Scientists, Scientific Societies, and the Armed Forces

Herman S. Wigodsky

Silver Spring, Maryland

THE RECENT PUBLICATION by the Department of the Army of the booklet *Scientists in uniform, World War II* was followed by a small flurry of editorial comment. Although the booklet was published by the Army, it is based on data obtained from scientists who had served in all branches of the armed forces. This renewed interest in the problem of the scientist's place in the National Military Establishment apparently was short-lived and resulted in no really significant action either on the part of the military or on the part of science. It is difficult to understand the apparent disregard of this critical summary of the experiences of a great number of scientists, which offered many lessons. These experiences should inspire an intensive effort to correct what are apparently self-admitted deficiencies. By this time, however, it is evident that the effort will not arise spontaneously within the armed services. If it is to be made, the effort will have to come from those scientists who provided the material on which the booklet was based, acting together with their fellow scientists, both as individuals and through their collective media—the scientific societies.

Is this problem important enough to warrant some concerted action on the part of scientists? The evidence indicates that such action is not only desirable but actually fundamental to successful national defense. Even the layman saw how dependent the armed services were upon scientific advances during the war. Now that the war is over new weapons are still essential to successful national defense, and only scientific research can produce them. Many more facts point up the importance of good relations between science and the military. We have a large military establishment, which is continuing its war-born policy of supporting research. This country is assuming increased international responsibilities. In the event of another war an attack on the continental areas of the United States is almost certain. These are all reasons for establishing an efficient scientific organization within the services.

One might well inquire next whether science would be justified in attempting to establish within the armed services those conditions that are so well recognized as being essential to fruitful research. In this connection, the scientist should bear in mind that he has a dual responsibility, the first being his responsibility as a citizen of the United States, and the second his acknowledged indispensability in the development and application of new weapons, techniques, and operational methods. In answer to this inquiry, it cannot be overemphasized that the armed forces are the stewards of the people in regard to military affairs. The services are under civilian control, as has been well demonstrated. It therefore becomes a duty of every citizen, and particularly of every scientist, not only to support the armed services but also to scrutinize their actions, criticize where necessary, present constructive suggestions as needed, and finally to determine whether these suggestions have been adopted. What section of the citizenry is better qualified to carry out these duties, where scientific policies are involved, than the scientific segment?

Once the importance of the problem of science in the armed services is established, and the duty of the scientist in regard to the problem, two more questions present themselves. First, are the military services dealing adequately with this problem? Second, is organized science taking sufficient interest in the actions of the military services?

In answering the first question, one must remember that, in peacetime, the primary mission of the armed services is to prepare for the defense of the nation in the event of war. As has been stated, these preparations must depend upon scientific research to develop and to assist in the application of new weapons, techniques, and operational methods. In order to coordinate the scientific efforts of the National Military Establishment, Congress established the Research and Development Board. The Board's functions are limited to surveying fields of interest to the military for pertinent scientific discoveries, and to coordinating research so as to minimize duplication. Unfortunately, the board's authority does not extend to such major responsibilities as selection of scientists, operation of laboratories, establishment of operating policies, planning careers in science, or publication of research. It is difficult to see how the Research and Development Board can ever be completely successful until these duties are assigned to some section of the Military Establishment and are put on an equal basis with the ones now performed by the RDB. Clearly, there is not now in the Military Establishment any central group discharging these responsibilities.

Although the necessity for establishing such authority was pointed out on numerous occasions before the end of the war, no action was taken. There was widespread dissatisfaction with the place of the scientist in the military at that time, as reflected in the the booklet, *Scientists in uniform, World War II.* Testimony to the strength of this dissatisfaction is presented by the precipitous decrease in the number of scientists in the services after V-J Day, in spite of well-equipped laboratories and good salaries. Apparently little has been done to remedy conditions responsible for this dissatisfaction and certainly scientists outside the services have done nothing toward solving the problem.

A few quotations from *Scientists in uniform, World War II* will illustrate the type of problem under discussion and the failure of the armed services to correct the apparent defects: Page 61: "More than one-half of the respondents emphasized the need for better methods of assignment or supervision of technical personnel in uniform. The emphasis varied from 80 percent of the respondents in the field of biology to 35 percent in the fields of geology and psychology." The number of respondents are: biology 2,830; geology 605; psychology 1,168. The percent reporting utilization in primary field and at proper level of competence for at least half or more of the time in military service are respectively 34, 27, and 72 percent. Page 13: A chart presents the information that 63.2 percent of the respondents suggested better assignment or supervision. Page 16: "Scientists trained in technical fields whose uses were not thoroughly understood by personnel of the Armed Services tended to be poorly utilized, the opposite was generally true for scientists representing technologies with which the services were familiar. . . . Failure to understand the application of many technical fields to military functions led to a lower efficiency of technical military activities and an inability of scientists to carry projects through to active military application."

These several quotations all refer to assignment and supervision of scientists, and without doubt, these are key factors in the successful utilization of scientists in the services. With the exception of certain of the civilians on the Research and Development Board, however, none of the top rank positions within the three armed services is held by an outstanding scientist. On the contrary, many are held by military men who are poorly trained in science, some of them with no training in science at all. This same condition extends downward to the level of laboratories and other working facilities. Some of them are sympathetic with the scientists' problems, but the point is that they are not scientifically competent. There are of course exceptions—a few conscientious, competent scientists in various echelons who are doing an excellent job, in spite of difficulties, and who deserve praise and encouragement.

From this and other evidence, such as the failure to establish a section to deal with scientists in the newly appointed Secretary of National Defense's Personnel Board, one is led to believe that the National Military Establishment is not dealing adequately with the problem of science and the scientist in the armed services. One even suspects that scientific possibilities are not fully pursued and that the best efforts of the Research and Development Board must be nullified within the services themselves.

Turning to the second question—whether organized science is taking sufficient interest in the actions of the armed services—one must conclude that it is not. Several branches of organized science have appointed advisory committees to the Department of the Army in recent months, but only at the invitation of the Department, and no such committees have yet waited upon the Secretary of National Defense.

As in prewar years, it has become unfashionable to discuss such matters at scientific meetings. Postwar problems have completely overshadowed them, although they had immediate and personal importance to many scientists who served in the armed services. It is difficult to understand why organized science has not maintained greater interest in problems so important to national defense. Unless the situation is corrected in peacetime, scientists will be faced with the same problems in the next war.

Not only is there apparently great reluctance on the part of organized science to attempt to correct the military situation, but also there is increasing reluctance to accept from the armed services any research contracts that have a security classification. Recently, the president of a leading university stated definitely that his university would not accept such contracts in the future. This attitude has found many adherents and will find many more. I will neither attack nor defend this position, although it is my opinion that research on classified projects in academic institutions is incompatible with academic and scientific ethics. The fact remains, however, that this attitude by academicians, scientists included, only increases their responsibility to see that the armed services are provided with the personnel and facilities necessary to carry out research themselves.

Realizing the failure or inability of the military services to solve the problem properly, and the failure of organized science to insist on a proper solution, one cannot help but be concerned about the situation. There is ample evidence at hand that the services will not take the necessary action of their own volition. This leaves but one course of action—organized science must reawaken its interest in the military problem. The medical profession, having failed to take similar action in the face of a parallel and long-standing problem, are now faced with a draft. Will a similar crisis be required to stimulate scientists?

In answer to the question, "What can be done?" I make the following suggestions:

1. Committees can be organized within scientific societies to make a thorough investigation of the role of the scientist and science in the armed forces.
2. The services of these committees can be offered to the Secretary of National Defense to investigate the problem and to make necessary recommendations.
3. Standing committees can be established to provide periodic resurveys and to assist in (or to insist upon) the correction of obvious defects.
4. A mechanism can be established whereby scientific societies and academic institutions may assist the armed forces in obtaining necessary scientific personnel of sufficiently high caliber to meet the needs.
5. A plan for determining the supply of scientific man power in the United States and for using it in time of national emergency can be developed and presented to the President of the United States.

These suggestions are only a few of the many that could be made. Unless scientists take action on these or other suggestions which will aid in resolving this important problem, they will have failed to discharge a public duty and to exercise an important right of citizenship. The costs of such failure will be made clear in the event of a national emergency—a time for implementation of plans, not their preparation, and for use of weapons, not their development.

Infrared Spectra of Tissues

Elkan R. Blout and Robert C. Mellors[1, 2]

Polaroid Corporation, Cambridge, Massachusetts, and
Sloan-Kettering Institute for Cancer Research, New York City

THE INFRARED SPECTRA of many substances such as proteins (*1, 5, 8*), amino acids (*7, 9*), and nucleic acids (*2, 3*) extractable from tissue have been determined. The purpose of the present investigation is to examine the infrared transmission of whole tissue sections of various types with a view toward comparing the data. In this paper we are reporting some measurements of the infrared spectra of tissue sections and blood smears.

The technique used for determination of the spectra consists of mounting the tissue sections (4 to 50 μ thick) directly on thin (0.060-in.) disks of silver chloride without the use of cover slips. If paraffin sections are used, the paraffin is removed by immersion in xylene and washing two or three times in absolute alcohol. A drop of oil is then placed on the section and spread as evenly as possible over it before measuring the spectrum. The use of such a liquid is desirable in order to reduce scattering by the tissue, especially at wavelengths shorter than about 5 μ. A high molecular weight liquid fluorocarbon[3] has been found useful for wavelengths between 1 and 7.3 μ, since thin layers of it are completely transparent in this region. For the portion of the spectrum between 7.3 and 15 μ a hydrocarbon (mineral) oil is satisfactory in spite of its slight absorption at 13.8 μ. In all measurements a comparison silver chloride disk coated with approximately the same thickness of oil is used. The tissue section adheres strongly to the silver chloride through these manipulations, and is then ready for measurement in the spectrometer. We use a Perkin-Elmer instrument (model 12A) and place the sample close to the slit. Because the sample is not placed directly at the slit, it is desirable that the tissue area selected for measurement be approximately 17 by 5 mm (slightly larger than the slit size).

In all the spectra shown in Figs. 1–5 there are several strong absorption bands which may be correlated with those of known chemical groupings, viz., 3.04 μ (3290 cm^{-1}), N-H stretching; 3.4 μ (2940 cm^{-1}),

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[2] We are indebted to Miss A. P. Sutton for technical assistance, to Dr. K. G. Stern of Brooklyn Polytechnic Institute for the histone sample, and to Dr. M. Pechet of Children's Hospital for the leukemic blood smear.

[3] Perfluoro lube oil (E. I. du Pont de Nemours & Co.), bp 130–150° C/10 mm, n_D^{20} 1.335. The relatively low refractive index is a disadvantage.