Abstracts of Current Aerospace Medicine Literature

I Acceleration Physiology

1. Correlation of plasma norepinephrine and plasma atrial natriuretic factor during lower body negative pressure. Schmedtje JF, Jr., Varghese A, Gutkowska J, et al : Aviat Space Environ Med 1990 ; 61 : 555-558

Plasma atrial natriuretic factor (ANF) is released in proportion to intra-atrial pressures. Plasma norepinephrine (NE) levels are considered to be an indirect reflection of sympathetic tone. These two mediators were studied during human regulation of intravascular volume in the course of exposure to fluid shifts associated with a model of gravitational stress, lower body negative pressure (LBNP). Blood was drawn from 10 normal subjects before and after exposure to 2 min of a graduated increase in LBNP to a level of 55 mm Hg followed by 5 min at 55 mm Hg. Plasma ANF was measured by RIA and catecholamines by HPLC-ECD. NE increased from 358 44 (SEM) pg/ml to 511 48 pg/ml ($p = 0.03$.) Although ANF only decreased from 27.3 2.4 pg/ml to 23.5 2.9 pg/ml ($p = 0.33$,) a statistically significant negative correlation was observed ($r = -0.70$, $p = 0.02$) between the changes in NE and ANF induced by LBNP. The modeling of physiologic responses to gravitational stress in this experiment revealed a negative correlation between changes in sympathetic tone (as reflected by plasma NE) and ANF levels.

2. Dynamic cardiovascular response to +Gz stress in aerobically trained individuals. Forster EM, Whinnery JE : Aviat Space Environ Med 1990 : 61; 303-306

Very high onset sustained +Gz stress requires rapid cardiovascular response to support human tolerance. This study was conducted following a previous study concerning +Gz tolerance in aerobically trained individuals, and was initiated to determine if intense aerobic conditioning might affect cardiovascular +Gz tolerance through reduction in heart rate response data on 22 aerobically trained runners and 13 less-conditioned individuals. All subjects were exposed to a standard medical evaluation protocol, which consisted of a gradual-onset (0.1 G/s) acceleration exposure (GOR1), followed by a series of rapid-onset (1.0 G/s) acceleration exposures (ROR), a second gradual-onset rate exposure (GOR2), and a third gradual- onset rate exposure with the subjects performing anti-G straining maneuvers (GORS). Aerobic conditioning was not found to be associated with a reduced heart rate response to +Gz stress, compared to the response of unconditoned subjects, when the following variables were considered : heart rate change from rest to maximum exposure heart rate, heart rate change from rest to the heart rate acheived at the onset of maximum G, and the rate of change in heart rate per unit +Gz. Although enhanced parasympathetic tone, induced by long-term aerobic conditioning (running) results in a reduced heart rate at rest and during +Gz stress, it does not alter the responsiveness of the heart rate to +Gz stress.

3. Recognizing +Gz-induced loss of consciousness and subject recovery from unconsciousness on a human centrifuge. Whinnery JE : Aviat Space Environ Med 1990; 61:406-411

Human exposure to +Gz-induced loss of consciousness (G-LOC) remains of some concern relative to the well-being of the individuals experiencing the unconscious episodes. Detailed kinetic analysis of over 500 G-LOC episodes on a human centrifuge allowed an evaluation of the time for subjective recognition by observers of the onset of G-LOC and subsequent recovery to normal baseline conditions. The characteristics of early, coincident, and late recognition of the onset of G-LOC were evaluated. Earlier recognition of the G-LOC was observed to occur when the rate of onset of the +Gz-stress was gradual (G/s). Rapid onset rate (0.06 G/s) exposure were more likely to result in late recognition of G-LOC. The duration of the resulting period of unconsciousness (absolute incapacitation) was very sensitive to the time for recognition of G-LOC and most rapid return to a normal (+1 Gz) environment. The absolute incapacitation increased significantly from early (10.7 s) to coincident (11.4 s) to late (13.2 s) recognition of G-LOC which differed by a total of only 4.6 s. The results allow development of an initial standard of care envelope for apparently safe exposure of

human subjects to centrifuge G-LOC since no adverse effects were observed with any of the exposures. The results also demonstrate the extreme sensitivity of the central nervous system to small changes in exposure to +Gz-stress which can be accurately measured.

II Accident Investigation

4. Ascertaining the causal factors for "ejection associated" injuries. Guill FC : Aviat Space Environ Med 1989; 60 (10 Suppl) : B44-B71

Determining the cause(s) for an ejectee's injuries is one of the more important and yet most difficult tasks associated with an ejection investigation. Selection of causal factors is often distorted by rumors and inaccurate teaching concerning how specific types of injuries occur and/or the consequences of using specific types of Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) equipment. Unfortunately, aiding and abetting the selection of incorrect causal factors is the "strength-in-numbers"-type legitimacy that many of these factors have acquired through frequent usage over the years. Thus, if one should query the Naval Safety Center computer concerning either 1) how many ejectees under certain conditions and/or using specific AAES/ALSS equipment sustained specific type of injuries, or 2) how many ejectees received a specific type of injury caused by a specific factor, that computer will obligingly and non-critically provide numbers. Because those numbers are generated by a computer, they gain an overwhelming appearance of irrefutability in demonstrating the correctness of any assessment that conforms. Careful, detailed investigations (and also general statistical investigation), however, often has revealed that these accepted causal factors either cannot be applicable or are of extremely doubtful applicability for the specific situations. This paper discusses some of the recent results investigating many of the accepted causal factors and some methodologies that might aid an investigator in determining the causal factors. Also discussed is the value of admitting to not knowing the causal factor and the harm that can arise from guessing or joining the crowd in stating a causal factor in the Flight Surgeon's Report(FSR).

III Aviation Psychology

5. An empirical assessment of stress-coping styles in military pilots. Picano JJ : Aviat Space Environ Med. 1990 ; 61 : 356-360

Although aircraft pilots are generally regarded as having superior stress-coping skills, there has been relatively little empirical research on how pilots cope with stress. New stress-coping models and measures for understanding and assessing these previously elusive processes greatly facilitate the empirical study of stress coping-styles. This study employed a new measure of stress-coping style, rationally developed from an integrative model of coping, to study stress-coping in US Army pilots. Results indicated that the pilots preferred problem-focused stress-coping strategies oriented towards direct action to master stressful situations. Also, the pilots tended to de-emphasize emotion-focused forms of coping with stress. Differences in stress-coping between pilots and samples of aircrewmen and non-rated military personnel suggest that this coping style reflects differences in psychological functioning independent from the pilot's adaptation to the aviation and military environment.

6. Psychomotor screening for USAF pilot candidates : Selecting a valid criterion. Cox RH : Aviat Space Environ Med 1989;60 : 1153-1156.

Subjects for this research were 153 prospective pilots who were tested on computerized versions of the Two Hand Coordination (2HC) and Complex Coordination (CC) psychomotor tests. Independent variables included five basic error scores associated with the two psychomotor tests. The criterion for pilot performance was conceptualized as a function of the number of flying hours required to graduate from Undergraduate Pilot Training (UPTFLY). Results of MANOVA and multiple regression analyses revealed that performance on the two psychomotor tests was significantly related to the criterion for pilot performance (UPTFLY). The multiple regression analysis resulted in 27.1% of the variability of UPTFLY being accounted for by psychomotor performance. When the data were reanalysed using a pass/fail UPT criterion the variability accounted for remained high,

suggesting an anomaly associated with sample selection. Undergraduate pilot training outcome (pass/fail) remains the most valid criterion for Undergraduate Pilot Training success.

IV Clinical Aviation Medicine

7. A controlled trial of transcutaneous electrical nerve stimulation (TENS) and exercise for chronic low back pain. Deyo RA, Walsh NE, Martin DC, et al : N Engl J Med 1990; 322: 1627-1634

A number of treatments are widely prescribed for chronic back pain, but few have been rigorously evaluated. We examined the effectiveness of transcutaneous electrical nerve stimulation (TENS), a program of streching exercises, or a combination of both for low back pain. Patients with chronic low back pain (median duration, 4.1 years) were randomly assigned to receive daily treatment with TENS (n = 36), sham TENS (n = 36), TENS plus a program of exercises (n = 37), or sham TENS plus exercises (n = 36). After one month no clinically or statistically significant treatement effect of TENS was found on any of 11 indicators of outcome measuring pain, function, and back flexion; there was no interactive effect of TENS with exercise. Overall improvement in pain indicators was 47% with TENS and 42% with sham TENS (P not significant). The 95% confidence intervals for group differences excluded a major clinical benefit of TENS for most outcomes. By contrast, after one month patients in the exercise groups had significant improvement in self-rated pain scores, reduction in the frequency of pain, and greater levels of activity as compared with patients in the groups that did not exercise. The mean reported improvement in pain scores was 52 % in the exercise groups and 37% in the nonexercise groups (P = 0.02). Two months after the active intervention, however, most patients had discontinued the exercises, and the initial improvements were gone. We conclude that for patients with chronic low back pain, treatment with TENS is no more effective than treatment with a placebo, and TENS adds no apparent benefit to that of exercise alone .

8. Exercise in leisure time : coronary attack and death rates. Morris JN, Glayton DG, Everitt MG, et al : Br Heart J 1990; 63 : 325-334

9376 male civil servants, aged 45-46 at entry, with no clinical history of coronary heart disease, were followed for a mean period of 9 years and 4 months during which 474 experienced a coronary attack. The 9% of men who reported that they often participated in vigorous sports or did considerable amounts of cycling or rated the pace of their regular walking as fast (over 4 mph, 6.4 km/h) experienced less than half the non-fatal and fatal coronary heart disease of the other men. In addition, entrants aged 55-64 who reported the next lower degree of this vigorous aerobic exercise had rates less than two thirds of the remainder entrants of 45-54 did not show such an effect. When these forms of exercise were not vigorous they were no protection against the disease, nor were other forms of exercise or high totals of physical activity per se. A history of vigorous sports in the past was not protective. Indications in these men are of protection by specific exercise: vigorous, aerobic, with a threshold of intensity for benefit and "dose response" above this threshold, exercise that has to be habitual, and continuing, which suggests that protection is against the acute phases of the disease. Those men who took vigorous aerobic exercise were demonstrably a favourably "selected" group they suffered less of the disease, however, whether at low risk or high by the several risk factors that were studied. Men with exercise-related reduction in coronary heart disease also had lower death rates from the total of other causes, and so lower total death rates than the rest of the men.

9. Treatment of essential hypertension with yoga relaxation therapy in a USAF aviator : A case report. Brownstein AH, Dembert ML : Aviat Space Environ Med 1989: 60:684-687

A 46-year-old Caucasian male USAF aviator with a 6-year history of mild essential hypertension (medical waiver for flight duty) under unsuccessful treatment with hydrochlorothiazide, dietary modification, and exercise, was subsequently trained in yoga relaxation. After 6 weeks, medication had been discontinued, and his diastolic blood pressure remained within normal levels. The patient was subsequently returned to full flight status without recurrence of diastolic hypertension at follow up 6 months later.

Relaxation training, of which yoga is one type, has been reported in the medical literature to have wide clinical application. It should be considered as nonpharmacological therapy adjunct or alternative for medical disorder among personnel in occupations (e.g., aviation) where the side effects from medications are of great concern and could be disqaulifying from those duties.

V Disaster Medicine

10. Acute postdisaster psychiatric disorders : identification of persons at risk. Smith EM, Carol S, McCool RE, et al : Am J Psychiatry 1990 ; 147 : 202-206

This study examined the prevalence of four psychiatric disorders - posttraumatic stress disorder, major depression, generalized anxiety disorder, and alcohol abuse/dependence - in survivors of a jet plane crash into a hotel. Forty-six subjects were interviewed with the Diagnostic Interview Schedule/Disaster Supplement within 4-6 weeks of the event. More than half of the subjects met criteria for a psychiatric disorder after the disaster. More than two-thirds of the cases of acute postdisaster psychiatric disorders were predicted by identifying the subjects who had predisaster psychiatric histories. Predisaster psychiatric disorder predicted postdisaster psychopathology with a sensitivity of 72% and a specificity of 90%.

11. Mass fatality aircraft disaster processing. Clark MA, Clark SR, Perkins DG : Aviat Space Environ. Med. 1989 ; 60: (7, Suppl.) A64-A73

On Dec 12, 1985, a contract transport carrying 248 US Army personnel crashed on take off at Gander, Nfld, Canada, killing all the passengers as well as the crew of eight. This was the worst aircraft accident in US Military history and, at the time was the fifth worst accident in aviation history. Cooperation between the governments of Canada and the United States allowed for the transport of all human remains to the US Air Force mortuary facility at Dover AFB, DE, where they were processed, identified, and ultimately returned to their families for burial. Under ideal circumstances, any medical examiner's office or mortuary facility would be overwhelmed by a mass disaster of this magnitude. Before the arrival of the first shipment of bodies, a concerted planning effort was undertaken and the facility arranged so that remains would pass in a logical sequence through a series of 10 "work stations". This report details the process and outlines the logistics of the operations.

VI Environmental Medicine

12. Effects of ultraviolet radiation. Howard Hu : Med Clin North America 1990; 74 (2): 509-514

Ultraviolet radiation from high-intensity sources has well-known acute effects on the eye and skin, consisting primarily of photo-keratoconjunctivitis and sunburn, which are enhanced in the presence of photosensitizing agents. Long-term elevated exposure to low-level ultraviolet radiation is also responsible for an increased risk of cortical and posterior subcapsular cataracts, pterygium, and cutaneous and intraocular melanoma , and possibly responsible for immunologic effects of clinical significance.

13. Health effects of nonionizing radiation. George MW, Carl HS : Med Clin North America 1990; 74 (2): 489-507

Electromagnetic energy in the microwave and radiofrequency bands can produce biologic effects which are predominantly thermal. The human body has efficient thermoregulatory mechanisms that provide a substantial degree of protection from excessive thermal loads[1,2]. At carefully controlled power levels with accurate thermometry, electromagnetic radiation can be employed safely and effectively for therapeutic purposes in several fields of medicine. During therapeutic use under medical supervision, desired biologic effects are produced and potentially injurious effects minimized.

14. Heat, cold, noise and vibration. Steven MH, John FB : Med Clin North America 1990; 74 (2): 515-525

Exposure to a cold environment induces a number of physiological alterations, the most serious being hypothermia. This state can occur in all individuals, but the very young and the elderly are more susceptible. Environmental and industrially generated high ambient temperature can place further stress on aged individuals and

workers, resulting in a complex symptom picture. Morbidity and death may result from such exposures. Causative factors have been identified. Noise exposure induces hearing losses above those secondary to the aging process. Psychophysiological effects during noise exposure are considered to result from the sympathetic activity secondary to a general stress reaction. Vibration from the use of power tools results in Raynaud's phenomenon. However, modification of power tools has reduced the symptoms associated with vibration exposure. Termination of exposure to vibration appears eventually to reduce symptoms related to white-finger spasms. Interaction between these stressors has not been clarified because of the complex effects of each. The need for additional information about the response to these stressors is evident.

VII Exercise Physiology

15. Reflex venomotor responses to lower body negative pressure following endurance training. Vroman NB, Healy JA, Kertzer R : Aviat Space Environ Med 1990; 61: 307-309

The effect of endurance training on reflex venomotor control during an orthostatic challenge was investigated in 11 sedentary male volunteers. An exercise (E) group (n=6) underwent 12 weeks of endurance exercise training, whereas a control (C) group (N=5) remained sedentary. Training significantly increased VO_2max values in E (Pre-training : 37.0 ± 2.5 ml kg^{-1}. min^{-1} ; post training: 44.6 ± 2.5 ml. Kg^{-1}. min^{-1}), while C showed no significant change. During exposures to two levels of lower body negative pressure (-10 and -40 mm Hg), both C and E groups showed similar graded decreases in forearm venous volume (FVV). The magnitude of the FVV decreases did not differ between groups or when comparing pre-training and post-training values. We conclude that the reflex venoconstrictor response to LBNP was not effected by endurance training.

VIII High Altitude Physiology

16. Rapid decompression of a transport aircraft cabin : protection against hypoxia. Marotte H, Toure C, Clere JM,et al : Aviat Space Environ Med 1990 ; 61 : 21-27

The hypoxic hazard after rapid decompression in transport aircraft was evaluated as a function of the current means of protection, including the role of the inhaled oxygen fraction (F_{IO2}) prior to decompression. The decompressions were made in 2 s; the initial altitude was 8,000 ft and the final altitude was 16,000-45,000 ft. The physiological measurements were arterial oxygen saturation, heart rate, ventilatory frequency, and gaseous analysis in the mask. Results show that F_{IO2} prior to decompression is not very significant, but the delay before doning the oxygen system seems to be the most limiting factor against tolerance to hypoxia.

IX Neurophysiology

17. Differentiation of negative event-related potentials in an auditory discrimination task. Novak GP, Ritter W, Vaughan HG Jr, et al : Electroenceph Clin Neurophysiol 1990; 75: 255-275

Several different negative potentials elicited in auditory perceptual tasks make spatially and temporally overlapping contributions to the scalp-recorded event-related potential. Frequent non-target tones in a 2 stimulus oddball pitch discrimination tasks, when compared with the same stimuli in ignore or simple reaction time conditions, elicit a negative deflection with two peaks (NA1 and NA2) differing in their latency and topography from the exogenous N92-P156 deflections. Oddball tones, when compared with the frequent ones, elicit mismatch negativity (MMN) in both ignore and discrimination conditions; MMN displays a frontocentral-posterolateral polarity inversion. In the discrimination condition, MMN is followed by N2 and P3b; the former has a more central amplitude maximum than MMN, and no posterolateral polarity inversion. When the pitch discrimination task was made more difficult, there was no effect on NA1 or NA2, but the latency of MMN, N2, P3b, and reaction time all increased in parallel. It is hypothesized that MMN reflects the outcome of an automatic mismatch detection process, and that the subsequent processing of targets is related to the event of mismatch detection.

18. Human somatosensory evoked potentials to mechanical pulses and vibration : contributions of SI and

SII somatosensory cortices of P50 and P100 components. Hamalainen H, Kekoni J, Sams M, et al : Electroenceph Clin Neurophysiol 1990; 75 : 13-21

Somatosensory evoked potentials (SEPs) were measured to short tactile pulses and vibratory stimuli applied to the fingertip to determine the characteristics and scalp topography of different early and late SEP components to these types of stimulus. The measurements were obtained form 3 homologous contra - and ipsilateral locations and from the vertex. In 2 subjects the SEPs were measured from 23 recording locations. The subjects were reading during the experiments. The first distinct contralateral respones was an anteriorly negative and centrally as well as posteriorly positive peak at about 50 msec latency (P50). Largest P50 response with shortest peak latencies were measured to single tactile pulses. We suggest that P50 is probably generated in the contralateral SI cortex. The P50 was followed by a distinct negative deflection (N70) in the middle and posterior recording locations on the contralateral hemisphere, which reversed its polarity in the frontal records. This peak was also seen ipsilaterally. At about 100 msec latency a distinct bilateral positive P100 peak was obtained. This peak was most prominent to vibratory stimuli, and especially to high frequency vibration. Comparisons with recent intracortical SEP studies in primates and MEG studies in humans suggest that P100 might be best accounted for by bilateral generators in SII cortices. The early components were followed by a negative N140 wave and by a slow, positive wave with a maximum at about 300 msec. Both waves had an asymmetrical distribution. The N140 wave occured bilaterally, but was largest contralaterally, and often had two peaks at posterior recording locations. The slow positivity was largest at the vertex and at mid-posterior recording sites.

19. Modifications of sleep structure by brief forced awakenings at different times of the night. Foret J, Touron N, Clodore M, et al : Electroenceph Clin Neurophysiol 1990; 75 : 141-147

Four subjects were awakened once a night for 10 min at either 01.30, 03.30 or 05.30 h. During the waking intervals, they performed a mental task while remaining in bed. The awakenings did not significantly modify the amount of different stages during subsequent sleep with no effect of time of occurrence in the night. In contrast, the timing of the awakening within the cycle had a significant influence on REM cycle structure. If awaking occurred during a REM episode, it increased the inter-REM interval beyond the reference length of the corresponding uninterrupted cycle. An explanation based on a model of sleep which implies the simultaneous activity of REM-on and REM-off neurons is proposed.

X Otolaryngology

20. The use of tympanometry in predicting otitic barotrauma. Ashton DH, Vatson LA : Aviat Space Environ Med 1990; 61:56-61

Static acoustic impedance tympanometry was used to examine 80 subjects prior to and after exposure to decreased ambient pressure in a hypobaric chamber. The predictive value of tympanometry in detecting those individuals likely to suffer from otitic barotrauma (aerotitis media) was evaluated. The results suggest that testing prior to altitude exposure is of no value in identifying those individuals who will suffer from otitic barotrauma during flight. Tympanometry however proved a useful tool in confirming the presence of barotrauma following flight, but it was no more useful than taking a history and performing an ear examination.

21. Vestibulo-ocular reflex as a parameter of seasickness susceptibility. Shupak A, Kerem D, Gordon C, et al : Ann Otol Rhinol Laryngol 1990; 99: 131-136

The vestibulo ocular reflex (VOR) is known to be modulated in response to changing vestibular and optokinetic stimuli. The purpose of this study was to investigate possible relationships between VOR and future susceptibility and habitutation to seasickness. Thirty candidates for future maritime service were exposed to a series of yaw axis smooth harmonic accelerations before and after 6 months of regular sailing, and their VOR gain and phase responses were recorded. Seasickness severity was estimated after 1 and 6 months of service by a questionnaire. We conclude that VOR gain at 0.01 Hz may serve as a physiologic correlate helping

to predict seasickness susceptibility, and that the increase in phase lead at 0.021 Hz may mark the habituation process to sea conditions.

XI Psychiatry

22. Depressive episodes and dysphoria resulting from conjugal bereavement in a prospective community sample. Bruce ML, Kim K, Leaf PJ, et al : Am J Psychiatry 1990 ; 147 : 608-611

Using three waves of interviews from the New Haven Epidemiologic Catchment Area Program, the authors contrast the extent and natures of depressive episodes and dysphoria between newly bereaved (n=39) and married (n=1047) respondents age 45 and older. Bereavement greatly increased the risk of both conditions. This observation did not appear to be an artifact because psychosocial risk factors were similar for the bereaved and married groups. Bereavement increased the risk for a depressive episode more among respondents who reported no prior dysphoira than among those who did. Among those meeting criteria for depression, the bereaved reported symptoms similar to those of the married group except for significanly fewer reports of guilt.

23. Irritable bowel syndrome and psychiatric illness. Walker WA, Peter PR-B, Wayne JK, et al : Am J Psychiatry 1990 : 147 : 565-572

Psychiatric illnesses such as mood, anxiety, and somatization disorders share many common features with irritable bowel syndrome. The authors review recent developments in the definition of irritable bowel syndrome and its relationship to psychiatric illness, discuss the diagnostic validity of irritable bowel syndrome from several perspectives, and offer a pathophysiological model of irritable bowel syndrome that integrates many of the biological and psychosocial findings of earlier studies. Psychiatric evaluation appears to be an important factor in the diagnosis and treatment of patients with irritable bowel syndrome.

XII Space Medicine

24. Advantages of a low-oxygen environment in space cabins. Shvartz E : Aviat Space Environ Med 1990; 61 : 272-276

The advantages of having a low-oxygen environment in space cabins are discussed. The major advantage is a sharply reduced fire hazard, which is a major threat in manned space flights. At 1 atm, for example, 15% O_2(9,000 ft altitude equivalent) would not support most fires and could accomodate the crew with respect to hypoxia, decompression sickness (DCS),and other requirements. Chronic exposure to such a hypoxic environment (altitude acclimatization) could improve major areas of crew health and safety including alleviating deconditioning effects, decreasing susceptibility to DCS, and improving tolerance to severe hypoxia.

25. Cardiovascular response to 4 hours of 6 head-down tilt or 30 of head-up tilt bed rest. Butler CG, Xing H, Hughson RL : Aviat Space Environ Med 1990 : 61 : 240-246

The cardiovascular responses to 4 h of 6 head down tilt (HDT) were compared to those of 4 h of 30 head-up tilt (HUT) following a period of 1 h baseline in the 30 HUT position. Eight healthy males completed each tilt position. Immediately on assuming HDT, heart rate decreased slightly from baseline, but did not differ from HUT. Stroke volume and cardiac output both increased significantly by as much as 54% and 26%, respectively, in the first HDT. The difference between HDT and HUT was no longer present after 30 min. Mean arterial blood pressure was unchanged throughout 4 h or HUT or HDT. Plasma volume was slightly elevated over the 4 h HDT, while plasma hemoglobin concentration was significantly reduced. No evidence of a diuresis was found with 4 h HDT. Plasma catecholamine were not different between HDT and HUT. The present results show that the immediate transition from a HUT to a HDT position causes a dramatic change in cardiovascular variables. These changes are generally transient with baseline values resumed by many variables within 30 min of exposure to 6 HDT.

26. Influence of 7 days of hindlimb suspension and intermittent weight support on rat muscle mechanical properties. Pierotti DJ, Roy RR, Flores V, et al : Aviat Space Environ Med 1990; 61:205-210

Unloading the rat hindlimb results in a decrease in mass, especially in those muscles

that normally have a load-bearing function. The present study was designed to evaluate the effect of intermittent periods of weight support in ameliorating this atrophic response. Adult male Sprague-Dawley rats were assigned to either control (CON), a hindlimb suspended (HS), or a hindlimb suspended plus intermittent weight support (HS-WS) group. HS-WS rats were walked slowly on a treadmill at 0.2 m/s and a 19% incline for 10 min, every 6 h. After 7 d, the in situ mechanical properties of the soleus (Sol) and medial gastrocnemius (MG) were studied. Body weights of HS and HS-WS rats were 9 and 13% lower than CON, whereas HS-WS had values similar to CON. The MG weight relative to body weight was significantly lower in both suspended groups. The maximum tetanic tension relative to muscle weight was significantly elevated in HS-WS compared to CON, suggesting that weight support may have preferentially maintained the contractile protein componet of the muscle. Contraction times were 25% faster (P) in the Sol and unchanged in the MG of HS rats. For each muscle, the fatigue properties were similar in all groups. These data indicate that a low-force, short-duration exercise regime results in significant functional recovery in the "slow" Sol, whereas the "fast" MG is less affected. Further, these data indicate that the amount and/or intensity of exercise necessary to maintain the functional integrity of the Sol appears to be minimal.

27. Perception of linear acceleration in weightlessness. Arrott AP, Young LR, Merfeld DM : Aviat Space Environ Med 1990 ; 61:319-326.

Tests of the perception and use of linear acceleration sensory information were performed on the science crews of the Spacelab 1 (SL-1) and D-1 missions using linear "sleds" in-flight (D-1) and pre-post flight. The time delay between the acceleration step stimulus and the subjective response was consistently reduced during weightlessness, but was neither statistically significant flor of functional importance. Increased variability of responses when going from one environment to the other was apparent from measurements on the first day of the mission and in the first days post-flight. Subjective reports of perceived motion during sinusoidal oscillation in weightlessness were qualitatively similar to reports on earth. In a closed-loop motion nulling task, enhanced performance was observed post-flight in all crewmembers tested in the Y or Z axes.