

The problem that now confronts the Tariff Commission is to get together all the material and facts so that Congress can enact a tariff that will provide half our ordinary government receipts, will not unfavorably affect the cost of living, will expand our domestic industry to its maximum and will prevent its being crippled because of failure of the usual channels of international trade.

#### THE "CHEMICAL SCHEDULE"

In order that the Tariff Commission may properly discharge its duties to Congress it is necessary for it to have comprehensive and complete detail information on a vast multitude of different subjects and items so arranged and so coordinated that it will lend itself to the treatment to which the Commission must submit it before a report to Congress can be made. For the purpose of so collecting and collating information the Commission has established a technical staff comprising specialists in the various technical branches involved. Among such specialists there is a chemist.

In reading our tariff enactments, the all-pervasiveness of things chemical is very striking; but only recently has that impressed the general public and obtained recognition from Congress. The chemists' interests do not end with Schedule "A," which deals largely with chemicals and with so much of the Free List as relates to things allied to those of Schedule "A," but they permeate almost each and every one of the fifteen schedules of the Act. Obviously, the chemist member of the Technical Staff of the Tariff Commission must examine a host of industries not ordinarily looked upon as chemical in addition to the very large number of industries that are acknowledged to be chemical in greater or smaller degree. His task is most difficult and its successful execution will require much farsighted, patient and diligent labor on his part and the frankest and fullest cooperation of our industries.

#### NATIONAL RESEARCH COUNCIL, CHEMISTRY COMMITTEE SECOND REPORT

By MARSTON TAYLOR BOGERT

Chairman Chemistry Committee, National Research Council

Being the subject matter of addresses delivered by the writer at the 55th Meeting of the American Chemical Society, Boston, September 11, 1917, and at the Third Exposition of Chemical Industries, New York, September 25, 1917

In the preliminary report of the Chemistry Committee of the National Research Council,<sup>1</sup> the organization of the Council and of its Chemistry Committee was explained fully, and an attempt was made to point out some of the many ways in which such an organization could hope to be of service to the country in normal peace times. Before that article could be published, our country joined in the World War, and it became necessary immediately for the Chemistry Committee to concentrate its attention upon matters relating to the security and defense of the nation. It seems desirable, therefore, after the past months of experience under these new conditions, to submit a second report, which shall epitomize what has been accomplished since the previous one, indicate the lines along which we are advancing, present some of the difficulties confronting us, and in general endeavor to depict the situation as we see it.

And so it may not be amiss at the outset to direct attention to certain matters which concern all loyal Americans vitally and the truth of which is borne in upon us daily, not because there is any new thought embodied in these statements but because they appear to need constant iteration and emphasis.

#### IMPORTANT GENERAL CONSIDERATIONS

1—The seriousness of the situation should not be underestimated. We are at war with one of the most efficient, if not the most efficient, nation in the world, a nation which has been preparing for the struggle for forty years and is concen-

trating every resource to the achievement of its purpose. Of the many mistakes already recorded in this war, none has proven more disastrous than that of underestimating the strength of the opponent.

2—The duration of the war is a matter which no living being can forecast. The only safe plan is that adopted in England, where preparations are being made always for two years more of war. No matter how long the war may last, England's preparations will be always for two years beyond it, and we should not be one whit less forehanded.

3—Speed in getting ready to do our share is of the utmost importance. France is admittedly at the maximum of her man-power and gaps in her ranks can be filled only with difficulty. It is not likely that England can increase her present fighting strength sufficiently to provide the necessary preponderance to secure a decision upon the western front. The only great increase in fighting strength for our Allies there must come from the addition of American armies, and until such troops arrive in sufficient numbers the outcome of the struggle still hangs in the balance. Not only men are needed, but supplies and equipment of all kinds as well, and meanwhile submarines are steadily reducing the number of vessels available as transports and freighters.

4—The extent to which we are willing to work together and to make such sacrifices as are necessary for the common good will, in large measure, determine our success or failure. This applies not only to individuals, but also to corporations and to municipal, state and federal officials. Pettiness and selfishness will, in the long run, defeat themselves, and, if sufficiently wide-spread, may defeat our country. As Benjamin Franklin said many years ago: "We shall either hang together or hang separately."

5—Loyalty. The time has come when everyone must take his stand clearly and unequivocally in the ranks of loyal Americans or with the enemies of our country. There is no neutrality or "twilight zone" for those claiming United States citizenship. If it were necessary to emphasize the fact that spies are abroad in our land the Chemistry Committee has in its possession ample evidence of the work of such traitors. It is well to make clear also that what in normal peace times might be passed by as cavilling criticism may now be sedition, and what was formerly regarded as wrong-headed opposition to our country's laws and administration may be treason to-day, and such expressions should be so recognized and promptly silenced.

6—The brains of the country should not be squandered by permitting highly trained specialists, inventors and men of genius to enlist in the rank and file of the army for duties which could be satisfactorily discharged by men whose loss would not so seriously impair the offensive and defensive power of the country. Under the exigency of the moment, both England and France allowed men to go to the front at the outbreak of the war who should have been retained at home at all costs; such men as Mosely, for example, cannot be replaced, and both France and England are feeling at the present time the loss of the scientific experts who went to the front. As soon as the situation permitted, both countries sent thousands of scientists and skilled artisans back from the front to the aid of the industries at home, realizing very quickly that modern warfare depends absolutely upon industrial organization and efficiency. It has been stated upon creditable authority that England alone has recalled from the fighting line over 128,000 of such men. It takes time, however, to bring this about and we should be careful to retain at home those who can serve their country and our Allies more effectively here than in France. All that any loyal American asks is that he be employed by his country in that particular line of work for which he is best qualified and where he can help most. Skilled men of all kinds are needed in both the army and the navy, and in the case of the younger

<sup>1</sup> *J. Amer. Chem. Soc.*, **39** (1917), 841-855.

men it is hoped that those drafted can be detailed for service for which their scientific training especially fits them; this will avoid the further depleting of our industrial and research armies which would result from calling upon them for volunteers.

Turning now to matters which concern us primarily as scientists, everyone must appreciate by this time that wars are not fought as in the olden time, when individual physical prowess was the chief deciding factor, but that modern warfare is a highly complex problem in applied science and its outcome is decided largely in the laboratories and factories; or, to put it somewhat differently, military power is dependent upon scientific and industrial organization and efficiency. It is neither an impossibility nor even an improbability that a single chemical discovery might change totally the history of a nation. In fact, Germany would have been practically defenseless after the exhaustion of her accumulated stores of Chilean nitrate had it not been for the discovery of methods of fixing atmospheric nitrogen. The nation unfamiliar with aeroplanes, submarines, gas warfare, modern artillery, and all the engines of destruction of present-day warfare, would be more helpless before an army so equipped than was the American Indian with his bow and arrows against the firearms of the white man.

In a very real sense, therefore, American science is on trial in this struggle, and it is for us to demonstrate that American chemists are not inferior to those of other lands, and that our country can turn to them with confidence and assurance that they will play their part well. Never in the history of the world hitherto has the rôle of Chemistry in warfare approached anything like its present importance, and the opportunities and responsibilities of the chemist have increased concurrently.

#### MOBILIZATION OF AMERICAN CHEMISTS

Up to date, the mobilization of American chemists for the assistance of the nation has been effected mainly through three organizations which, in the order of their establishment, are:

I. NAVAL CONSULTING BOARD OF THE UNITED STATES—A Board which was called into being by Secretary Daniels for the study of scientific problems of interest to the Navy Department, and which recently has been acting also as a Board of Inventions for the Council of National Defense. Its chemical delegates, appointed by the American Chemical Society, are Drs. L. H. Baekeland and Willis R. Whitney.

II. NATIONAL RESEARCH COUNCIL—This Council was organized by the National Academy of Sciences at the request of the President of the United States, and its Chemistry Committee was established by concurrent action of the American Chemical Society, the National Research Council and the Association for the Advancement of Science, as explained already in our previous report. As the Department of Science and Research of the Council of National Defense, it is acting as a central clearing house for the chemical research work of the country.

III. COMMITTEE ON CHEMICALS OF THE ADVISORY COMMISSION TO THE COUNCIL OF NATIONAL DEFENSE—A Committee of which Dr. William H. Nichols is Chairman, organized under that branch of the Advisory Commission over which Mr. Baruch presides. It concerns itself with raw material and manufacturing problems and not with research, and is divided into various *Sub-Committees* for the more effective conduct of its business.

The close coöperation between the Chemistry Committee of the National Research Council and the other two organizations mentioned above is evident from the fact that the chemical members (Baekeland and Whitney) of the Naval Consulting Board are also members of our Chemistry Committee, and the Chairman of the latter is a member of the Committee on Chemicals, as well as of the Committee on Gases Used in Warfare and of the Board of Munitions.

Since its organization, the time of the Chemistry Committee has been occupied chiefly in the following directions:

1—The establishing of such additional *Sub-Committees* as

appeared to be expedient, keeping track of their various activities so as to avoid overlappings and duplication of work, and aiding wherever possible in bringing about more effective coordination between investigators interested in the same line of research.

2—In connection with the census of American chemists taken jointly by the American Chemical Society and the U. S. Bureau of Mines, the Committee has taken a census of all the research chemists of the country, and these returns, numbering many thousands, have been classified, carded and indexed, and are now on file in our Washington office. The Chairman of each *Sub-Committee* has been provided with an alphabetical list of the investigators in his own chosen field, showing the names and addresses of these men, the lines of research in which they have been or are interested, the amount of time they can contribute to such voluntary service, and supplying much additional collateral information.

3—In coöperation with Secretary Parsons of the American Chemical Society, the Committee has furnished to various officials of the War Department, and of other branches of the Government, lists of drafted chemists, requesting their detail to special duties where their chemical training will be of service to their country, and we have every reason to believe that the great majority of these requests will be granted and our chemists used for chemical work.

4—In extending and developing its function as a central clearing house for the chemical research work of the country for the purpose of bringing about a better coördination of such work and a closer rapprochement between individuals, corporations and state or federal officials; and its service as a general bureau of information in this field for the benefit of all.

5—The study of not far from 300 specific problems, correspondence with the investigators to whom the same have been referred, and the transmission of reports to the appropriate Government officials.

6—Moving the office of the Committee twice, first from Columbia University to the Woodward Building, Washington, D. C., and then from the latter to the Munsey Building, and the outfitting of these new offices.

7—Raising the funds, by solicitation among personal friends and public-spirited citizens, to pay the expenses of carrying on the above work. Among those whose generous financial assistance has enabled us to pay our way hitherto, we are indebted especially to Messrs. Charles Hayden, Frank A. Vanderlip, Thomas Leeming, Martin H. Ittner, and the American Chemical Society. As the National Research Council receives no appropriation whatever either from the Government or from the Council of National Defense, it was in no position to assume the expenses of any of its Committees.

8—Participating in conferences with visiting foreign scientists who have come over at the invitation of our Government or of our National Research Council, and assisting in the selection of chemists who have gone abroad to represent us there or to gather first-hand information for investigators at home. The data communicated by Drs. Grignard and Engel of France and the reports brought over by Drs. Dakin, Burgess and Hulett, have been of greatest assistance in our war preparations. In return, we are aiding our Allies by every means in our power, communicating to them freely whatever information we may possess which is of interest to them and supplying much needed raw material of all kinds. Drs. Grignard and Engel are still in this country studying our chemical industries and our natural resources.

#### FIELDS IN WHICH AMERICAN CHEMISTS ARE NOW NEEDED

##### I—FOR SERVICE AT HOME

1—AS TEACHERS. The maintenance of our training schools for chemists is of fundamental importance since upon them rests the responsibility for keeping up to full strength and efficiency

our army of chemists. They are the recruiting stations for our industries and for our research laboratories, and must see to it that a steady flow of new effectives is kept moving toward the industrial and military fronts. To disorganize our educational institutions by withdrawing so large a proportion of teachers that the chemical students cannot be trained properly would seriously jeopardize the future of our whole country. The chemistry teacher, therefore, who sticks to his task as a teacher is not in any sense a "slacker" but is rendering the most valuable kind of patriotic service, and it should be so recognized.

2—CONTROL AND DIRECTION OF INDUSTRIAL OPERATIONS, such as the manufacture of munitions, poison gases and gas masks, incendiary and smoke bombs, signalling devices and pyrotechnics, motor fuels, foods and drugs, dyestuffs and textiles, oils, paints, rubber, leather, metal goods, etc., etc.

In the opinion of the writer, it is desirable that all drafted chemists who have been exempted because of the value of the industrial service they are rendering, should be entitled to wear an emblem or insignia of some kind to indicate that fact and to show to the world that they are not "slackers" but are serving where they can help their country most. In France the industrial worker wears an arm-band or "brassard." As all male citizens there of military age are drafted, their assignment to industrial duty is regarded as a special privilege, and any industrial worker convicted of inexcusable stupidity or gross carelessness knows that he will be punished by being transferred immediately to the fighting front; whereas if suspected of any deliberately treasonable act he will be tried, not by a civil tribunal, but by a court martial, and, if convicted, will be shot.

3—INSPECTION, TESTING AND ANALYSIS OF MANUFACTURED PRODUCTS, especially those required for Government use, such as munitions and supplies of all kinds, the identification of new poison gases or shell fillers, the detection of poison in streams and wells, and the determination as to whether goods supplied are up to standard or not. This is where the engineering and testing laboratories, analytical laboratories, food and drug laboratories, of our educational and research institutions are already aiding existing Governmental agencies, and where they are quite certain to be increasingly called upon as our part in the war develops and expands, for this is what has happened in England.

4—DEVELOPMENT OF NEW PLANTS AND PROCESSES made necessary by the increased demands due to the war (as in the case with nitrates, toluene, glycerol, sulfuric acid, caustic soda, etc.), to the cutting off of our previous source of supply (potash, for example), or to wholly new war needs (such as poison gases, smoke and incendiary bombs, etc.).

5—SMALL SCALE MANUFACTURING OPERATIONS, to be conducted in our university and research laboratories, for the production of special drugs, differentiating biological and bacteriological stains, rare reagents, poison gases and research chemicals which, although of the utmost importance to the welfare and security of the country, yet are required only in such small amounts relatively as to make it very difficult to induce manufacturers to undertake their production.

6—RESEARCH. Chemists are needed to aid the Government in the solution of problems connected with the security and defense of the country, to protect our soldiers against enemy contrivances, and to increase our military offensive power. Sir J. J. Thomson said recently that "applied science can lead to reforms, research in pure science leads to revolutions."

7—ADVISERS. As advisers to our Government, bringing to it first the best existing knowledge on any chemical subject and the best qualified experts, and then causing researches to be undertaken in the most promising or most urgently needed directions. It is in this field that our Sub-Committees have already rendered splendid and most welcome service and where they can be of ever-increasing value. With the exception of Prof. Bray,

whose residence on the Pacific Coast has made it impossible, every Sub-Committee Chairman has visited Washington at least once during the past summer, so as to get in closer touch with the situation there and thus be enabled to help more intelligently.

8—IN GOVERNMENT CHEMICAL LABORATORIES, to supplement the present working force, and to fill places made vacant by the drafts, by our army and by industry.

## II—FOR SERVICE ABROAD

1—WITH OUR OWN FORCES IN FRANCE. Chemists are required for service with our troops in France, in the Sanitary Corps, the Poison Gas Service, the Ordnance Department, the Engineering Corps, the Quartermaster's Corps, and in many other positions. At the fighting front, they will be called upon probably to collect and make preliminary examination of poison gases, shell fillers of various kinds, fuses, bombs of different types, signalling devices, etc., sending the material so collected to the main laboratories back of the lines for more thorough investigation; the analysis of drinking waters, the detection of poison therein and their purification, the disposal of refuse and garbage, and the recovery of fats and other materials from the waste. In the laboratories back of the lines will be the headquarters for the major part of the chemical work of all kinds needed by our armies.

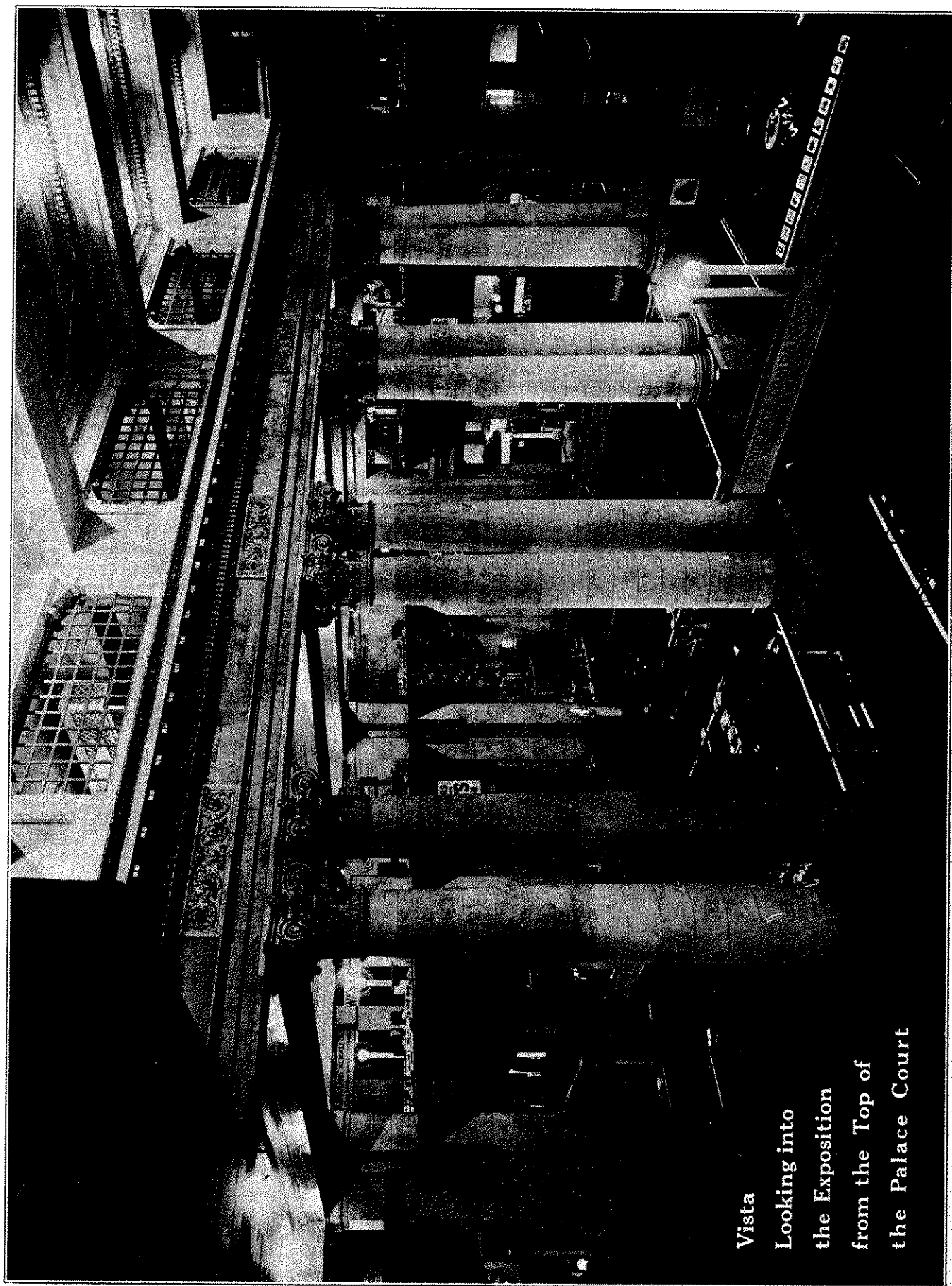
2—IN THE LABORATORIES AND CHEMICAL INDUSTRIES OF OUR ALLIES, THE FRENCH, where competent chemists are sorely needed to fill the ranks thinned by the war.

Attention should be called, in this connection, to the fact that the Chemistry Committee is not an employment agency and has nothing whatsoever to do with the finding of places for chemists out of a job. As already stated, it is assisting Secretary Parsons in securing appropriate detail for drafted chemists; but those who are seeking industrial positions should take the matter up with the Employment Bureau of the Chemists' Club, 50 East 41st Street, New York, which is the appropriate clearing house for all such matters and a most admirably conducted office. Those seeking Government employment as civilians should bear in mind the fact that Government Departments are required to select their employees from the Civil Service lists, and that to appear on these lists they must have passed the necessary examinations, further details concerning which can be obtained by direct application to the Civil Service Commission, Washington, D. C.

## PROBLEMS

While we cannot discuss the details of the various problems submitted to the Committee, it is advisable to make a few general statements in this connection.

In the first place, many of our chemical investigators appear to overlook the fact that our organization is not the only agency for investigating the chemical problems of the Government and that, in addition to the Naval Consulting Board and the Committee on Chemicals already mentioned, the Government has various chemical laboratories of its own for the study of chemical questions of all kinds. Such are the various laboratories of the Department of Agriculture (Bureau of Chemistry, Bureau of Plant Industry, Bureau of Animal Industry, Forest Service, Bureau of Soils, etc.), of the Department of the Interior (Bureau of Mines, Geological Survey, etc.), of the Department of Commerce (Bureau of Standards, etc.), of the Treasury Department (Internal Revenue Bureau, etc.), of the War Department (the Arsenal Laboratories, etc.), and of the Navy Department. The Chemistry Committee is not in any sense a rival to any of these, nor has it the slightest desire or intention to displace or supersede these existing agencies with all of which it is coöperating in entire accord, its purpose being rather to supplement and coördinate wherever assistance of this kind is welcome. The Government laboratories are doing splendid work, and our nation



Vista  
Looking into  
the Exposition  
from the Top of  
the Palace Court

should be proud of the high standards maintained there. It is too often the case that the high-class work done by Government scientists is not assessed at its real value, nor are these investigators given the recognition which their distinguished attainments so richly merit. In the present emergency, the Government laboratories naturally are overwhelmed by demands made upon them from so many different directions, and our Chemistry Committee is in the position to mobilize the additional help required. When peace returns to our land, and aid of this kind is no longer needed, the Committee can then devote itself to those other activities described in its previous report.

In the second place, many of the problems referred to our Committee during the past few months immediately following our entrance into the war were not research problems at all, in the sense in which we understand the word "research," but related to the adequacy of our supplies of raw materials and chemical products. At the outset, and failing any other civilian organization to handle such questions, we did what we could to secure the desired information through our own men and by cooperation with the appropriate Government officials and with the Advisory Commission to the Council of National Defense. Since the organization of the Committee on Chemicals already noted, all such questions are referred to them.

Further, there is nothing strange about a Government accustomed only to peace conditions and up to within a few months apparently convinced of the impossibility of our ever becoming embroiled in a world-wide war, learning rather slowly the tremendous rôle of science in modern warfare and the many research problems which inevitably follow in its train and which must be studied in connection therewith.

It is to be hoped that these general remarks will furnish some explanation as to why there are now more volunteer investigators than can be supplied with problems whose study the Government has requested. The inability of the Committee to supply to all applicants important Government problems has been a cause of much disappointment and complaint on the part of our research men for the reason that they have not fully comprehended the situation. In fact, some university officers have specified that problems sent them should be of such a nature as to provide appropriate work for their full chemical staff, an order which would be an exceedingly difficult one for the Committee to fill.

#### FINANCIAL NEEDS OF CHEMISTRY COMMITTEE

The greatest and most urgent single need of the Chemistry Committee at the present time is financial assistance to enable it to do properly and effectively the work for which it is organized and which it alone is in a position to accomplish for our Country. Without money, it can do but little. One way of meeting this situation would be for Congress to make an appropriation for the benefit of the National Research Council. Is it too much to expect that the combined intelligence of our investigators would bring the war to a close one day sooner? In such matters it is not the money which should be considered although we are now expending about \$40,000,000 a day for war purposes but the human lives sacrificed every twenty-four hours with all the accompanying train of sorrow and suffering. How much would it be worth in dollars if such a strife could be shortened even a single hour?

In the absence of Governmental aid, the National Research Council has been enabled to conduct its work partly because certain of its active members are university officers, and the universities concerned have granted leaves of absence to these men and generously have carried them at part or full salary. This, of course, the universities cannot continue to do for any length of time, as they themselves are facing serious financial straits due to rapidly diminishing revenues, nor is it fair that

those endeavoring to serve the Government should have to do so at the expense of our universities.

When members of the Council, now partly or wholly supported by their universities, are cut off from this, one of two things must happen in the absence of Governmental aid:

(1) The work of the Council will have to be abandoned.

(2) The men concerned may accept officers' commissions in the Army or Navy or positions in some other Government Department. If the latter policy is followed by any considerable portion of the membership, the Council at once loses its civilian character and individuality by adsorption into the various Government Departments. While there is doubtless much to be said in favor of such a merger, it would be, from the writer's point of view, foreign to the original intent of the organization and a handicap to much of its work. As civilians, we enjoy a freedom of thought and action, and a privilege of conferring on a basis of equality with Government officials of all ranks which might not be accorded us as subordinate officials in a Government Department. Further, while all Government Departments have no objection to using a neutral civilian body as a central clearing house, they might not be so ready to do this where the Council Committee concerned was recognized as under the control of some single Department.

This brings me to another matter, namely the great desirability of the Government making more extensive use of our organization, getting the habit of turning to it for the aid it is so well qualified to render, and recognizing it as the central clearing house for chemical research.

#### THE TARIFF COMMISSION AND OUR CHEMICAL INDUSTRIES

By WILLIAM S. CULBERTSON

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I am grateful to you for affording me this opportunity to discuss some of the broader aspects of our investigation of the chemical industries. It was clear from the time of the organization of our Commission in April that the chemical tariff presented complex problems of immediate importance which will become more important as the War progresses and as peace again comes. When we began work, we had before us the legislation Congress passed at the same time as the act creating our Commission which recognized the need of a new policy toward the coal-tar dye industry; we saw how vitally the chemical industries are related to the successful prosecution of the War; we saw that the very existence of many industries depends upon their maintenance; we saw the War revolutionizing these industries—financially, technically, and industrially; we foresaw some of the competitive difficulties which they will have to face when normal times return. And seeing these things we determined to make—as it has never been made before—not a partial and inadequate, but a comprehensive study of our chemical industries in their relation to the tariff.

We recognize frankly the difficulties of our task. The expert chemist and manufacturer no doubt realizes, more even than the layman, the diversity of problems presented by the chemical schedule of the tariff law. Schedule A, coming first in the tariff act, is, like the preface of a book, usually passed over by the average tariff student. If industrial chemistry has been a closed book to the public, and to most economists, we hope with your coöperation to make it less so by our investigation. While we have employed some of the ablest experts in the country and while neither time nor labor will be spared in exhausting published sources of information, we must have help from those directly in touch with our chemical problems. *We are looking for coöperation from the chemists in our universities and in our industries, from those experienced in the importation of chemicals, from those who use the*