Bone disease may be useful in preventing bone loss in spaceflight.

Symptoms of space adaptation syndrome. The early Ca homeostatic response to low through FDC, and also recovered by R+6. Mg and P did not change. CONCLUSION all samples, confirming biological validity of our data. An unexpected finding was a much stronger correlation in the male crew (r=0.8, p<0.001) than for the female crew (r=0.3, N.S.). Ca increased markedly (25%) by DF2 and remained elevated (19%) through DF6, with recovery by R+6. PTH decreased by DF2, was low through DF6, and also recovered by R+6, Mg and P did not change. CONCLUSION. The hypercalcemia is clinically significant, and could be responsible for some symptoms of space adaptation syndrome. The early Ca homeostatic response to spaceflight is consistent with long-term observation, but this is not proved. Antiresorptive drugs such as those in research trials in osteoporosis and metastatic bone disease may be useful in preventing bone loss in spaceflight.

MAGNETIC RESONANCE IMAGING (MRI) OF SKELETAL MUSCLES IN ASTRONAUTS AFTER 9 DAYS OF SPACE FLIGHT. M. Jawad1, P. Narayana2, J. S Stadt, J. Buter2, V. Schneider1, A. Leibly1, L. Fodor1 and D. Bacon2. NASA Johnson Space Center, 1Naval Health Science Center, 2Bay College of Medicine, 3KRUG Life Sciences, 4Rhuma Hospital, Houston, TX.

INTRODUCTION: Skydata data indicated that prolonged exposure of human subjects to the microgravity environment caused significant muscle atrophy accompanied by reduced muscle strength and fatigue resistance. The objective of this study was to determine decrements in muscle size, if any, in the soleus and gastrocnemius muscles of male and female astronauts after 9 days of space flights. METHODS: Eight astronauts, one female and seven male, between the ages of 31 and 59 years, 59-84 Kg in body weight were examined by MRI 2-3 times preflight within 16 days before launch; and 2 days (n=6) and seven days (n=6) after landing. The right leg muscles (gastrosoleus) were imaged with a lower extremity coil in magnets operating at 1.0 or 1.5 Tesla. The imaging protocol consisted of spin echo with a TR of 0.7-1.5 sec. Thirty to forty 3-5 mm thick slices were acquired in 256 x 128 or 256 x 256 matrices. Acquisition time lasted 20-40 minutes. Multiple slices were measured by computerized planimetry. RESULTS: Compared to the preflight, the cross-sectional areas (CSA) of the soleus, gastrocnemius and the leg, at 2 days after landing were reduced (at least P<0.05) 8.9 percent, 13.2 percent and 3.5 percent, respectively. The soleus and the leg of three astronauts evaluated at 7 days postflight did not show full recovery compared to the preflight values. Conclusions: It is concluded that 9 days of space flight may cause significant decrease in CSA of the leg muscles. The factors responsible for this loss need further delineation.

THE METHODOLOGICAL PRINCIPLES OF MEDICAL CONTROL SYSTEMS (MCS) DESIGN FOR LONG DURATION SPACE FLIGHTS (LDSF). E.S. Berezhnov, A.I. Gorbachev, V.S. Barchenko. Air Force, Aerospace Medicine Service, Institute of Biomedical Problems, Institute of Aerospace Medicine, Moscow, USSR.

INTRODUCTION: The USSR experience, having been accumulated in LDSF medical support, has shown the necessity of the definite correction and specification of methodology of MCS design. METHODS: By use of systemic analysis, the generalized estimation of the results of MCS in space has been performed. There have been considered the results of examination of 19 Soviet cosmonauts, who performed LDSF, lasting from 2 to 12 months, in 1980-90. The analogous estimation has been carried out in 566 experiments with volunteers during the modelling of space flight environment. RESULTS: The systemic analysis has shown, that in addition to 3 well-known methodological principles (i.e. pathogenesis, "MC by stages" and succession's ones), 4 new principles must be formulated and taken into account. They are the systemic-structural approach, the determinism of the infrastructure of the basic physiologic model, the notion of the "total image" of MCS, the search of "organ-targets". CONCLUSION: The realization of all the mentioned methodological principles leads to the significant improvement of the informative and diagnostic possibilities of on-board MCS in LDSF.


INTRODUCTION: Bone loss following spaceflight is well documented, and if left untreated, by rational countermeasures could limit manned space exploration. Many health and weight-load and water-salt alterations, and prevent cardio-vascular disease.
A CAMERICAL HAZARDS OF HIGH TERRESTRIAL ELEVATION: EF-
FECTS OF 4300 M, AMS, AND OXYGEN ON COGNITION AND MOOD.

INTRODUCTION: Sustained exposure to high terrestrial altitudes is associated with physical and psychological decrements. Relevant aeromedical guidelines for aircrew management and selection. METHODOLOGY: Thirteen male subjects ascended in 10 minutes from SL to 4300 m (simulated), and remained there for 2 1/2 days. Four times per day, subjects completed a well-known physical symptoms, suggest that afflicted the cognitive and mood effects of AMS, combined with the tolerance and adaptation to flight-induced stress. METHODS: Thirteen male subjects completed 2 cognitive tasks. Most tasks displayed a strong and persistent learning effect. Subjects reporting AMS demonstrated consistently slower rates of learning and negative changes in mood compared to well subjects. ALTITUDE day 1, oxygen administration improved performance on both cognitive tests and on mood scale. CONCLUSIONS: Following rapid ascent to 4300 m, performance is most affected during the first several hours. After a period of acclimatization, oxygen may not be necessary for ground duties. However, the cognitive and mood effects of AMS, combined with the well-known physical symptoms, suggest that afflicted aircrew should not fly.

A TAXONOMY OF FLYING STRESS RESPONSE SYNDROMES IN MILITARY STUDENT PILOTS. J.J. Picano* and R. Biselli. Aerospace Training Support Center, Wilford Hall USAF Medical Center, Lackland AFB, TX 78236.

INTRODUCTION. We sought to develop a taxonomy of stress response syndromes among student pilots referred for psychiatric evaluation during flight training based upon prominent symptom patterns and their relationship to subject variables and eventual completion of flight training. METHODOLOGY: Two aeromedical psychologists retrospectively reviewed consecutive student pilot referrals over a two-year period to the mental health clinic at the Army Aviation Training Center. Data on completion of flight training was later obtained. RESULTS: Out of 155 referrals, 99 manifested maladaptive responses to flying stress. Prominent syndromes (and prevalences) were: Anxiety (38%); Malingering (32%); Somatization (19%); Emotional Exhaustion (13%); Phobic Reaction (9%); Emotional Disengagement (11%); Phobic reactions presented early in training, whereas marital conflicts were more prevalent in later phases (p<.02). All phobic students were eliminated; 65% of all others completed training. Completion was significantly more likely for students presenting early in training, but especially for those with anxiety reactions and malingering. CONCLUSIONS: The taxonomy developed provides a useful framework for describing maladaptive stress responses during flight training and differentiates eventual completion. Despite high overall elimination rates, completion of training was most likely for students with anxiety reactions and marital conflicts which occurred later in training.


INTRODUCTION. The quantitative evaluation of flight-induced stress may be useful to monitor the level of "adaptation to fly" of student pilots. The aim of this study has been the analysis of the hormonal response to flight activity to establish whether or not the hormonal changes induced by flight are a reliable tool to quantify the flight-induced stress level. METHODS. The hormonal responses of growth hormone (GH), cortisol and prolactin (PRL) to flight activity were evaluated in one group of student pilots (n=11; group A) and another of instructors (n=11; group B) of an Italian Air Force flight school. Blood samples were obtained one hour before and just after a standardized training flight session. RESULTS. The hormonal determination by RIA technique after flight showed a significant increase of plasma levels of GH (p<.003 vs pre-flight baseline values), cortisol (p<.025 vs pre-flight baseline values) and a fair but not significant increase in PRL cortisol and prolactin. CONCLUSIONS. The data led to establish a close correlation between the hormonal response to flight activity and the development of tolerance and adaptation to flight-induced stress.


INTRODUCTION. The aim of this study has been to compare the change in the circadian rhythm of plasma cortisol levels following a 3 day stay and an West-, East- and Southbound return flight from Paris, San Francisco (SFO) and Sydney to Tokyo. METHODS. Six healthy non-smoking male subjects volunteered for the project. Plasma cortisol levels were monitored 4 times (3am, 7am, 15pm and 23pm) daily for 13 days during the experimental period. RESULTS: In Tokyo, the baseline pattern of cortisol concentrations showed the classical diurnal profile with the values ranged from 2.3 ug/dl (3am) to 12.2 ug/dl (7am). During the 3 day stay after transmeridian flight, disappearance of circadian rhythm (Paris) or phase advancement of 8 hours (SFO) were observed. After returning to Tokyo, the subjects exhibited the original diurnal pattern beginning Day 1, however, complete re-synchronization was not apparent until Day 2 (Paris) or Day 4 (SFO). In contrast, circadian rhythm was not disturbed by the Southbound flight to Sydney with one hour time difference. CONCLUSION. The data demonstrated that the recovery of circadian rhythm was faster in Westbound than in Eastbound flight. It also provided valuable insights as to how to optimize flight schedule for cockpit crews in order to minimize jet lag.


INTRODUCTION. We presented that lymphocytes increased in number and Natural killer (NK) cell activities increased after the transmeridian flight. This may be two factors round trip, in mechanism; difference caused by the flight and unusual physical condition during the flight. This study aims to clarify the involvement of time difference in the lymphocyte changes. METHODS. Eighteen subjects were deviated into 3 group. After the baseline study in Tokyo, the first group flew to San Francisco, the second to Paris and the third to Sydney. After staying two nights at each destination, they returned to Tokyo and spent 6 days to observe the recovery. The number of lymphocytes and its subsets were measured in peripheral blood at 3:00, 7:00, 15:00 and 23:00. NK cell activity was measured in a standard culture system. RESULTS. After east and westers round trip, the number of lymphocytes and NK activities increased and the cell activity had been disturbed by Day 5. In case of southbound round trip with 1 hour time difference, however, these factors were little affected. CONCLUSION. These results indicated that time difference after transmeridian flights induced the increased number of lymphocytes, the disturbance of circadian rhythm and the enhancement of NK cell activities.

THE SURGICAL PATHOLOGIST: A RESOURCE IN THE FLIGHT SURGEON'S MANAGEMENT OF FLYING PERSONNEL WITH NEOPLASMS. B.M. DeWanders, Wilford Hall USAF Medical Center, Lackland AFB, TX 78236.

Major gains in rates of cure and/or long term survival of patients with neoplasms have been made in the past 20 years. Increasing numbers of Air Force flying personnel have requested waivers to return to flying status after treatment for a large variety of neoplasms. The surgical pathologist, by his role in diagnosing neoplasms and assessing response to therapy, is an important source of information for flight surgeons managing patients with neoplasms. Wilford Hall USAF Medical Center is a major referral center for flying personnel with neoplasms. In recent years, challenging cases are presented. These include the case of a pilot diagnosed with a cutaneous treated with biopsy, a location treated with extensive bone marrow transplantation for chronic myelogenous leukemia and a patient with melanoma. The utility of consultation with the surgical pathologist will be discussed. Insights gained from analysis of the Wilford Hall Tumor Registry files involving flying personnel will be reviewed.
AIRCRAFT DISASTER PLAN IN TOKYO INTERNATIONAL AIRPORT.

INTRODUCTION. It has already been reported in number of studies that about 8% of aircraft accidents occurred within 5 miles from airport. For this reason it is important in the report, for example, Blankenship of the Airport Service Manual ICAO 1980 that all airport must have definite plan to the aircraft accident and cope with such disaster. At the Tokyo International Airport (Nakano) this has been possible in to the readers. On 2/11/81, we had an accident of JAL DC8 with 42 dead and 146 injured at Narita. At this time the disaster plan was not established yet, we had very trouble on the site, since we have not make effort in preparing disaster plan. In cooperation with the various organizations concerned referring to ICAO manual or to the study of Dr. Star(JFK) it has been serious accident in the past: In 1982 we had crossing of JAL DC8 and American DC10. The resultant item factor groupings were essentially the same for both the attrités and those who passed (N = 1258) basic Aviation Individuation and also with those who attrited (N = 413) during the same training. The resultant factors were then forced into a discriminant function analysis. RESULTS. The principal component analysis was limited to 18 factors based on eigenvalues greater than one. The resultant item factor groupings were essentially the same for both the attrities and those who attrited. The purpose of this study was to assess the effects of previous experience on success in training facility to which the trainee is assigned, pass rates and time to complete training. This study was conducted to assess differences in training programs for facilities. This purpose was to assess the effects of previous experience on success in training at facilities. The resultant item factor groupings were essentially the same for both the attrities and those who attrited. The resultant item factor groupings were essentially the same for both the attrities and those who attrited.

THE EFFICACY OF BIOGRAPHICAL INVENTORY DATA IN PREDICTING EARLY ATTRITION IN NAVAL AVIATION OFFICER CANDIDATE TRAINING. L. R. Street, D. R. Street, and L. D. Dolpe. Naval Aerospace Medical Research Laboratory, Pensacola, Florida 32589-5700.

INTRODUCTION. Early attrition in the training of U. S. Naval aviation Officer candidates presents a historic problem with increasing implications in a time of service drawdown and budgetary constraints. This investigation assesses the value of Biographical Information Data (BID) as a measure of Aviation Officer Candidate Naval Aviation Cadets in predicting early attrition at the indoctrination level of Naval Aviation Officer training. METHODS. A sample of 1659 Aviation Officer Candidates and Naval Aviation Cadets with an Armed Forces Qualification Test (AFT) Aptitude Rating (AQT/FAR) between 1987 and 1993 was selected for analysis. A principal component factor analysis of Biographical Inventory Data was conducted with those individuals who passed (N = 1258) basic Aviation Individuation and also with those who attrited (N = 413) during the same training. The resultant factors were then forced into a discriminant function analysis. RESULTS. The principal component analysis was limited to 18 factors based on eigenvalues greater than one. The resultant item factor groupings were essentially the same for both the attrities and those who attrited. The resultant item factor groupings were essentially the same for both the attrities and those who attrited. The resultant item factor groupings were essentially the same for both the attrities and those who attrited. The resultant item factor groupings were essentially the same for both the attrities and those who attrited.

PERFORMANCE OF TERMINAL AIR TRAFFIC CONTROL SPECIALISTS IN FIELD QUALIFICATION TRAINING. E. A. Manning and Wayne L. McMillin, FAA Civil Aeronautical Institute, Oklahoma City, OK. 73125.

INTRODUCTION. Many studies of the Federal Aviation Administration's (FAA's) Air Traffic Control Specialists (ATCSs) focused on the en route option. Training of terminal ATCSs differs from en route training. Depending on the type of facility to which the trainee is assigned, pass rates and time to complete training are often lower than for en route controllers and may also differ among terminal facilities. This study was conducted to assess differences in training programs for terminal ATCSs, using available training data. The primary purpose of the study was to assess the effects of previous experience on success in training at facilities controlling different amounts and types of air traffic. METHODS. Training records, updated in August 1994, were obtained for 4220 ATCSs who graduated from the FAA Academy and entered terminal field training between August 1983 and December 1993. Demographic and biographical data and measures of training performance were extracted. Statistical analyses were conducted to compare performance of students assigned to different facility types, and assess the effect of different types of training on performance. RESULTS. Approximately 78% of terminal trainees successfully completed training at their first assigned facility. Another 8% switched to other terminal facilities before completing training. However, the effect of different facility types (50/50 split) on performance was not significant. A comparison of facility type and measure of performance showed that there was no significant difference between terminal and en route training. One third of the students assigned to towers not using radar procedures were successful in their first assigned facility (2% were reassigned to other terminal facilities) while only 58% of those assigned to level 4 or 5 radar facilities were successful. CONCLUSIONS. Terminal trainees have historically been classified as successful if they remain in training at any terminal facility. This way of classifying training status does not fully reflect the loss rates in the terminal option, especially at certain facilities. FAA's ongoing improvements in ATCS training could benefit by increased attention to training for terminal ATCSs.
INTRODUCTION. The present study was conducted to evaluate the prevalence of NIDDM among cockpit crews to analyse the present status of individuals with NIDDM and impaired glucose tolerance (IGT). METHODS. A total of 1263 active crews age ranging 40-60 yrs are included in the study. All received annual medical examination every 6 month since employment and those who showed urine glucose > trace and/or fasting plasma glucose (FPG) > 100 mg/dl took 75gOGTT every 2-3 yrs. As of 3-31-91, laboratory variables were measured to determine their control status. RESULTS. Of 1263, 43 were diagnosed as NIDDM, 192 as IGT, 10 as renal glucoseuria and the remaining 1018 were normal. Prevalence rate of NIDDM was 3.4%. A cross sectional study demonstrated that present age (52.8, 49.2 ± 46.8 yrs), FPG (107, 104 vs 92 mg/dl), HbA1c (6.1, 5.8 vs 5.5%) were higher in NIDDM and IGT than in normals, however, BMI, T.chol and uric acid levels were identical among three groups. None of them were grounded due to poor control of diabetes. CONCLUSION. The occurrence of NIDDM among cockpit crews was approximately 1/3 of general population despite thorough health supervision. Future effect cannot be neglected, however, intensive supervision by us seems to be effective to ameliorate their glycemic control.

INTRODUCTION. In efforts to enhance a high performance fighter pilot's tolerance of high sustained +Gz (HSG) centrifuge training in which the subject undergoes a series of runs attaining a maximum of 70 for 15s are commonly employed with minor if any complications. This paper, however, describes just such a routine centrifuge session resulting in the fracture of the subject's femoral neck. Thorough search of the literature revealed no similar mechanism of injury. CASE REPORT. A 30-year-old Air National Guard pilot in good health (no history of lower extremity injury or pathology or change in activity) was approved for centrifuge training at a military training facility. In a rapid onset run (ROK) of high +Gz, he was accelerated from 1.20 to 7.0G at a rate of +2.0 G.s^{-1}, sustaining 7.0Gz for an additional 15s while performing the H-1 maneuver. At the completion of this run, the patient reported marked pain in his right hip. Examination revealed a complete fracture of the right femoral neck with no concomitant pathology. Initial biomechanical assessment of possible causative factors suggests that a minor shift in seating during the rapid onset of +G's may have channeled enough force through the hip to exceed bone strength. IMPLICATIONS. With thorough biomechanical analysis, the possible etiologic factors of this unique case will be discussed, furthering our understanding of human function under high-G stress, and hopefully preventing future occurrence of such injury.

INTRODUCTION. Ejection from jet aircraft is an area that has been exhaustively studied from many perspectives, e.g. causes of ejection, types and causes of ejection injuries, etc. Curiously, no study was found concerning the fate of eyewear in ejections. Many pilots are required to wear corrective lenses during flight ops and 1000's wear sunglasses. What happens to these during ejection? What injuries are caused? What factors can be identified that influence retention rate and severity of related injury? Do contact lenses provide significant advantage? METHODS. Subjects, 33 pilots, serving from '77 to '90 involving corrective or sun lens use were retrospectively examined. 5 were contact lens wearers. Most information was obtained from Naval Safety Center records and some from personal questionnaires. Injury and retention rates were examined as functions of several variables. RESULTS. Though 37 of 46 lost all lenses every single instance of retention occurred with visor down, 02 mask on, helmet properly secured, and at lower ejection speeds. Related injuries were minor and occurred in only 20%. CONCLUSION. The utility of and need for enforcement of standard operating procedures (i.e. mask on, helmet secured, and visor down) was clearly demonstrated. Only 19 of 46 clearly met all three criteria. Contact lens users were too few to draw meaningful conclusions.

INTRODUCTION. The peak deceleration load allowed for aeroshckling of manned vehicles is a critical parameter in planning future excursions to Mars. However, considerable variation exists in the limits used by various investigators. The goal of this study was to determine the most appropriate level for this limit. METHODS. Since previous U.S. spaceflights have been limited to 5+ days duration, Soviet flight results were examined. Published details of Soviet entry trajectories were not available, however, personal communication with Soviet cosmonauts suggested that peak entry loads of 5-6 g had been encountered upon return from 8 months in orbit. Soyuz entry capsule characteristics were estimated and the capsule's entry trajectory was numerically calculated. The results confirmed a peak load of 5 to 6 g. RESULTS. Although the Soviet flights were of shorter duration than expected Mars missions, evidence exists that the deceleration experience is applicable. G tolerance has been shown to stabilize after 1 to 3 months in space if adequate countermeasures are used. The calculated Soyuz deceleration histories are graphically compared with those expected for Mars aerobrakes. CONCLUSIONS. Previous spaceflight experience supports the use of a 5 g limit for the aeroshck of a manned vehicle at Mars.