

ARMY MEDICAL SERVICE

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PROGRAM

PROGRESS

REPORT

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1. Ionizing Radiation Injury - Prevention and Treatment

a. An In-Process Review was held in October 1965, in which the Army Staff was asked to accept certain protective criteria as an interim goal for drug development. One participant did not concur in the proposal.

b. The types of chemicals that are needed for the screening program were discussed with representatives of the pharmaceutical industry at the Pharmaceutical Manufacturers Association meeting in Colorado Springs.

c. Under the provisions of Mutual Weapons Development Data Exchange Agreements, investigators in 7 European nations were visited.

d. A discussion paper, "The Radiation Chemoprophylaxis Program of the U. S. Army," was presented as part of the first meeting of the Quadripartite Standing Working Group/Radiological Defense, at the U. S. Army Nuclear Defense Laboratories, Edgewood Arsenal.

e. Members of the Nuclear Energy Division participated in the AFEB Commission on Radiation and Infection meeting held at Rockefeller Institute, New York City, the session on bone marrow transplantation and radiation protection, held at the US Naval Radiological Defense Laboratories, San Francisco, and the conference on "Research Methodology for Use in the Development of Anti-Radiation Agents," conducted by the Federation of American Societies for Experimental Biology at Beaumont House, Bethesda, Maryland.

f. Screening of chemicals for anti-radiation activity continued during the quarter.

g. Two new contract studies were begun during this quarter. One, in the general area of combined injuries, is an investigation of the mechanisms underlying the failure of macrophages to control massive bacteremia following total-body irradiation. The other study seeks to develop a rapid technique for the identification of karyotypes that will be free of human bias. Such a technique would be of value in the quantification of ionizing radiation injury before overt clinical signs are manifested.

2. Medical Unit, Self-Contained, Transportable (MUST)

a. In December 1965, the AMEDS Technical Committee recorded the approved QMR and formally initiated Project 3A643324D828, Medical Unit, Self-Contained, Transportable with four tasks:

- (1) Task .01 - Utility Element (MUST)
- (2) Task .02 - Inflatable Shelter (MUST)
- (3) Task .03 - Expandable Shelter (MUST)
- (4) Task .04 - Equipment Systems (MUST)

b. Data to incorporate MUST into the Army Force Development Plan as item No. 76 was submitted to ACSFOR.

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c. In November 1965, clinical evaluation of the operating room, ward, and sterile preparation elements, using actual patients, was completed. The elements were found to be superior to similar present field equipment. The minor changes recommended are being incorporated in the appropriate element.

d. Second generation prototype utility elements, inflatable shelters, and expandable shelters were contracted for delivery in sufficient quantity in time to begin the service test of a mobile surgical hospital on 1 May 1966. Operating room, sterile preparation, and ward equipment for a MASH were also contracted. X-ray and oral surgery prototypes are under contract.

e. Arrangements were completed to road-test the clinical laboratory and a second model dolly.

f. In December 1965, the Medical T&E Activity completed a 2000 hour endurance run of the utility element. The element tested is now at AiResearch Mfg. Co. for tear down, engineering analysis, and evaluation. The Engineer Research and Development Laboratory (ERDL) endurance run continues. Additional funding has been given ERDL for this purpose.

g. A lighter, more flexible fabric for the inflatable shelter passed its first tests.

h. Natick Laboratories were provided funds with which to begin development of food service and sanitation/water recycling systems.

3. Combat Surgery

a. Continued investigations are in progress on the effects of orthophasic postsystolic myocardial augmentation (PMA) and its application in shock. It has been demonstrated unequivocally that PMA can reverse the lethal course of hemorrhagic shock in animals having an ordinarily lethal lactate-pyruvate ratio.

b. During 1965, 53 severe shock patients were treated and studied at the University of Maryland Shock Center. Research protocols included a multidisciplinary approach (hemodynamic, renal, coagulation, pulmonary, and biochemical) with complementary animal studies. A hemorrhagic shock model for a uniform study of shock is being developed.

4. Military Internal Medicine

a. Current and newly developed rations (fresh or as altered by varied storage conditions) are being evaluated as to their capability to provide adequate nutrition to the soldier under an ever changing variety of duty requirements and environmental situations.

b. Utilizing nutritional survey data, an attempt has been made to determine the average daily caloric intake necessary to supply the energy requirements of men undergoing the U.S. Army Ranger Training Cycle in whom the caloric equivalent of the mean body weight loss amounted to 442 calories. The daily food consumption over the entire Ranger training period, using the chemical analyses of the food composites, averaged 4,400 calories/man/day, or 22.2 percent more than the prescribed daily minimum.

c. An area of continuous investigation at the U.S. Army Medical Research and Nutrition Laboratory is the production of experimental fat emulsions, their chemical evaluation, animal toxicity testing, and histopathological examinations of tissues from animals receiving various commercial or experimental intravenous fat emulsions by members of the SGO-Toxicity Testing Group.

5. Military Environmental Medicine

a. Although the depressing effect of hypoxia of heat regulation in animals is known, there is no clear data regarding the thermoregulatory responses of man to cold at high altitude, the relation between different altitudes and different temperatures, and the effect of altitude acclimatization to this response.

b. A recent study has confirmed in man that altitude impairs thermoregulation in the cold, primarily by inhibiting heat production; that the pattern of adaptive changes in the cold at high altitude does not involve a recovery of the depressed heat production, but a change toward increased heat loss through the skin. The study further suggest that the intermediary metabolic responses to cold may be affected by altitude. This latter possibility was also suggested by data obtained from dogs breathing hypoxic mixture in the cold at Army Research Institute of Environmental Medicine which showed a decreased utilization of both fat and carbohydrate.

c. Previous reports on attempts to artificially acclimatize human subjects by daily exposure to low temperature in a climatic chamber involved individuals raised in a temperate or cold climate with at least seasonal experience with winter cold during most of their lives. A recent study appears to indicate that previous cold experience is important in human cold acclimatization, but other life-history differences, primarily in nutrition and disease, may make any temperate vs. tropical comparison a multi-variate experiment.

6. Military Psychiatry

a. Contract research on the detection of deception has resulted in the preliminary finding that physiological indicants of organismic states may be more inhibited in individuals attempting information concealment than in other individuals when all are tested as a group.

b. Additional information from the adeno-virus studies in recruits at Fort Dix show that endocrine patterns may predict the onset of symptoms 3 days before their clinical manifestation. Contract research at Fort Dix also indicated that psychiatric information obtained from members of squads and from squad leaders may be predictive of hospitalization or unusual behavioral acts such as AWOL. In these studies, withdrawal from group participation by an individual soldier seems to be an indicant of trauma. Studies are continuing to validate these findings on soldiers at Fort Ord.

c. Other contract work involves the possible application of operant control techniques during psychotherapy. A project is being initiated to study the effect of application of preventive psychiatry concepts in mental hygiene clinics at various posts within CONUS.

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7. Oral and Macillofacial Sciences

a. Studies on cyanoacrylates are being pursued, through inhouse and extramural projects, in the rapid closure of oral incisions and lacerations and for hemostasis. The investigators are ready for clinical applicatory projects, especially for Vietnam conflict injuries; one of the earliest uses in developing the indications and techniques is visualized for mucoperistial flap immobilization and stabilization.

b. A project on silastic temporomandibular joint arthroplasty is proceeding exactly on schedule. An ankylosis is being produced in primates by a unique technique, and then the joint is rebuilt with silastic. Thus far the technique has permitted a resumption of vigorous and normal jaw movements following surgery. In producing the ankylosis, as an experimental model, an autogenous graft is used from the adjacent zygomatic arch.

c. In a study, under the technical coordination of the U. S. Army Institute of Dental Research, of 204 cases of patients with periapical lesions, it was found that 48 percent were granulomas and 45 percent were cystic. In an extension of this study, a technique was developed to produce granulomas in rats similar to those in humans, as a model for exploratory studies in prevention of the high prevalence of these lesions.

d. USAIDR prepared an interim report of a feasibility study on the shell investment technique. It is hoped that by further improving and simplifying of the technique, it may become suitable for field prosthetic units.

e. The Letterman General Hospital team compiled the results of experiences with 100 U. S. Army maxillofacial casualties treated in the Vietnam chain of evacuation. In addition, they are involved in a study of Vietnam casualties treated in the general hospital in Saigon.

8. Military Psychophysiology

As part of the vision conservation program, rapid screening devices are being developed for the treating of depth perception. Work applicable to hearing conservation continues. In this latter program, it has been found that infrequent auditory signals presented in addition to visual signals impair the efficiency of performance; but presentation of frequent auditory stimuli can improve performance when responding to visual signals.

9. Aviation Medicine

a. New projects have been initiated to study the responses of the eye during light and dark adaptation and the ability of the eye to sense objects in the environment while in the process of rapid lateral or vertical movements.

b. Studies on the responses of the cardiovascular system to the stress of parachuting operations have indicated that, at the moment of impact, a paratrooper may suffer from a mild form of cardiac failure. A project is in the planning stage dealing with responses of the respiratory system to the stresses of helicopter flying.

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c. Work is continuing on the measurement of noise levels in the family of Army aircraft, on deficiencies of helicopter communication systems, and on improvements desirable or necessary on aviator equipment, such as helmets and flying suits.

10. Communicable Diseases and Immunology

a. A method of action of tetracycline has been discovered. Using cell-free Escherichia coli ribosomal systems, it was observed that tetracyclines inhibit lysine or phenylalanine polymerization and amino acyl sRNA binding. The inference is that tetracyclines, perhaps in the form of divalent metal chelates (Mn^{++} or Mg^{++}), interfere with protein biosynthesis by acting upon messenger RNA.

b. The effectiveness of erythromycin stearate versus tetracycline in Eaton agent pneumonia was investigated in 188 military trainees and college students. With erythromycin, clear x-ray pictures were obtained in 5.5 days, and with tetracycline in 7.9 days; but duration of signs and symptoms was the same in both groups. In vitro studies showed erythromycin to be several times more active against various strains of Mycoplasma pneumoniae than tetracycline. Of great importance is the fact that only half of those cases positive by culture or complement fixation showed significant cold agglutinins. Therefore, the reliance upon the presence of cold agglutinins as an indication for therapy with an antibiotic in primary atypical pneumonia is probably unsound, especially in endemic situations.

c. Clinical trials in 12,040 subjects have attested to the effectiveness of a new vaccine against Mycoplasma pneumoniae (Eaton agent). Pneumonia from all causes was reduced by 43 percent as compared with the control group. In addition, bronchitis was reduced by 46 percent and pharyngitis by 20 percent. This study is being expanded. It is worthy of note that 40 percent of all pneumonia cases at Keesler AFB over the past 6 years has been due to M. pneumoniae, and that last year two-thirds of all pneumonia cases in Tulane University students was due to the same organism.

d. Immunochemical studies have shown that cholera toxin and mucinase are distinct entities. Cholera toxin is elaborated in vitro during the growth phase of vibrios. It is now isolated and purified, and in its pure form it produces cholera symptoms in infant rabbits and human volunteers. It is postulated that cholera toxin causes diarrhea by altering the permeability of the microcirculatory vasculature of the villi of the small intestine. Cholera toxin is apparently a pure (unconjugated) protein that immunophoretically exhibits a migration pattern similar to 7S gamma globulins.

e. Further studies have shown that it is highly unlikely that mucinase plays any primary role in production of cholera. In former times, both were neutralized by the same antiserum, but this was probably due to the fact that the crude cholera toxin used as antigen for immunization of rabbits contained some mucinase. Mucinase is not associated with the increase in capillary permeability, but cholera toxin clearly causes this both in gut and skin of the rabbit.

f. Intestinal biopsies of two cases of cholera shed additional light on the pathogenesis of the disease. There were no striking microscopic findings in the intestinal mucosa, adding new evidence against

the desquamation concept of Virchow. Also, there was no microscopic evidence of acute enteritis as had been described recently in Thai and Filipino patients with cholera. In addition, there was marked intravillous capillary dilatation, so that the bowel appeared grossly hyperemic. The villous blunting and extensive inflammatory infiltrate found in the typical cholera patient in Asia is now thought to represent a chronic and pre-existing condition caused by a combination of factors including intestinal parasitism, repeated enteric infections, and poor nutrition. Finally, an in vivo change occurred in the antigenicity of the infecting strain from Inaba to Ogawa.

11. Contract and Grants

a. At the close of the second quarter Fiscal Year 1966, there were 521 current contracts being administered by the Command. Of these 40 were new awards during the quarter.

b. There were 58 current grants in effect during the second quarter, of which 2 were new grants totaling \$32,956.