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The Genesis of the National Research Council and Millikan's World War I Work

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NEITHER the history of the genesis of the National Research Council, its operations in World War I and the formal permanent status established for it by President Wilson's Executive Order No. 2859 of May 11, 1918, nor that of Millikan's World War I work is a story that can be told within the compass of a single short chapter. Each is worthy of a book written only after careful study of the voluminous record of correspondence and reports, many of them scattered, and after consultation with the few active participants in those exciting days who are still alive.

I have not attempted to make such a study beyond consulting a few readily accessible records. So in the few pages at my disposal all that I can hope to do is to tell something of the story as I remember it after the lapse of more than thirty years. If the story is found inaccurate in parts, the explanation resides in Father Time's predilection for blurring the details of ancient memories and, in this case, by the masking effect of the incidents of a much more recent and far greater world war.

While my intimate friendship with Dr. R. A. Millikan, Dr. George E. Hale, General John J. Carty, and Dr. Arthur A. Noyes went back many years before 1916, it was only in June of that year that I became fully apprised of the movement, even then well under way, which led shortly to the formation of the original National Research

Council. At the time Mr. (later General) and Mrs. Carty, Mrs. Jewett and I were house guests of the Millikans at their home on Woodlawn Avenue, in attendance at the festivities of the 25th anniversary of the founding of the new University of Chicago. Many of the leading scientists of the nation were in Chicago for the ceremonies. Despite the numerous functions and the fact that the country was on the eve of a presidential campaign in which President Wilson was to ride to the victory of re-election on the slogan "he kept us out of war," it was soon evident that they did not believe we could stay out long and that once in, science and scientists would be put to the test as never before. Hale, Millikan, and a small group of men prominent in the Academy were active leaders in the movement to organize science for its coming war tasks.

Numerous informal conferences initiated by Hale and Millikan were held during the week and culminated in a large formal gathering at Millikan's home. Mainly those present were distinguished members of the National Academy. Neither Carty nor I were members of the Academy at the time but we were included because we were active in the affairs of the national engineering societies and in industrial research, and it was recognized that when the blow fell it would be primarily in that sector that science would be involved. Further, Carty,

Pupin, and Gano Dunn, then President of the United Engineering Societies, were already deeply interested and involved in the movement Hale and Millikan were promoting for a powerful National Research Council under the aegis of the National Academy and its Federal Charter and designed to weld all science, fundamental and applied, together in the national interest.

At this conference, Hale, Millikan, and Carty outlined the steps already taken and the plans for the future. The conference was unanimous in its approval and from then on things moved rapidly.

When or where the idea of a National Research Council as part of the National Academy of Sciences structure first arose, I do not now remember, if I ever knew exactly. Nor do I know whether it originated with Dr. Hale or was suggested by someone else and was seized upon by his imaginative mind. Doubtless the answer is to be found in his correspondence or in the Academy records.

My recollection is that it originated sometime prior to 1915 in the consideration Hale and others were then giving to strengthening the Academy by the creation in it of an Engineering Section. These considerations led to discussions with Dunn, Carty, Pupin, and other leaders in the engineering field. They were discussions destined to bear rich fruit later, not only in furthering the creation and initial operations of the Research Council, but in the establishment of the Engineering Foundation which Dunn was even then discussing with Mr. Ambrose Swasey.

Whatever the exact state of affairs in the spring of 1916 at the time of the conference at Millikan's home, one thing is certain: the remarkable triumverate of Hale, Millikan, and Noyes, which a few years later was to exert such a powerful influence on scientific and technical education in the creation of the California Institute of Technology, was already in full operation.

It was an extraordinary team, seldom, if ever, equalled in the history of American science. All were in the prime of life, all had outstanding world-wide reputations in their respective sectors of science, all were persuasive expositors of their ideas, and all were close personal friends. The bond between Hale and Noyes dated from their early days at M.I.T. That between Hale and

Millikan from years of close association as young faculty members in Harper's new University of Chicago. The qualities of each complemented those of the other two. The frail imaginative Hale was the recognized chief of staff of the combination—the student who, mainly outside the scene of conflict, planned the major moves. Millikan, dynamic then as always, was commander-in-chief of the field forces, while Noyes was the wise counsellor of both and kept the team properly headed for its objective and out of troubles which his imaginative and dynamic partners might otherwise have encountered.

I think that the original idea of the Research Council was merely that the Academy should formally establish it as part of the machinery by which it discharged the statutory obligations of its act of incorporation. By including in the Council official representation from all branches of fundamental and applied science, the Academy would vastly broaden the base of its ability to serve the nation. By extending to a semi-autonomous Council the standing and protection of the Academy charter, it would make the Council a powerful instrument in advancing all fields of science.

If this was the original idea, it was apparent by the spring of 1916 that if the Council was to achieve all that it was capable of, in an impending war it was not enough. To insure full effectiveness for the Council as a war agency to bolster the military, some specific recognition and authority from the Chief Executive was required.

In the spring of 1916 this was difficult to obtain. Despite the fact that war in Europe had been in progress for two years and the fateful tide of early United States involvement was clearly accelerating, the country, Congress, and most of all the President, were reluctant to admit it. Most difficult of all was the fact that the President was committed to a course of strict neutrality and was embarrassed to take any step which could be construed as being in the direction of an abandonment of this policy.

In 1915–16 much more even than in the corresponding period before United States entry into World War II, leaders of thought in civil life were more aware of impending events and more vigorous in seeking to prepare for them

than were the leaders of political government. Scientists generally were in the vanguard of this movement.

On June 19, 1916 the Council of the Academy held a special meeting at the University Club in New York at which Hale, Noyes, Pupin, and Welch were present and by invitation of President Welch, Dr. Millikan, Dr. Flexner, and Mr. Carty, then President of the American Institute of Electrical Engineers.

The members of the Committee which had conferred with President Wilson on April 26, *viz.*, Conklin, Hale, Walcott, Welch, and Woodward, reported the results. At this meeting President Welch appointed G. E. Hale (Chairman), Simon Flexner, E. G. Conklin, R. A. Millikan, and A. H. Noyes as a committee to present a statement on the organization of a National Research Council to the Academy at its fall meeting.

Apparently the report of the committee which saw the President was not encouraging, and so concerned were Hale, Millikan, Carty, Pupin, Dunn, and others at his apparent reluctance to accord the newly created N.R.C. the official recognition and status needed to make it fully effective in the impending crisis, that they considered making the matter a political issue in the 1916 campaign. They went so far as to draft a statement for use by the Republican campaign managers. These expressed a willingness to employ the statement if the President refused to act. Following this, General Carty spent an evening with Colonel House, laid the problem before him, and discussed the entire situation fully. Colonel House was impressed with the importance of the matter and immediately telephoned the President with the result that the next day Dr. Welch, the President of the Academy, received from him a long telegram according the Council the needed recognition and status.

From this time matters moved with great celerity and by early fall preliminary organization of the National Research Council was completed with Dr. Hale as Chairman and was ready to begin operations. Shortly afterwards Dr. Millikan was made Vice Chairman and moved to Washington where the Council had offices in the Munsey Building. This building was also the headquarters of the recently formed Council

of National Defense which by the end of 1916 was in active operation. During the preceding few months affairs had moved with great rapidity in the direction of early participation of the United States in the war. Each day it was becoming clearer to all that the period of neutrality was nearing its end. The days of uncertainty, argument, and *laissez faire* in the matter of military and civil preparation for the inevitable conflict were giving way to days of hectic and frequently chaotic efforts.

The Council of National Defense was the powerful agency set up to mobilize and direct the vast civil effort without which the military could not operate. Those who had brought the N.R.C. into being realized that the approval and support of the C.N.D. was necessary if it was to succeed in major fashion and they set about securing it. Largely under Millikan's leadership this was accomplished. The C.N.D. was impressed not only with the urgent need for effective coordinating leadership in the field of science, but with the ability of the N.R.C. to give that leadership.

The C.N.D. went further than merely sanctioning the efforts of N.R.C.—it designated N.R.C. as its Department of Science and Research. Thereafter and until the end of the war the letterhead of the Research Council was:

National Research Council
Acting as the
Department of Science and Research
of the
Council of National Defense

Why the name of the Council's parent body, the National Academy of Sciences, was omitted from the masthead, I do not know.

But Millikan and his associates, notably Noyes, Pupin, Dunn, and Carty, went much further in strengthening the ability of the Council to serve the war effort and the military establishments. They—and principally it was Millikan—presented the N.R.C. so effectively to the military high command that shortly it was designated the Department of Science and Research of the Signal Corps and later of the Ordnance and other departments.

When in the spring of 1917 Millikan was

commissioned a Major (later Lieutenant Colonel) in the Signal Corps and became a member of the Navy's Anti-Submarine Board which was created at his initiative, the tie between coordinated civilian science represented in N.R.C. and the military services was as strong as it could be made.

Although Hale was Chairman of N.R.C. he spent most of his time in Pasadena where he was protected against the pressure of urgent daily problems and so was free to deal with the larger problems of strategy. Millikan as Vice Chairman was the field general and the amount and variety of the work he undertook and did was prodigious. No one not in the prime of life and endowed by nature with a perfect constitution and the urge of a zealot could have stood the strain of those interminably long days.

Hale's determination to spend most of his time away from the scene of activity in Washington, and to delegate Millikan for the work there, was a calculated one which sprang from his knowledge of the part he could do best and of the limitations of his own physical strength. In one of his letters replying to one of the urgent pleas that his counsel was needed in Washington, he says he is convinced that he can do more for the Council in Pasadena than in Washington.

The separation of the chief of staff and his field general resulted of course in a voluminous correspondence by letter and telegram—largely with Millikan. This correspondence is illuminating in many respects. It shows the wide variety of problems in which the Council was embarked and the way Millikan handled them; it speaks of the plans which even from the beginning Hale, Millikan, and others evolved and worked on for a permanent N.R.C.; it serves as a constant reference to things, trivial or great, in which Hale and Millikan were interested and to the freedom with which highly confidential war matters were entrusted to the ordinary post. In this latter respect the contrast with the highly involved hampering restrictions on communication imposed in World War II is very great. Rarely was a letter even marked "confidential" and then not because of any military reason but merely because of some frank comment on an individual. Apparently "secret" and "top secret" classifications never entered correspondence in

this sector and yet there is not the slightest indication of anything ever having gone astray.

Letters dealing with the most important military developments are interspersed with matters concerned with the 100" telescope, of Millikan's troubles with Michelson because the latter had not been fully informed of the reasons why it was imperative that he stay in Washington, or of the loss both in Washington and Pasadena of the keys to Hale's desk in the Munsey Building. There is a long-hand postscript to one important letter to Millikan in which Hale says, "sorry to hear about the mumps but hope they have departed by now."

In addition to his heavy administrative load of work and to the duties imposed on him in the early stages of the war by the visits of the English, French, and Italian scientific war missions, there was hardly a single important (and some not so important) military development of a scientific nature to which Millikan did not give personal attention. Communications, airplanes, tanks, poison gases, ordnance (including a much touted centrifugal gun), sound ranging, the dispatch of scientific attaches to Europe, and submarine detection and destruction, together with a host of others, all were grist to his mill. So also was the same problem which nearly thirty years later was to bedevil those who sought to make civil science fully effective in war: the uncritical and stupid drafting of scientists for military service in the same category as laborers.

While numerous and onerous, most of these items were essentially transient calls on his time. Such was not the case with the anti-submarine problem, however.

Even before the United States entered the war it was clear that the German submarine was the most serious threat to Allied victory or even the life of the European Allies, dependent as they were on waterborne transport for food and materials. For the United States it was imperative that this menace be eliminated if we were to play any substantial part in the European war where the final answer had to be given. Unless this could be done effectively, it was inconceivable that millions of men and millions of tons of material could be transported across the Atlantic.

While the Navy had done much to develop the submarine as an offensive weapon, they had done little or nothing effective by way of coping with it. Nor had anyone else.

Millikan was keenly alive to the fact that if submarines were to be destroyed not only had new weapons to be devised, but more important some effective way had to be found for locating accurately the position of a submerged vessel at the time of attack. This was a scientific problem of the first magnitude because of the peculiar characteristics of water which barred employment of most of the physical phenomena which might otherwise be employed.

Some time after N.R.C. was organized, but long before the United States was at war, Millikan was deeply involved in initiating work on submarine detection. Much of this was before he became Vice Chairman of N.R.C.

An N.R.C. Anti-Submarine Committee with Millikan as Chairman was appointed by Hale on February 6 by telegram from Pasadena and approved by the Executive Board. Millikan immediately got in touch with Admiral Griffin, then Chief Engineer of the Navy, and secured his hearty endorsement of a plan of experimentation. Admiral Griffin then as later was an enthusiastic supporter of all that was undertaken in the anti-submarine field.

The plan roughly was to initiate research and experimental work under N.R.C. sponsorship by private organizations at their expense with such aid as the Navy was then in position to give. Several ideas that looked promising had already been suggested. In passing, it might be noted that most of the work undertaken by N.R.C. before war was declared was privately financed.

Space does not permit detailed enumeration of all that Millikan did in the early months of 1917 to bring about active work in the anti-submarine field. A rather full account of the various steps he took with exact dates will be found in a memorandum on "The beginnings of the New London experimental station" which he prepared for N.R.C. files in 1919 while the matter was still fresh in his mind.

It is sufficient here to say that as a result of Millikan's work, strongly supported by Admirals Griffin and Taylor of the Navy and Generals

Crozier and Squier of the Army, an experimental station was established at Nahant, Massachusetts, by the Submarine Signal Company with the cooperation of the General Electric Company and the Western Electric Company. All three companies had agreed to work together at their own expense in an attack on this most difficult problem.

With the assistance of the Navy and the Coast Artillery some tests on suggested devices developed by the Submarine Signal Company and the Western Electric Company were tested even before the Nahant group was in operation.

By early May 1917 things had progressed so far that the time was ripe for a major step forward. By then the country was deeply involved in the war and General Carty had proposed a plan for an all-out attack on the problem under Navy sponsorship and with the aid of N.R.C.

On May 9, Dr. Whitney, a representative of the Submarine Signal Company and I were called to Secretary Daniel's office to a meeting of high ranking admirals to discuss General Carty's plan. At that meeting Secretary Daniels appointed the Special Board on Anti-Submarine Devices with Admiral Grant as Chairman and with Dr. Whitney, and Mr. Fay, Vice President of Submarine Signal Company, and me as civilian members. The fact that I was then an Army officer was not considered a bar nor was it a bar shortly afterwards to the addition of Millikan who by then was also wearing the gold leaf of the Signal Corps. To the Navy we were still civilians or possibly horse Marines.

Whitney and I immediately reported the conference to Hale, Millikan, and Carty and began at once organization of the Anti-Submarine Board and the development of what soon became the New London Experimental Station. This board and this station and its satellites in various parts of the country became Millikan's chief personal activity in war implements.

Luckily, as it turned out, the formation of the Navy Board did not stop private attempts to aid in the work. On May 19, President Butler of Columbia gave a dinner at the University Club for Hale and Millikan at which were present Mr. George F. Baker, Dr. Pupin, Mr. Newcomb Carlton, Dr. Dunn, General Carty, and Com-

modore Gaunt of the British Navy. At this dinner a New York group of N.R.C. was organized with adequate funds privately supplied and with full cooperation of the Navy pledged. The work to be undertaken was development of an idea that had been recently suggested in the visit of the French Mission and in which Pupin was deeply interested. It was from the work of this group under the leadership of Pupin and Millikan that the whole vast area of supersonic detection, later to prove so valuable in anti-submarine warfare, evolved.

The spring and summer months of 1917 were hectic ones for all and most of all for Millikan. In addition to his load of work as Vice Chairman of N.R.C. and on the Special Board, he organized conferences with the foreign scientific missions and the Special Board members on the submarine problem and was indefatigable in securing the best scientists in the country for work at New London and elsewhere.

At one of these conferences called by Millikan, as Vice Chairman of N.R.C., a decision was made by which the American group undertook responsibility for the major share of research and development in the anti-submarine field for the Allies.

While Millikan's major war activities were concerned with the affairs of N.R.C., the Special Anti-Submarine Board, aid to the several tech-

nical branches of the Army and Navy in securing able scientists for war work, and in furthering the development of a host of implements, they were by no means confined to these.

He was very frequently called upon by the Secretaries of War and Navy and by the high military and naval commands for advice on scientific and technical matters. By the end of the war he had developed an understanding of military problems concerned with science possessed by no other American. No other American had had such wide contact with so many phases of the application of science to modern warfare. It was an understanding which qualified him uniquely to see clearly the form of military organization which could best aid the military in the future application of science and the development of new implements.

A noteworthy example of his clarity of thinking in this sector is to be found in "A plan for the organization of the research work of the U. S. Army" which he presented to the War Plans Division of General Staff at the War College on December 14, 1918.

That it was not adopted then is no derogation of Millikan or of the plan since in its essentials it is basically the organization now, nearly thirty years later and after another world war, being set up on a broader base in the new Department of National Defense.