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Call Dr. Gregg — Col. 5-81 Rock Fdn.
get Miss Russell, Secy — very urgent in rel. to report.
In Mass. on vacation —
Should be incl. in report? (Barser dissented)

Washington, D. C.
June 20, 1947

Mr. David E. Lilienthal, Chairman
U. S. Atomic Energy Commission
1901 Constitution Avenue
Washington 25, D. C.

Dear Mr. Lilienthal:

Attached you will find the report prepared for the Atomic Energy Commission by its Board of Review.

Following your presentation of the problems of policy concerning research in the fields of biological and medical science as they now confront the Commission, the Board of Review embarked upon a series of consultations. During the course of three days, June 16th to 19th, the Board held interviews with eleven men who have had intimate contact with the work of the Manhattan District and the Atomic Energy Commission as related to medical, health-physics and research programs. These men included Drs. Stafford L. Warren, Robert S. Stone, H. Friedel, H. Parker, A. Dowdy, G. Failla, L. Hempelmann, N. Hilberry, A. Brues, H. Curtis and A. Dounce. In addition, conferences were held with Colonel Cooney, Rear Admiral Brown and Dr. R. E. Dyer of the United States Public Health Service. Furthermore, the Board had access to and utilized for its information all reports pertinent to the problems with which it had to deal.

After the Board had acquainted itself with the work of the past and the various proposals concerning the future of the program, it discussed at length on June 20th the problems presented and has summarized its thoughts, its recommendations and suggestions in its report. It is the sincere hope of the Board of Review that the results of its deliberations may prove of assistance to the Commission in establishing certain matters of policy.

The Board is desirous of taking this opportunity to express its appreciation to the Commission for its whole-hearted cooperation in facilitating a difficult assignment. The Board is also deeply indebted to Major Birchard M. Brundage, Dr. J. W. Howland and Lt. A. H. Holland, Jr., [illegible] and effective assistance in its work.

Faithfully yours,

/s/ ROBERT F. LOEB

Robert F. Loeb
Chairman

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REPORT OF THE BOARD OF REVIEW

After an introductory discussion (Section I) of the need for medical and biological research in the field of radiation, as related to the policy of the Atomic Energy Commission, this report will describe and define in Section II the primary areas of responsibility of the Atomic Energy Commission for the maintenance of medical and biological research. Section III will outline and discuss what may be called the Commission's shared responsibilities, i.e., those that involve cooperation or shared responsibilities with other branches of the Government or with universities and private institutions. Section I, II, and III contain specific recommendations of the Board of Review within or immediately following the statements of related conditions or objectives.

From this point the report proceeds to deal in Section IV with handicaps the Atomic Energy Commission must surmount in fulfilling its obligations. A much more important set of problems, those related to the recruitment and training of personnel, is presented, with recommendations, in Section V. Section VI is devoted to an aspect of the Commission's work which contrasts sharply with the usual circumstances of scientific work, namely, its secret, restricted, or classified character, and some of the implications thereof. The report concludes with a Section (VII) devoted to a brief statement regarding an organization within the Atomic Energy Commission with responsibilities for maintaining satisfactory direction and support of medical and biological research in or related to the Atomic Energy Commission.

SECTION I. The Need for Medical and Biological Research and Training.

Because advances in medical and biological knowledge are of vital public advantage, because radio-active materials can be effectively used in obtaining such knowledge, and because new medical and public health problems are associated with the development of atomic power for both industrial and military purposes, we strongly recommend that research and training in all aspects of the application of atomic energy to medical and biological problems be continued and where profitable expanded. The extent to which the Atomic Energy Commission should conduct, financially support, or assist without financial support, research and training in medicine and biology will be further defined.

The need for medical and biological research on the various effects of radio-active substances and atomic fission is both urgent and extensive. It is urgent because of the extraordinary danger of exposing living creatures to radio-activity. It is urgent because effective defensive measures (in the military sense) against radiant energy are not yet known. From now on we shall mine, transport, process and use radio-active substances as sources of power, tools for investigation of biological processes, and for the treatment of disease. There will therefore be incessant danger in handling such substances and using their radio-active properties. The need for further research is extensive as well as urgent. As an explorer allows for unforeseen hardships and unpredictable events, the investigator must plan for extensively unforeseen eventualities. The number of radio-active substances is large; many have never been identified as existing in nature. Such substances call for suspicious study. The facts learned and the mastery obtained in the past four years acquire most of their immense significance not merely from their present state of development but from what they will lead to. As the sole possessor of the materials and the processes involved, the Atomic Energy Commission must continue and extend research for which it has the primary, and in the U.S.A.

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the sole responsibility. In terms of human life, this research must be based on medical and biological science.

Section II The Primary and Exclusive Responsibilities of the Atomic Energy Commission for Medical and Biological Research

The primary responsibility of the Atomic Energy Commission for medical and biological research is in a sense self-contained, direct and inherent. In control of operations with potentially dangerous materials, the Atomic Energy Commission has heavy responsibilities to its employees and to any others who could suffer from its negligence or its ignorance. With an absolute monopoly of new and powerful tools for research and important knowledge, the Atomic Energy Commission has obligations to share its acquisitions with the scientific world wherever security considerations permit.

Because the Atomic Energy Commission is charged by law with the exclusive control of materials, equipment, processes and information which are unique, constantly dangerous and certainly not yet sufficiently understood, the Commission has every reason to assume extensive responsibilities for further development and study of the effects of products of atomic fission on human life. For reasons of national safety, no other agency has the information, the "know-how," the equipment, or the substances possessed by the Atomic Energy Commission.

The possible hazards to the health of human beings, animals and plants, incident to research, development and production of materials concerned with atomic power, make knowledge regarding the nature of such hazards, their recognition and their control a subject for which the Atomic Energy Commission must assume primary responsibility at this time.

Such research is of the programmatic, applied type, related to the protection or treatment of persons possibly exposed to or affected by radiation. It is not directed to the furtherance of knowledge regarding cellular physiology as such,

Fissionable material is being produced. This will continue, and in all probability the discovery of new substances and new production methods will raise new research problems, the solutions of which are the responsibilities of the Atomic Energy Commission for the protection of their workers in the factories and the public in their environs. Such research belongs in the regional laboratories because of security and availability of special facilities. It must be classified and it will usually be programmatic and applied to specific problems or difficulties. It calls for and has greatly benefited from the services of health-physicists, doctors of medicine and considerable numbers of dependable personnel less extensively trained. The Board of Review wishes to record here its profound admiration for the work accomplished during the past four years in protection of the factory and laboratory personnel.

We recommend that for the further study of the biological effects of radiation and all forms of detection, protection and treatment, and for the protection of employees, the public if exposed, and the civilian population in case of war, research involving classified materials or operations be liberally provided for in Atomic Energy Commission installations. Where research bearing on the detection, prevention, or treatment of radiation effects can be carried on properly outside Atomic

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Energy Commission installations, there should be no obstacle to partial or complete Atomic Energy Commission support for such research.

We recommend that (a) the biological and medical consequences of radiation (with particular attention to new radioactive materials), (b) the training of personnel in the recognition and contol of radiation hazards, and (c) the health control of operations involving hazardous amounts of radiation be made primary activities of the Atomic Energy Commission.

Those activities involving classified materials or operations must be supported by and carried out within Atomic Energy Commission installations. It will also be desirable to encourage and, where necessary, support with funds correlative studies at universities, contributing to knowledge, on the biological and medical effects of radiation but not involving the use of classified materials or information.

We recommend that the Atomic Energy Commission continue to provide isotopes for sale at nominal prices to scientists qualified to work with such materials. A consulting service should be provided through the Isotope Branch for the purpose of protecting those engaged in the use of radioactive isotopes derived from Atomic Energy Commission sources.

The time is approaching when the supply of isotopes for the study of fundamental biological and medical problems will more than meet the needs of American investigators. It would be in the interest of progress in medicine and biology that qualified investigators in other countries have such isotopes for their studies.

We suggest that steps be taken to make isotopes available to foreign investigators.

It might be noted that the publication of the monthly sales record of isotopes in Science would aid in showing the scientific world that the Atomic Energy Commission is effectively contributing to the advancement of knowledge despite the impressions often left by security regulations.

Comparable to the distribution of isotopes, the dissemination of scientific information by the Atomic Energy Commission calls for favorable, though cautious, attention. Prompt clearance of papers submitted by former staff members and the publication of accumulated information in the present possession of the Atomic Energy Commission, when cleared for security, would similarly enhance the scientific status of the Commission, the morale of its staff, and further accelerate biological and medical research. Probably much of the information not yet published will prove to be tentative and incomplete. However, recognition should be given, wherever security considerations will now permit publication, to workers whose patriotism often persuaded them to forego the credit of having done valuable work under exceptionally difficult conditions.

We recommend active encouragement of publication of accumulated scientific papers after declassification, either as records of the Atomic Energy Commission or through subsidies to professional journals, as may be proposed by the Medical Director and approved by the Medical Advisory Council (see Section VII).

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Section III. Shared Responsibilities of the Atomic Energy Commission for Medical and Biological Research

In contrast to the primary responsibilities of the Atomic Energy Commission for work described in Section II, there is a second type of research which the Commission should share with other organizations. Here the Commission should collaborate, offering the use of its equipment, staff experience, materials such as isotopes, and the services of its staff as teachers, lecturers or consultants. Perhaps the simplest way to present this field of work is to name the agencies with which the Atomic Energy Commission should be prepared to collaborate in the study of medicine and biology.

(a) The U. S. Public Health Service has experience and authority as a guardian of the public health in peacetime and of civilian populations in wartime. Its staff enjoys continuity and effective promotion policy. It can offer careers in medical and biological research which compare favorably with those at universities. It has an established administrative structure to deal with industrial hazards. It would have a logical interest in the industrial developments of atomic fission. It has had for 25 years an increasing measure of public confidence and Congressional support. In its National Institute of Health, it possesses laboratories and a growing staff of medical and biological scientists. In the interest of protecting the public, the Atomic Energy Commission might look forward to the establishment, in conjunction with the U. S. Public Health Service, the Bureau of Standards, the Department of Agriculture, and other pertinent Governmental agencies, a center for research and for training to provide an extensive reservoir of personnel in and out of Governmental services, equipped for special needs of the public.

We recommend that in view of these considerations the Atomic Energy Commission explore and consolidate, if possible, cooperative relationships with the U. S. Public Health Service, with a view to offering the U. S. Public Health Service personnel opportunities in the Atomic Energy Commission regional laboratories to learn and further investigate methods of protecting industrial employees and civilian populations against hazards of gases, dust, contact, effluents, and other forms of exposure to radiation possibly affecting industrial workers and civilian populations.

(b) The Armed Forces have grave responsibilities for defense against atomic bombs. Accordingly, it is imperative for the Atomic Energy Commission to offer instruction and experience to Army and Navy medical and ancillary personnel in the protection of troops and ships from the effects of atomic weapons. The urgent need for the accumulation of a backlog of trained personnel within and outside the Armed Forces can not be over-emphasized.

We recommend that offers be promptly made for the training and instruction of representatives of the medical personnel of the Armed Forces in the installations of the Atomic Energy Commission and such further collaboration in the study of problems already common to both organizations as may be possible. Immediate provisions should be made for the specialized training and indoctrination of personnel at various levels. These should include the doctoral, technical, and apprentice categories.

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(c) The relations of federally sponsored research and research organizations to educational and scholarly forces and resources of this country require more time for reflection and more extensive discussion than we can give in this report. The knowledge that made atomic fission conceivable came almost entirely from university staff and university-trained men of many lands. The future of atomic fission and our knowledge of radioactivity depends also on the recruitment and training provided by the universities. There is nothing mysterious about universities. Their peculiar contributions are easy to understand though almost impossible to duplicate elsewhere. They are in contact with a constant oncoming stream of ambitious and educable young men, they foster a passionate exercise of untrammeled curiosity, they possess a broad and stimulating variety of intellectual contacts, a traditional yet lively skill in teaching, and a continuity and stability for persons of exceptional ability in teaching and research. University personnel at their best exercise freely their curiosities over a wide range of theory and experience. This all too brief account reveals the advantages that university contacts afford to scientists in the Atomic Energy Commission. What can the Atomic Energy Commission offer the universities in return?

The Atomic Energy Commission can offer the use of its unmatched equipment and unique conditions for observations in its regional laboratories. It can furnish material, e.g., isotopes (as it is now fairly effectively doing) to university workers. It can continue to make a special effort to release promptly information from war-time security restrictions, and to assist in the publication of Atomic Energy Commission compilations, reports, and records which universities are too poor to publish.

It can do more. Realizing the desperate financial straits of university departments in biology and medicine, the Atomic Energy Commission might provide grants for training and appropriations for laboratory remodeling or construction when these are essential for training of young men. It is the interest if not the obligation of the Atomic Energy Commission to defend the nation by maintaining our leadership in the control of atomic energy. Scientific leadership is the nation's best defense. A large number of young, available, and active scientists with continuing experience in atomic fission, its dangers, and its potentialities, assures the safety of our country more certainly than the memory of priceless but static knowledge in a declining team of former collaborators. The Atomic Energy Commission must be prepared to give aid over long periods to universities if the Atomic Energy Commission is to obtain a recruitment

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of able and trained young men adequate to its needs.

Education is a function of the universities and its components in preparation for a career in biology are largely the same without regard to the sector of specialization within the science. The existence of this basic education is presupposed in relation to the considerations to follow.

Why a given individual turns to one line of specialization or another depends upon a number of factors. It may be through the enthusiasm aroused by an inspiring teacher, through the allure of a branch in which scientific advancement is rapidly going forward, or through the vision of an opportunity for a career.

Even with these attractions at hand, it is realized by those who are interested in the advancement of science that an adequate number of scientists will not develop if the sole source of supply is to be individuals with native ability who have the economic competence to provide for their own education. Some sort of financial aid must be provided. The measure to which this is true in the specialties in which the attractions are manifest, emphasizes how much greater is its importance in relation to an undeveloped specialty.

The biological effects of radiation must be regarded as an undeveloped specialty. Of the possible attractions, the minimum of the assurance of a career must be provided. Then the necessary financial aid must be forthcoming. In relation to the latter, the following series of recommendations is set forth:

A. Fellowships

We recommend that opportunities should be afforded for fellowships of 1-3 years duration for individuals desiring experience in the biological effects of radiation as a part of predoctoral training, and for post-doctoral training in Atomic Energy Commission regional laboratories and other institutions where the application of available techniques and unique opportunities will further their problem.

B. Training of Technical Personnel for "Health-Physics" and Related Research.

We recommend that subsidized technical training of 1-2 years duration should be available in regional laboratories for candidates with an adequate background of mathematics, physics, chemistry, and biology. The establishment of special courses in technical schools and colleges, designed for a career in the field of atomic power, would be highly desirable. Similar courses of study already exist in engineering schools for careers in electronics, communications, acoustics, etc.

Though no recommendations can be made at this time, we would call attention to the possibility of collaboration at some future date with the National Academy of Sciences, certain committees of the National Research Council and, if it comes into being, the National Science Foundation. The last named organization might supplement, or supply to a considerable extent, the fellowship program now recommended to the Atomic Energy Commission by this Board of Review.

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SECTION IV. Handicaps in Fulfilling the Primary and Shared Responsibilities of the Atomic Energy Commission in Medical and Biological Research.

A somewhat heterogeneous list of obstacles or handicaps to the fulfillment of responsibilities described in Sections II and III deserves at least some measure of attention from the officers of the Atomic Energy Commission. Most of these handicaps are imponderable but not less important because they are mute in the face of challenge or intensified by neglect.

(a) Psychological. The emphasis on the responsibilities of the Atomic Energy Commission for atomic warfare and the consequent fear and distaste which is engendered in the public mind, brings added difficulties to the work of the Commission. In the discharge of its responsibilities in the areas of biological and medical research, this takes the form of making recruitment of students and scientific personnel difficult. This is particularly true of medical personnel.

Since it is reasonable to expect that the benefits to man derived from the application of atomic power to his life, comforts, and health will, in the long run, outstrip the military significance of atomic energy, it is suggested that further steps be actively undertaken to bring these applications of atomic energy to the attention of the public, and particularly to students.

In this connection, it may be stated that the wide distribution of non-classified isotopes for biological, medical, chemical, physical, and engineering research has already gone far to create an interest among students and investigators, outside the Atomic Energy Commission. This in turn will assist in directing attention of the public to the possible peacetime uses of atomic power as the results of studies involving the beneficial use of isotopes become public.

(b) The factor of continuity. As young men in science grow older they often assume additional responsibilities - marriage, children, etc. - and naturally become increasingly concerned with the continuity or stability of income and position. Young doctors of ability now-a-days can find an attractive career in the private practice of medicine. Those in the basic medical sciences regard university posts as preferable to positions on short term projects because of the lack of continuity in the latter. Since the market for the next five years will be extremely narrow in point of able young men, we suggest that grants for university training and research should be made for at least five years, extendable for a sixth year at the expiration of the first year in course, and thus on for a number of years. Such a device goes a long way to secure continuity in a training program supported by an agency outside the university itself.

(c) Any new organization offering new careers to young men must reckon with the fact that young men in choosing their careers are influenced by "the long view." By so much as the Atomic Energy Commission can establish wise policies for selection, salary, promotion, and retirement it will be able to create a reputation for stability and continuity that will provide real advantages in attracting and keeping the servicesof desirable key personnel.

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(d) Freedom of enquiry vs urgency of assignment. One of the major satisfactions of an investigator in a university or an enlightened research institute is his freedom to choose his research problems. The makers of Atomic Energy Commission policy will realize that the motives of war-time service must now undergo a change because scientific workers will find programmatic research or imposed assignments unsatisfying unless sweetened with freedom to follow their own choice of problem for part of their working time, and also the development of new ideas by these workers may prove of inestimable importance.

(e) Because of the serious shortage of able scientists we believe the Atomic Energy Commission, with its drawing power of large financial resources, has an especial obligation to exercise great care in the allocation of funds and in the initiation of research programs. To this end the wide support of research by investigators who are already working on problems which might incidentally include a specific study of the biological effects of radiation desired by the Atomic Energy Commission is to be preferred to the initiation of broad new programs of research in laboratories which are not specially qualified to deal with such basic investigations. Scientific manpower will in this way be conserved and scientific accomplishments will be more significant and teachers will be conserved to the universities.

(f) Control of grants. Though direct support from the Atomic Energy Commission to a given project carries with it a control which is inseparable, however well disguised, it may be pointed out that required reports if they are also required to be brief are preferable to long

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or frequent reports. Like scanty clothing, brevity exposes soundness and strength, but corpses look better in ample wrappings; reports of work done should be brief.

(g) The Atomic Energy Commission officers, in making arrangements with universities, might well explore the possibilities of simplifying such contracts and contractual forms as may be necessary. Such efforts to bridge the considerable gap between university and Government forms and regulations will pay surprising dividends in reducing the timidities and aversions of professors, prima donnas, and perfectionists.

SECTION V. Personnel Recruitment and Training

Attracting the interest of able young men in the medical and biological aspects of radiation and providing them with training appropriate to their capacities and probably future careers is the most important long term task in the Atomic Energy Commission research program. Indeed, a failure to assure the recruitment of an adequate number of able young men may easily prove an irreparable mistake.

The supply is small. The war has seriously interrupted the advanced training of an adequate number of chemists and physicists. There is considerable evidence that not enough doctors are being trained, and ample proof that advanced training in the basic medical sciences was strangled by the clutches of Selective Service. A plethora of scholarships and fellowships for training in other careers are already in competition with what the Atomic Energy Commission can offer. Service in the Atomic Energy Commission has as yet none of the advantages of a traditional and therefore predictable career. The colleges and universities are the only source of recruitment of professional personnel, and yet the attractions of commercial careers for chemists and physicists, of private practice for doctors, of teaching and free research for biologists, will make themselves felt very clearly in the deciding years of college and university. Though nuclear physics is already interesting to students of physics, radiant energy is as yet a powerful tool with which the young biologist and doctor must yet become acquainted.

The process of recruitment and training begins in the contact of a stimulating teacher with alert college students. Consequently it makes sense to know what colleges and universities give evidence of possessing instruction in physics or biology or medicine that is attracting competent and interested students.

The next stage of recruitment involves undergraduates in their senior year and graduates in the predoctoral stage.

We recommend that a survey be made of existing sources of recruitment by the office of the Atomic Energy Commission. Gifted teachers

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are the best suppliers of fellowship candidates and among the most helpful partners the Atomic Energy Commission could find. Accordingly, active steps should be taken to increase the familiarity of teachers with the scientific significance of atomic energy. Aggressive yet critical search must be begun and continued if such sources are to be located and aided with training grants.

We recommend that a discriminating and detailed review be prepared of all personnel known to be already in the field of radiation biology and medicine. A study of the experience, the capacities, the interests and probably potentialities of existing personnel could point the way to more effective placement and use of present human resources. Such an inventory would vividly confirm the need for a larger recruitment from the first stage onward.

SECTION VI. Secrecy in Scientific Work

Secrecy in scientific research is distasteful and in the long run is contrary to the best interests of scientific progress. The Board of Review recommends that in so far as it is compatible with national security, secrecy in the field of biological and medical research be avoided.

If perforce there are some who must carry on certain of their investigations under secrecy restrictions, they should be permitted as much unrestricted research as possible. Furthermore, every effort should be made to dissociate as many workers as possible from secret research and to isolate such research from university centers.

SECTION VII. Organization for Research in Biology and Medicine in the Atomic Energy Commission.

We recommend the creation of an Advisory Committee for Biology and Medicine. The principal function of this Committee would be to recommend to the Commission directly general policy in the field of research and health.

We recommend the appointment of a Medical Director by the Commission in consultation with the Advisory Committee for Biology and Medicine. This should be done as soon as a candidate can be found who is qualified to assume general responsibility for the research and training programs in both biology and medicine and for the health protection activities of the Atomic Energy Commission.

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Although it has not been possible for this Board to review adequately the research projects proposed for the fiscal year 1947-1948, we recommend, in order to assure continuity of work, that the existing programs currently active be given favorable consideration, but that the activation of new projects await the appointment of the Advisory Committee for Biology and Medicine and a Medical Director.

/s/ DETLEV W. BRONK
Detlev W. Bronk

/s/ EARNEST W. GOODPASTURE
Earnest W. Goodpasture

/s/ WALLACE O. FENN
Wallace O. Fenn

/s/ ALAN GREGG
Alan Gregg

/s/ HERBERT S. GASSER
Herbert S. Gasser

/s/ A. BAIRD HASTINGS
A. Baird Hastings

/s/ ROBERT F. LOEB
Robert F. Loeb, Chairman

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