams, contain data which determine the spatial reach area of arms for the Polish population and constitute a basis for designing spatial structures of machines, installations and workplaces.

34. A Variable Axis Electrogoniometer for the Measurement of Single Plane Movement.

J. A. TATA, A. O. QUANBURY, T. G. STEINKE and R. E. GRAHAME, *Journal of Biomechanics*, P. 421-425, Vol. 11, No. 8/9, 1978.

An accurate single plane electrogoniometer weighing 181 grams is described. This instrument permits all knee movements in 3 planes of motion measuring the functionally applicable flexion and extension for use in objective clinical assessment and as a research tool. The main features of the design are a flexible junction bar connecting the two main electrogoniometer arms and the application of a trigonometric relationship for the determination of the actual joint angle. Evaluation, both dynamic during walking and static including a radiographic technique, has shown overall accuracy of the attached instrument to be ± 2°. The instrument has been used to measure knee flexion and extension during stair climbing and has demonstarted its ease of attachement and lack of restriction of any motion in this application.