

**NAVAL MEDICAL RESEARCH INSTITUTE**

Location: National Naval Medical Center, Bethesda, Maryland.

Historical notes: The Naval Medical Research Institute was commissioned on Navy Day, 27 October 1942. It then consisted of a laboratory building, an animal house, and a temporary building for housing the high-pressure tanks and other installations for research in submarine and diving medicine. These facilities proved inadequate to meet the demands of war-time research and there were constructed in 1944-1945 an annex to the laboratory building and a larger animal house. In order to provide facilities for basic research in aviation medicine, plans have been made for an aviation annex to the main laboratory building, and funds for this purpose have been requested in the 1949 budget.

Organization and relationships: The Institute is a sub-command of the National Naval Medical Center and its research facilities are available to the staffs of the Naval Hospital, Naval Medical School and the Naval Dental School, which also are sub-commands of the Center. It is equipped, staffed and organized for basic research in medical and allied sciences and in the special fields of aviation medicine and submarine and diving medicine. On its 85,000 square feet of floor space there are 105 laboratories, all adequately equipped for research in chemistry, biophysics, physiology, psychology, bacteriology, virology, parasitology, pathology, pharmacology, and for research in dentistry and experimental surgery. In addition, there are installations including pressure tanks for research in aviation medicine and submarine and diving medicine and psychometric rooms for physiological studies. In support of these laboratories there is a large animal house with air conditioned laboratory suites for studies requiring control of temperatures and humidity. Technical shops, glass apparatus and instrumentation laboratories with skilled machinists and mechanics are available for the design and construction of laboratory apparatus.

The laboratories are organized into facilities as indicated on the attached chart. While each facility is a unit for the purpose of administration, it is not an isolated department for research. The unit for research is the research project, each of which has a principal investigator, and the necessary collaborators and consultants. While the requirements of some of the research projects are such that they can be conducted within one facility, most of the projects require collaboration and cooperative effort of several facilities. The availability of the resources of the Institute as a whole to any one investigator has proved an important factor for attainment of the goals of the research. As a corollary of this interdepartmental team work, undesirable departmentation and isolation of individual investigators have been avoided.

Research programs: Currently the principal fields of research at this Institute are as follows:

1. Prevention and treatment of bacillary dysentery and diarrhea and related infections. These diseases became serious hazards in the Pacific Fleet during the last phase of the Pacific campaign, and still constitute the major cause of morbidity in the Fleet. Studies have been conducted on the various epidemiological factors involved, and plans made for trials of a specific vaccine. These trials will be carried out by a team of bacteriologists and immunologists from this Institute in cooperation with the medical officers in the Fleet.

2. Malaria, schistosomiasis and filariasis. These tropical diseases, particularly malaria, were a serious threat to victory in the Pacific, and will, in all probability, become of importance in future warfare. Current investigations deal with the life-cycles of the causative parasites with the ultimate objective of finding their most vulnerable stage; improved methods for screening antimalarials; and the development and testing of more efficient compounds for the irradiation of the insect vectors and the snail host of schistosomiasis. Plans have been completed for field trials of snailicides which have proved superior in laboratory tests. The trials will be made in Egypt by a team of parasitologists from this Institute. The base for their operation will be the Naval Medical Research Unit No. 3.

3. Scrub typhus and other virus diseases. The occurrence of scrub typhus in the South Pacific during the war led to the establishment of a research project to investigate the etiology of this disease and means of prevention and treatment. Currently a method for the production of a vaccine is being perfected. The availability of an effective vaccine is of interest not only for future operations in endemic areas but at present, since scrub typhus still is a menace to some of our troops in the Far East.

A field team consisting of a virologist and entomologist is at present on the Island of Ponape to investigate an epidemic disease among the natives of unknown origin and epidemiology.

4. Medical aspects of atomic energy. Following the atomic bomb explosions at Hiroshima and Nagasaki in August 1945, a field team of physiologists and radiobiologists organized at this Institute studied in detail the clinical and pathological effects on Japanese victims, made measurements of the physical effects of the explosions and assembled numerous data from various Japanese scientists - all in cooperation with Army field teams.

When plans for Operation Crossroads were formulated, key personnel from this Institute organized the Medical Section and, utilizing an entire troop transport converted into a laboratory ship with provisions for

thousands of animals, made a quantitative assessment by exposure of the animals of the probable effects of an atomic bomb explosion on personnel aboard naval ships. About 50 per cent of the Bikini animals have been returned to this Institute where a group of pathologists, hematologists and radiobiologists are continuing the study of the radiation effects. While some of the findings are classified SECRET or TOP SECRET, others have been published in the interest of disseminating knowledge in this field.

5. The use of radioisotopes in medical research. Radioisotopes have been employed at the Institute in several studies of fundamental importance to medicine, including the exchange of inert gases via the lungs. The absorption, distribution and excretion of radioantimony in the form of stibine and tartar emetic, and the determination of total body water with tritium tagged water.

The Institute is well equipped for the preparation and counting of samples of radioactive materials of the beta and gamma emitting type. At present the facilities are being expanded to include two radio chemistry laboratories, one for the handling of highly active samples received from the Atomic Energy Commission, and the other for the preparation of compounds at tracer levels of activity.

The addition of a mass spectrograph to the available equipment at the Institute will permit the utilization of stable isotopes in those tracer studies in which the radioisotope of the essential element is not available and in which the dilution factor is sufficiently low to permit use of the stable isotope instead.

The unique advantages of radioactive and stable isotopes as tools in the study of biological and medical problems needs no emphasis. It is the aim of the Institute to develop and apply methods for the synthesis of tagged drugs, vitamins, and hormones and to devise analytical procedures whereby the mechanism of their metabolism can be elucidated.

Methods for the determination of blood flow through various vascular areas utilizing colloidal compounds of radio phosphorous and dyes tagged with radioiodine are in early stages of development.

It is worth noting that no significant duplication of effort will be involved in the radiobiological programs envisioned in this laboratory and in the radiation laboratory at Hunter's Point. On the contrary, these two activities will act in a complementary capacity, and the interchange of ideas and mutual assistance encouraged.

6. Physiological effects of vibration and ultrasonics. This program consists of basic and applied studies on the biological effects of alternating mechanical forces. The field is largely unexplored and any

findings are of great potential importance. Work is being carried out on the structural dynamic properties of cells, tissues and organs. The physiological and psychological effects of exposure of man and animals to vibration and ultrasound will form a basis for the establishment of limits of safe exposure of personnel. Forces of this nature are found in connection with the operation of high speed aircraft, high speed naval vessels, land vehicles, and under other circumstances where human beings work near machinery of great power and speed.

Applications to medical practice are also under study. Specifically, the program includes experiments on the neuro-muscular responses to mechanical vibration, effects of exposure of man to low frequency mechanical shaking, effects of very intense high frequency sound and ultrasound on man and animals, and the physical properties of tissues and organs in relation to vibrations over a wide frequency range up to 100 megacycles per second.

This study is a joint project with the Naval Research Laboratory, Anacostia, D. C.

7. Dental research. Organized dental research has been conducted at this Institute since 1942 at which time it had been transferred from the Naval Dental School where it was started in 1939.

Efforts in dental research are directed towards three major divisions: (1) laboratory experimentation, analysis of records and field studies; (2) teaching in dental research methods and (3) review and recommendations on civilian dental projects being supported by the Office of Naval Research and the National Institute of Health.

Data procured by a careful survey and analysis of dental defects in a large sample of naval personnel revealed the impossibility of rendering all dental treatment necessary by dental personnel available. This fact as well as others showing important application to military logistics has stimulated present analysis of 600,000 dental prosthetic records. It is felt that even more far-reaching dental practical application of the results will be possible.

Studies initiated at this Institute on the enamel etching effects of acid beverages in laboratory animals has led to the present studies on dietary elements influencing dental caries in rodents. Development of biostatistical methods for dental studies are a part of this work. It is anticipated that these studies may contribute more knowledge to the dental caries process. Close collaboration with Cornell University has been established in these investigations.

Epidemiologic studies in oral Vincent's Infection are being organized in the field in conjunction with the dental research department of the National Institute of Health.

Identification of military personnel mutilated beyond recognition is extremely difficult and often can only be done by examination of their dentitions. By means of a photographic apparatus, designed at this Institute, rapid mass intra-oral color photography is possible. The photographs may be inserted in the health records, enabling other than experienced personnel to identify bodies by examining their dentitions.

The learning of dental research methods is afforded dental officers under instruction at the U. S. Naval Dental School with the objective of training and selecting dental officers for research careers.

The coordination possible by reviewing civilian dental projects by representation on the Study Section of the National Institute of Health Research Grant-in-Aid Division and within ONR, facilitates prevention of duplication of dental research.

8. Submarine and diving medicine. The Submarine and Diving Medicine Facility was established at the Naval Medical Research Institute to provide laboratories for basic research in high-pressure aerophysiology at a place where animal facilities and adequate support in the basic biological sciences were available. The endeavors of the Facility in the past have been to carry on basic studies in high atmospheric pressures and on submarine problems.

At the present time, animal and human experiments are underway with a view to establishing the relative susceptibility of various species to decompression illness. The objective of these studies is to devise a more adequate experimental method for the formulation of decompression tables which will permit diving to depths of 1000 feet. These decompression tables will be made available to the Experimental Diving Unit for adequate testing with human subjects.

In addition to these basic studies, work is in progress on a simple submarine escape device, namely, a hood which will permit men to float to the surface from stricken submarines. Upon completion this device will be made available to the Medical Research Laboratory, Submarine Base, New London, Connecticut, for further trial in the submarine escape training tank and aboard submarines.

9. Aviation medicine research. The research in aviation medicine at this Institute is directed towards problems which are basic in nature. Most of such studies require the collaboration of chemists, physiologists, psychologists and others, well equipped laboratories for basic sciences and animal facilities. These requirements can be met at this Institute in the fullest. The main research efforts at this time concern the following projects:

a. Investigations on the regulation of breathing and on acclimatization of respiration to high altitude.

b. Evaluation and study of certain agents and drugs that affect the performance of aviation personnel. It is anticipated that this study may elicit information that will lead to the development of new drugs which will contribute to the performance of aviation personnel. The study also concerns itself with the effects of these drugs in relation to such physical agents as noise, vibration, toxic gases and climatic conditions.

c. The biomechanics of aviation crash injuries. This involves the determination of "g" tolerance of head, thorax and abdomen under static and dynamic loads with the objective to obtain a quantitative basis for the development of devices and procedures for protection in aviation crashes and abrupt decelerations under other conditions.

d. Transmission of physiological responses from air to ground by electronic methods. In the past it has been necessary to design and construct devices to simulate the forces that occur in flight in order that the physiological responses to these forces may be studied. The successful development of pick-up system to transmit these responses from planes, pilotless aircraft or guided missiles will obviate such devices and physiological studies may be carried out on laboratory animals that will indicate the limits of human tolerance and aid in the development of devices to protect against such forces.

10. Research tests in support of materiel Bureaus. Not infrequently this Institute collaborates with the Bureau of Ships, Bureau of Ordnance and Bureau of Aeronautics in physiological evaluations of devices and installations. A study recently completed will illustrate this program. It concerned the effects of silicone vapor emanating from insulation on electrical equipment under conditions of submarine operation, and required the combined efforts of pharmacologists, chemists and the use of animal laboratories.

Personnel: The professional staff of the Institute is derived from several sources as shown below:

Medical Corps, U. S. Navy . . . . .	10
Medical Corps, U. S. Naval Reserve . . . . .	18
Dental Corps, U. S. Navy . . . . .	2
Medical Allied Sciences Section, Medical Service	
Corps, U. S. Navy . . . . .	10
Hospital Corps, U. S. Navy . . . . .	6
Line, U. S. Navy . . . . .	1
Civil Service . . . . .	<u>27</u>
TOTAL . . . . .	74

Six of these officers are required for administration, personnel and property. The investigators are assisted by about 115 technicians and laboratory aides. Property and maintenance requires a force of 30 civil service employees. The Institute is undermanned; to utilize fully its facilities there should be a staff of 85 investigators and 150 technical assistants.

<u>Operation cost F.Y. 1948</u> . . . . .	\$	721,885.00
plus military salaries . . . . .	\$	505,286.48

Facility Value:

Land . . . . .	\$	30,942.32
Buildings . . . . .	\$	2,144,492.00
Equipment . . . . .	\$	364,700.00

Comments: The Naval Medical Research Institute is the principal research facility of the Medical Department of the Navy. As indicated above, it is equipped, staffed and organized to conduct basic research in medical and allied sciences and particularly on problems confronting the naval service. In addition, it serves as the center of research for naval medical officers and medical allied scientists, where they can investigate problems which have confronted them aboard ship and at shore stations, and where they can receive training in research and develop into skilled investigators and administrators of research.

It also serves as a base for field studies of problems requiring specialists in various biological sciences for their solution. With the facilities of air transportation, the dispatch of such field parties to practically any unit of the Navy has proved entirely feasible.

The missions of the other research units in the Navy are in special fields of interest and supplement the mission of this Institute. \*