ARMY MEDICAL SERVICE

PROGRAM PROGRESS REPORT

1st QUARTER

FY 1961

OFFICE OF THE SURGEON GENERAL

DEPARTMENT OF THE ARMY

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16 AMEDS RESEARCH AND DEVELOPMENT PROGRAM

Research

1. Biological and Medical Aspects of Ionizing Radiation

a. Anti-Radiation Drug Program

(1) Progress continues to be made in the development of a chemical agent which is effective in reducing radiation injury. Sufficient compounds have now been obtained that correlations between chemical structure and biological function can be made. The finding of two additional chemical families which potentiate the action of mercaptans under development has enhanced the usefulness of the protective compounds already on hand. Although there have been no agents found which are more effective in dogs than the amino mercaptans now under development, the establishment of two tests which use only small quantities of material will permit the inclusion in the testing program of a greater variety of compounds than would have otherwise been possible. The rapidity which experiments can be run in the bacterial protection tests has made it possible to run experiments on additional combination of agents. The good correlations of protection with results obtained in the mercaptan disulfide interchange test have given further insight into the basic mechanism of the protective action of these compounds.

(2) The chemical synthetic program has progressed sufficiently far that compounds which were heretofore difficult to obtain are becoming increasingly available. One of the results of this program will be an appreciable development in the area of fundamental knowledge of the chemistry of poly-functional mercaptans.

b. Human Radioactivity Counters

(1) The addition of equipment at the Walter Reed Army Institute of Research for automatic data handling, computing, and display has markedly improved the operational details of gamma ray spectrometry of humans, with increased accuracy and availability of results for timely application. Since the installation of the Whole Body Counter in Landstuhl, Germany, more than 5,000 people were measured. Besides detecting Cesium-137 and potassium 40 in all these subjects, a few were found to have body burdens of other isotopes. The geometry and baffle type entrance of the detector make it possible to measure samples of large mass and low radioactivity quickly and with ease. A recently instituted clinical program shows much promise because of these characteristics.

c. Feasibility Testing for Computer Analysis. Tests were conducted for estimating the medical load incident to a nuclear explosion via a transmission program arranged through the Office of the Chief Signal Officer, US Army, between Germany and Fort Huachuca, Arizona. Out of three tests conducted, only one minor error was detected.

2. Radiation and Thermal Burns

a. Research studies have demonstrated that the electrophoretic pattern of human gamma globulin can be grossly altered by exposure in vitro to pulsed radio-frequency energy. The changes occur only at certain frequencies, the precise frequency being dependent on the temperature and perhaps on variations in molecular species. With the greatly increased power and variation in frequency, pulse width, pulse repetition frequency,

and antenna patterns from modern radar and communications equipment, it becomes imperative to search the spectrum for all possible specific effects so that these interactions in the body will be understood. At the same time there is the possibility, as specific effects are found, of using this energy as a tool to apply to other military medical problems, such as the despeciation of blood to eliminate unfavorable reactions to transfusions, or the sterilization of plasma.

b. Studies of local burn care have shown that ointments are of no more value than soda and water or a dry dressing. Local antibiotics offer no additional help.

3. Traumatic Surgery and Shock

a. Resistant staphylococcal infection has been approached by a unique method. Penicillinase, the "enzyme" which destroys penicillin and is produced by the staphylococcus, has been isolated in its natural form. Since this is different biochemically from the synthetic penicillinase commercially available it likely is also different immunologically. The formation of antibodies to this substance is to be attempted and if accomplished, penicillin will regain its original effectiveness.

b. Use of millipore membrane to protect the site of nerve repair has allowed more rapid and better organized regeneration of nerve filaments. This method has been used successfully in patients and for the first time, regeneration of transected spinal cord was accomplished. However, through the defect is bridged, propagation for any great length beyond the defect has not occurred.

4. Blood, Blood Derivatives and Artificial Expanders

a. Research studies continue on the polypeptide artificial plasma expander composed of glutamic acid: lysine in 6:4 ratio. The physical properties as an expander and lack of significant hematological effects make it ideal and shows great promise, but some evidence of antigenic properties have led to further evaluation before clinical trials are entered.

b. Blood preservation investigations have developed another quick freezing method. This method employs addition of a lactose-plasma mixture to packed cells and freezing with an ethanol-ice solution in 30 seconds. Adequate long term survival is accomplished in volumes of red cells equal to 500 cc. of whole blood. Although a single unit of this reconstituted blood can probably be given without difficulty, further clinical tests must be made. Optimum reduction of the total amount of plasma-lactose solution also must be determined.

5. Nutrition

a. Research by the U. S. Army Medical Research and Nutrition Laboratory indicate that the hotter it gets the more a man needs to eat and that there is actually an increased food requirement for men living in extreme heat. Experimental studies were conducted in the Arizona desert in three phases, first in the hot sun at 105 F., second in hot shade 104 F., and the third in an air-conditioned room at 78 F. The

study was divided into three 10-day experimental periods, using as test subjects eight normally healthy, volunteer conscientious objectors. They were kept on a constant daily schedule of physical activity, allowed all the food they wanted at meal times and had cool water available at all times. Food intakes were increased significantly, or by as much as the value of 400 calories a day, both in the hot sun and hot shade phases in comparison to the cool shade period. Account was taken of the daily water and nitrogen balance of the body, sweat rates, body temperature, body weight and other changes. Significant increases were noted in metabolic rates, sweat rates and body temperatures during the hot as compared with the cool periods.

b. Accumulated data indicates that a moderately active soldier adequately clothed requires the same number of calories in temperate and arctic enviornments. In hot climates, the requirement, in contrast to previous concepts, is actually greater than in cold environments. Results of these studies imply a direct contradiction to the long accepted and established standards of the past.

c. The Army Medical Research and Development Command participating with the Southern Regional Laboratories has managed to further purify one of the emulsifiers (TEM) used in the I.V. Fat Emulsion test, so that when administered to dogs they no longer develop an anemia. It is hoped this will have the same result when tested on humans.

6. Neuropsychiatry and Stress

Follow-up on previous stress studies shows the importance of the full temporal aspects of the central regulatory mechanisms. Detrimental effects of emotional stress occurring as an aftermath have implied that the temporal patterning of stress and rest periods may be critical. The significance of timing has been studied with brain stimulation and conditioned aversive behavior in animals, and with sleep deprivation in soldiers. The duration of sleeplessness does not seem to be related linearly to performance.

7. Psychophysiological Studies

a. The first steps were taken in the development of interim guide lines concerning hazards associated with Army weapons noises. Factual data are being accumulated about sound pressure levels accompanying the firing of new weapon systems and these data will be related to hearing loss data in the interests of developing damage risk criteria.

b. Army Medical Service support of the contract study on the effect of low frequency high amplitude vibration on human performance has been completed. The findings indicated that some decrements of a temporary nature are brought about but no risks of permanent injury were involved. The study will be continued under auspices of the US Army Ordnance Corps.

8. Oral Diseases

a. In the field of dental materials, a study on the behavior of wax patterns as used in the indirect inlay casting procedure has been

Research

successfully completed. The study shows that a more accurate casting can be produced by using a soft wax and small increments of wax additions rather than the present practice of using hard wax and large additions. These results will have a direct and immediate application to the practice of clinical dentistry.

b. A series of experiments are now in progress, in the field of fluoride metabolism, to demonstrate the effect of various concentrations of sodium fluoride on the development of teeth. Three groups of animals were used in this study. One group received a nutritionally adequate diet, the second group was fed the modified Steenbock diet (Ca:P ratio, 4-5:1) and the third group received the Chick Basal Diet (Ca:P ratio, 1-2:1). In the absence of vitamin D, the former diet produces rickets and the latter is non-rachitogenic. Marked changes were noted in the ameloblastic layer, the enamel matrix, odontoblastic layer and the dentin matrix of animals maintained on the diets and receiving normal to challange doses of sodium fluoride. An interesting finding was the fact that when an animal maintained on a diet containing vitamin D received fluoride injections, fluorosis (mottled enamel) did not occur. However, when animals maintained on a vitamin D free diet received fluoride injections, fluorosis was plainly evident. This might explain why some children when drinking fluoridated water from the same water supply are affected with fluorosis and others are not.

9. Communicable Diseases

a. Research investigations in Thailand and the Philippines under the auspices of the Armed Forces Epidemiological Board, and in Malaya by the U. S. Army Medical Research Unit, have emphasized the complexity of the dengue-group of virus diseases. Supportive research studies disclose that at least five of six different viruses are in the dengue complex, and not merely two as was believed a few years ago. Each of these viruses may produce a disease that may vary in its clinical manifestations and hence be difficult to diagnose at times. In Bangkok and in the Philippines there has been a hermorrhagic type of dengue, but this has not been seen in Malaya.

b. Rapid progress continues to be made in the identification and characterization of about 125 different agents believed to belong to the arthropod-borne virus group discovered in the past few years. These isolates have been obtained from almost every temperate and tropical area of the world. Many are recognized as causes of explosive epidemics with extremely high morbidity and/or high case fatality.

c. A new anti-malaria drug combination of chloroquine - primaquine into a tablet has been prefected and a once weekly dosage for U. S. troops in Korea initiated. Development of this new prophylaxis and treatment combination has resulted from intensive extramural research studies supported by the Army Medical Service. This new combined medication will assure better control of malaria in the endemic area and make rare the later development of the disease.

10. Contracts

As of 30 September 1960, the U. S. Army Medical Research and Development Command was administering a total of 387 R&D contracts and 17 grants for the purpose of basic research. The distribution by

Research

type of contract is shown in the table below:

Type of Contract	Number
Total	387
Cost Reimbursement	362
Cost-plus-fixed-fee	13
Fixed Price	12

Development

11. Development of Medical, Dental and Veterinary Equipment and Supplies

a. Recently a prototype spectacle for use in the M-17 Protective Mask was type classified standard. This binocular device is easy to insert into the eye lenses of the mask, can be readily adjusted to accomodate individual characteristics, and is capable of being moved in four different directions and tilted to provide proper angulation. The new inserts are fitted like ordinary spectacles, which eliminate undesirable prismatic effects and spherical abberations caused by the monocular fitting technique used for the old insert.

b. During the first quarter, the following progress and changes were made in the FY 1961 AMEDS Development Program:

(1) Three items initiated

(2) One item superseded

(3) Fifteen items cancelled