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COÖPERATION IN MATTERS CHEMICAL.¹
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The expressive and recently much quoted phrase, "Don't rock the boat," is an injunction promotive of safety, but the closely related "Pull together," of common parlance, suggests the method of effective advance. In the hope, therefore, of aiding somewhat that line of progress in which we feel particular interest and for which we are largely responsible, I have chosen as a subject for this occasion, "Coöperation in Matters Chemical."

Its treatment must necessarily be purely national, for the international aspects have been eliminated by the embitterments of the European struggle. Just three years ago there met together in New York City, on the occasion of the Eighth International Congress of Applied Chemistry, representatives of all the leading nations of the world for report and conference on subjects pertaining to the advance of that science whose interests call us together now. The key-note of that meeting was, "Science knows no geographical boundaries," and plans were enthusiastically formulated for future coöperative effort.

Alas, how unexpectedly, how grievously and how completely that key-note has been forgotten, those plans set aside, amid the strife and tur-

¹ Presidential address, Fifty-first Meeting of the American Chemical Society, Seattle, August 31 to September 3, 1915.

moil of war. The words "forgotten" and "set aside" are used advisedly, for that key-note is eternal verity, and men of all nations must work together if the greatest progress is to be realized. The unfortunate re-priminations of men of science, so widely heralded in recent months, will eventually be replaced by those nobler feelings of brotherhood which lie deep in the hearts of all whose life-work has been the search for truth.

Meanwhile, chemistry is suffering a staggering blow; the call for men in European armies has almost depopulated university laboratories, the gripping realities of war have absorbed the thought and interest of many of the leaders of our science, and the shrinkage of many chemical journals, as already evidenced in our own "Chemical Abstracts," bears abundant witness to the lean years that are just before us. That this sterility of production is to be extended far beyond the actual duration of the war period is emphasized by the ages of the men who constitute the bulk of the armies. The loss of such young men, the leaders of the next generation, casts its shadow before.

How does this situation affect us here where the curse of war has not fallen? Surely we would be false to our science, to ourselves and to humanity if we did not strive with redoubled effort to make good this present and oncoming deficiency so far as in our power lies.

It would be a work of supererogation for me to make any plea for research or to attempt its justification before the members of the American Chemical Society; for this organization embraces within its now more than seven thousand members that great body of men whose tireless efforts have within the last two decades so richly increased chemical literature, and the publications of this society show annually increased volume in the preservation and dissemination of the records of such research. The ever-present struggle between the makers of the budget and the pressing claims of the editors of our journals is sufficient proof of the rapid growth of research in America. Happily the day has passed when our chemists felt the need of publication in foreign journals to insure wide hearing. All honor to the men who early determined that America should have publications worthy of the name and who consistently gave their loyal support to this great undertaking!

The aim of research is the discovery of truth. On this point all are agreed. But why such an aim? "Truth for Truth's sake," "Science for Science's sake," and similar familiar phrases have no meaning to me. I can find only one answer to this question—the uplift of humanity. In the engrossing interest of research problems, however, we sometimes adopt an artificial division of scientific research into "pure" and "applied," the former term uttered sometimes by university men in a tone of snobbishness, the latter occasionally by men of the technical labora-

tories with a rather disdainful regard of obligations to the science on which their operations are based.

I think of research in chemistry as a field whose highest fruition calls for two kinds of service. On the one hand the constant enrichment of the soil, "pure chemistry," if you will, and on the other the seeding, tending and harvesting, "applied chemistry;" each absolutely essential, and incapable of its highest fulfillment without the other, using the same methods, demanding identical care, skill, accuracy and thoroughness, and working toward the same end—the uplift of humanity. If this be not the mutual goal, then pure chemistry becomes a selfish toy and applied chemistry a mere tool for greed. In both lines of service the hearty cooperation of all chemists is needed.

The continued use of the terms "pure" and "applied" in what follows involves, therefore, no question of relative dignity or scientific justification, but is based simply on that privilege of convenience which we reserve to ourselves in continuing the use of the terms "organic" and "inorganic" chemistry.

For training in the ideals and methods of chemical research we rightly look to our universities, and if the ideal of research include both "pure" and "applied," then must the universities set forth that ideal both in word and act. Its formal statement, accompanied by discriminating favor toward the one or the other in the actual lines of work pursued, does not meet that full responsibility which every university bears to chemical research.

And this brings the responsibility to the individual laboratory head, for in his own department he represents his university. Whatever his ideal, rest assured it makes its full imprint on those working under him. The joint planning of work, the daily informal conference in the laboratory and mutual presence at the dawn of new truth create naturally in the student a strong bond of sympathy and loyal regard. Ideals are unconsciously absorbed. Thus there are sent forth each year from the laboratories young men impressed with the ideals of the men in charge, and thus is the national viewpoint in such matters largely determined. I speak now of the average American university, fully conscious of the necessity of differentiation of work in the staffs of the larger institutions and equally conscious of the difficulties under which men in the smaller institutions often work. But the ideal holds for one and all alike.

The claims of research in pure chemistry in our universities need no urging on my part. The opportunities and inducements for such work already abundantly exist. It is gratifying to note the change of popular sentiment toward such work. The old question "Of what use?" is grad-

ually being replaced by a sound conception of the fundamental function of the science of chemistry and by a recognition that the advancement of this science is not effected by inspiration, but by the contributions of many zealous, patient and enthusiastic workers. By slow process of accumulation the data are supplied for new generalizations which bring us gradually nearer and nearer full truth.

The record in the Journal of this Society shows a steadily increasing output of such work from university laboratories. That the amount of this work will increase is a hope and a belief fully justified by the attitude of university authorities in providing better laboratory and library facilities and more fellowships for graduate students.

In connection with the subject of university research in pure chemistry, may I be permitted a word concerning a special class—the men in charge of laboratories in smaller institutions of learning. Fresh from doctorate training, they enter upon the new responsibilities filled with zeal and a fine fire for continuation of research. After a period of adjustment to normal duties of the new environment and with thoughts turned to independent research there comes the realization of the poverty of equipment both in laboratory and in library facilities as compared with former surroundings. Then comes a period of earnest effort to better this equipment, only to find how many other undeniable demands are being made on the very limited institutional funds. There follows a period of depression and discouragement, and then—how often that worker is lost to the cause of pure chemistry!

But is the situation really as bad as it sometimes seems? Many of the most valuable researches in the literature have been conducted on inexpensive material and often under most discouraging circumstances. If money is lacking, there are endowment funds to aid research, and, to supplement inadequate library facilities, there is the splendid library service of the United Engineering Society of New York City. By such means it may still be possible to follow that first fine impulse.

The great danger to research in pure chemistry in America at the present time lies in the mental distraction and demoralization resulting from engrossing consideration of daily developments of the European war. The mammoth scale and startling disclosures of that fearful struggle as depicted in the morning, evening and ever appearing "extra" newspapers challenge our constant attention and fill us with the horrors of the situation. Is it right that we give way to this demoralization and thus increase the disastrous effects of such abnormal times?

Chemistry, perhaps more than any other branch of science, has received wide advertisement in connection with the present war. Many

to whom it was formerly little more than a name, have within the past year done it homage; but such glorification has emphasized the application of chemistry rather than the broad, deep foundation which has been so quietly laid by the workers in university laboratories during the years that have passed. Pressure for industrial application of chemistry along very restricted lines is great at present. The public is willing to listen and capital ready to invest. It seems fitting, therefore, that at this moment emphasis be laid on the basic science which underlies these applications. It seeks no advertisement and often in disjointed form receives but scant recognition, but it is the soil from which the fruitage must spring. To the maximum development of that soil all chemists, at least to some degree, are pledged and bounden. I do not hesitate, in a plea for coöperation, to urge that in all industrial research laboratories, ranging from those of the large corporations, splendidly manned and equipped, to those of the youngest analytical chemists, there be carried on some line of research which has no special client, for which no fee is expected, but whose function is to repay in some slight degree the debt that every chemist owes to the science of chemistry. The subjective influence of such work would far more than compensate for the time spent in its execution.

The ideal of research which I am urging includes both pure and applied chemistry. Since it is the function of universities to give the younger generation, chiefly through research, that training which will equip them for trustworthy, intelligent and broad-minded independent effort, should not our universities provide investigations in the field of applied as well as pure chemistry? The carrying out of successful work in this field involves thorough search of the literature, preliminary tests, systematic experiments, carefully drawn conclusions and preparation of the work for publication. These are the normal proceedings in all research work.

Furthermore, it must be remembered that a majority of those being trained in university laboratories are looking forward to entering various industries. This is to be expected, for ours is a country in the midst of a great industrial development. We have passed through the pioneer days when the conquering of a new land, the struggle for habilitation, was supreme; so, too, has the fight for liberty of thought and action been won; and just a half century ago, in that bitter fratricidal strife, was established once and for all the fact that this is a united country. With the recovery from the wastage of that war industrial development came into its own. Manufactures are no longer characteristic of any one section, but, as labor becomes trained, are spreading rapidly over the whole land. Capital is constantly increasing and seeking profitable channels of investment.

It is important to us that the manufacturer is rapidly becoming convinced that the work of the chemist results in the substitution in industries of scientific foundation for gross empiricism, of accurate knowledge for approximate guesswork, and of lines of attempted advance based upon the results of research for the hit-or-miss method. This conviction was greatly strengthened by the address of President Little before this Society in 1913, on the subject of "Industrial Research in America."

Another call for the chemist in industry has arisen from the propaganda for conservation of our natural resources. President Bogert, in his 1908 address, pointed out clearly the important role the chemist must play in this great undertaking.

In view of the consequent increasing demand for chemists and of the relatively small number of highly trained men from our laboratories, is it small wonder that so many of our university students are looking forward to entering industrial chemistry as a profession?

In advocating a more general pursuance of research in applied chemistry in university laboratories, I do not feel that the prerogatives of the commercial industrial research laboratories of the country would be encroached upon. The field is so large and the problems awaiting solution are so manifold that the entire chemical strength of the country is insufficient to give these problems that consideration which would bring our industries promptly to the state of efficiency which can be reached only by the aid of the chemist. In the conservation and better utilization of natural resources lie sufficient problems to furnish subjects for theses in all our university laboratories.

The term "university research," however, has a broader meaning than the selection of a topic for a thesis and the systematic experimentation connected therewith. In its widest significance it is the embodiment of the university spirit itself. It typifies the relation of each university to its environment. Surely no institution can afford to be unheedful of that obligation. In its entirety it summarizes university attitude toward the complete life of the nation.

We would do well, therefore, to give serious consideration to the question often asked during the past year in a comparative way, "Is there adequate coöperation between our universities and our industries?"

I do not feel competent to attempt to answer that question categorically. Certain it is that coöperation implies the acts of at least two parties, and the question therefore directs itself with equal force to universities and to industries. Equally sure is the conviction that such coöperation would inure to the benefit of each.

For five years I was closely associated with successful business men. From that broadening experience I brought back to university surroundings no clearer impression of those men, both individually and in common council, than their desire to know the truth concerning any proposition before them, for with such knowledge they could wisely plan for the future. Desire for publication of that truth may not be so pronounced with them as with us of the universities, but the unflinching attitude towards facts, as revealing truth, is common to both classes and therein lies a strong bond of sympathy and basis of coöperation.

If that coöperation is not complete, how can the situation be improved? May I be permitted here to make a few suggestions, or rather, let me ask a few questions?

Speaking to the men of the universities I would ask:

First, of each individual head of a university chemical laboratory: What is your personal conception of the relation of your laboratory to industrial life? Do you feel that the problems in this field are fully worthy of your time and tireless thought? Do you find inspiration in the hope that your work may result directly in the transformation of some crude or now worthless natural product into a form of higher value to all, or that waste in some of its many forms shall be diminished, or that forces now acting disjointly may be so correlated that new blessings for mankind may result?

If such questions find ready affirmative, the spirit of coöperation is abroad and must make itself felt.

Second: Do we have the men of the industries often enough before our university classes?

I do not mean for the purpose of delivering formal lectures, knowing full well their aversion to the preparation and delivery of such; but surely each of these men has in his every-day life abundant experience and difficulties, the presentation of which would give sounder conceptions, broader understanding, and more intelligent grasp of conditions to be met in the work-a-day world ahead.

Third: Are we sure that we give our lectures on industrial chemistry, especially to undergraduates, from the best point of view?

A recent experience may be worth recording here. For several years I followed the lines usually adopted in standard texts, but the division into inorganic and organic technology seemed artificial, in view of the preachments on that subject during the previous course in general chemistry; the usual grouping of topics seemed to be very loosely connected; in fact, the course lacked unity of purpose and sound pedagogical basis. I finally determined to change the whole point of view, and gave a series of lectures on "Staple crops and natural resources as affected by industrial chemis-

try." For illustration, and without going into detail, the cotton crop was discussed: its demands on the fertilizer industry, following the fiber through its changes by bleaching, mercerization, mordanting, dyeing, printing, nitration, etc.; then following the seed through the mill and the conversion of the hulls into feed and paper, the use of the meal as feedstuff, the refining of the oil, its hydrogenation, the utilization in the soap industry of the waste in refining, the recovery of the glycerine and its nitration. In this way all the subjects treated in former years are covered, but in an entirely different order. The predominating thought is chemistry in the service of mankind. New conceptions are obtained of material blessings, of inter-relations of industries, of utilization of by-products, of advances already made and of promising lines of further advance. At the end of the year there is a complete picture in the student's mind, an awakened interest in his material surroundings, a true comprehension of the part chemistry has played in this industrial development, and, in many cases, a determination formed to join the ranks of chemists in carrying forward this development. The results already obtained from such a treatment of industrial chemistry abundantly justify the change.

Speaking to the men of the industries I would ask:

First: Is not your interest in our universities very remote, if indeed it exists at all?

Yet in them are being trained young men whom, in constantly increasing numbers, you will call to your aid to promote the efficiency of your operations and thus enable you to meet the keener competition of the future; in their libraries is a technical literature which will put you in immediate touch with the latest developments in fields of direct interest and importance to you; and on their staffs of instruction are men trained to think accurately, to investigate skillfully, and with whom frank discussion of manufacturing difficulties would often lead to valued connections.

Second: Is a visit to your plant by an instructor and his group of students simply a thing to be endured or gotten through with as rapidly as possible by the aid of some subaltern who lacks your knowledge of the larger aspects of the industry in which you are engaged?

Such occasions could be made of inestimable value in cultivating true coöperation between industries and universities.

Third: Would it not be possible to include university men more frequently on the programs of industrial conventions?

Such a policy would be a mutual help, stimulating thought and breeding good-will.

Fourth: Have you aided our universities in a material way?

Coöperation is mutual helpfulness. Many of the fundamental principles of present-day industries have been worked out in university laboratories. You can aid in many ways; by furnishing material prepared under factory conditions for use in research in university laboratories, by contributing equipment which will widen the possibilities of such work, by enlarging department libraries which constitute the prime prerequisite of all research laboratories, and by endowing fellowships which will enable many a promising young man, otherwise unable, to continue his work through that unremunerative period of higher training which is requisite if he is to realize his highest possibilities.

I know of no more fitting illustration of the spirit of coöperation in matters chemical than the organization and wise general policies of this Society. In its large and constantly growing membership are included the university men and those directly connected with the industries. By joint effort and with increasing enthusiasm an organization has been developed which is daily increasing in value as a national asset.

Its general meetings, stimulating interest in chemistry in whatsoever section of the country held, are participated in by both classes of chemists, and the healthy, broadening influence of this contact is appreciated by each alike.

Its three splendid journals are placed in the hands of every member. While the subject matter of these journals is differentiated, it is rightly assumed that each is of importance to every member and the three as a whole thus furnish the greatest of all influences in the development of chemistry in our country.

Rapid growth in membership and increased productivity in research rendering impossible the completion of programs at general meetings, divisions were organized under the administration of President Bogert. Reasonable opportunity is thus afforded for such specialization as may be desired, but membership in these divisions is open to all and attendance is composite.

Occasionally a note is heard that we should divide into two separate organizations, the university men in one and those of the industries in another. Happily that note finds no response of any general character and I sincerely hope it never will.

For the sake of the future let me point out one of the best features of our organization, and yet one which holds within itself the gravest danger if the spirit of coöperation be not all-pervasive. I refer to our Local Sections. With a membership distributed over such a wide area and with only two general meetings of the Society held each year, such local sections furnish to many almost the sole opportunity for fraternal

association, for discussion of matters of somewhat restricted interest, for bearing the expense of invited lecturers and for placing before the Council the views of the respective sections on matters of general policy of the Society. These are some of the strong points of this feature. The danger lies in local-sectionalism, which magnifies the part at the expense of the whole, which in the effort to advance locally is forgetful of the common good. The danger is insidious and often clothes itself in the guise of the broader sentiment, but it is all the more grave for this reason. Let us hold fast to all the elements of strength in our local section system and see to it that only good flows therefrom to the parent organization.

Another and novel form of coöperation in matters chemical has recently manifested itself in the form of an invitation from the Secretary of the Navy to our Society to nominate two of its members to serve, with representatives of other scientific societies, on the proposed Naval Advisory Board. I am sure you will approve my prompt acceptance, in your behalf, of this invitation. To secure the nominations promptly and in the spirit in which the invitation was given, the Council was asked to make these nominations as it is closely in touch with the full membership of the Society through the local sections. The result of the letter-ballot has been communicated to the Secretary of the Navy and will be announced by him.

That the spirit of coöperation is beginning to make itself felt is evidenced by the joint participation of the chemical manufacturers in this country and of the government bureaus in the first National Exposition of Chemical Industries to be held this month in New York City. This assemblage has in it great potentialities which, if realized, may have far-reaching influence in the rapid promotion of hitherto undeveloped lines of chemical industry.

In conclusion, let me discuss with you one other phase of coöperation, namely, that between the American people, through their representatives in Congress, and our chemical industries. I have no leanings toward paternalism, and I believe in the doctrine that a good, stiff struggle for existence is conducive to longevity, but there are certain normal functions of our national Congress which make or mar industrial development, and there are certain undertakings in behalf of the nation as a whole which individuals can not be asked nor expected to assume.

Recent events compel the conviction that the assumption of our peaceful world relations, which formed the basis of my earlier plea, may be at any moment completely shattered. In such an event the responsibility of all chemists in this country will be added to by the impelling

call of patriotism. That the contributions of our science are of the highest value in modern warfare is daily attested in the reportorial accounts of the new developments among the now contending nations. Who would dare say that the innovations of chemistry in the methods of warfare have reached a limit?

In view of this recognized fundamental importance would it not be well, in these days of talk of preparedness, to consider the question of chemical preparedness. Ships, guns and shells are necessary, yes, but most largely as a means to an end, and that end the effecting of a violent chemical reaction at a point more or less distant. Naturally in matters of preparedness there are topics whose public discussion is inadvisable, but there is one to which I do not hesitate to allude, for the facts are all matters of published record, and that is the question of the visible supply of sodium nitrate in this country.

In these days of rapidly shifting international relations the only sound and rational policy is national self-containedness. Blessed with a rich heritage of wonderful and varied natural resources, and, in our isolation, confident of freedom from grave international complications, we have received potash supplies from Germany with but scant forethought, save in the national Bureau of Soils; and now, today, agriculture is seriously threatened; so too textile manufacturers, reaping a bountiful harvest from the laboratories and dyestuff factories of Germany, have given no helping hand to the struggling young home industry which with a fair show would now have been able to meet the present serious deficiencies. Of far greater importance, at least from the standpoint of preparedness for war, is the fact that at present we are dependent solely on Chili for supplies of sodium nitrate, the crude material for nitric acid, that *sine qua non* in the manufacture of all modern explosives, whether guncotton, trinitrotoluene, picric acid, fulminating mercury or what not.

True, the work of the chemist has shown in later years how to prepare this substance from the nitrogen of the air, but such processes have not been able to compete commercially in this country with its manufacture from sodium nitrate and sulfuric acid. Equally true, we now see no immediate probability of any shutting off of the supply of nitrate from Chili; in the question of preparedness for war, however, probability has no place where certainty can be assured.

It would seem the part of wisdom, therefore, to accumulate, through governmental aid or agency, sufficient extra supplies of sodium nitrate to assure, in case of war, maximum activity of explosive manufactories until sufficient plants could be erected for the adequate manufacture of nitric acid from the air. The annual importation of this material

averages 550,000 tons, which represents an investment of approximately fifteen million dollars. The presence of an extra year's supply within our borders might prove of inestimable value. If, happily, the war cloud passes, such accumulations of nitrate would then be gradually absorbed in the more peaceful lines of the fertilizer industry, and the cost of such preparedness be thus limited to the expense of storage and the interest on the funds invested.

The phrase "chemical preparedness" refers really to the whole question of the status of chemical industry. Have we so grappled with the many questions of material national life that we can await future political developments with quiet confidence and utmost faith? Undoubtedly much has been accomplished, but this is no time for self-congratulation. Far more profitable will it be to look shortcomings squarely in the face, to trace influences which have retarded progress and to endeavor in every legitimate way to overcome such influences. Time does not admit of too extensive treatment of this subject, but there are two matters whose present importance justify further discussion. I refer to the patent system and to our tariff legislation.

The apparently authentic statement that more money is spent in this country to secure and defend patents than is earned from all those issued seems a sad commentary either on the morals of the nation or on the efficiency of the patent system. With a natural unwillingness to admit the first alternative we are forced then to ask wherein lies the deficiency of the patent system?

Primarily, and of greatest importance, is the failure of our people as a whole to understand the purpose of a patent system and its value as a national asset. Its purpose is to foster a creative spirit throughout our citizenry by giving to intellectual rights that legal protection in ownership which is afforded property rights, such ownership carrying with it the right to profit therefrom. He who creates is entitled to remuneration, for by his originality he places the nation in his debt. Such indebtedness is no hardship, for the patentee takes nothing away, but makes his entry in advance on the credit side of the national ledger. That such entries may represent maximum creative ability, it is essential that they be made in an atmosphere of good-will and in full confidence of due and prompt guardianship of the account.

Too often the attitude of the public is one of antagonism to the patentee, and too often manufacturers, pursuing a short-sighted policy, endeavor in every way to evade his legally conferred rights. Is it a worthy thought on the part of "business," that, since inventive genius so often lacks business qualifications, it offers a fair field for commercial piracy? Let us shake off such thoughts and by coöperation seek to promote that

creative spirit, the fostering of which lay in the minds of those who founded the patent system.

The value of the patent system as a national asset lies not only in the constant additions to daily welfare, but also in the eventual public ownership of the new ideas underlying these contributions, for the life of a patent is only seventeen years, during which time expenditure both of brain and of funds is necessary to bring the idea to its highest practical development; then the idea legally becomes the property of the nation for unrestrained use. Are we willing that this national asset should be depreciated by an unending tax on the time, thought and finances of composite American genius?

If these general considerations ever find full lodgment in the public mind, there will be no difficulty in securing such congressional action as will perfect the patent system and legal procedures incident thereto, thus enabling it to serve fully those high ends for which it was designed.

Finally, in the light of the present situation, may we not hope for more generous coöperation between Congress and our chemical industries in solving those innate economic difficulties whose temporary correction can be provided for only through adequate tariff legislation? I realize fully that the trend of national opinion in recent years has been toward a lowering of tariffs, in the conviction that industrial giants were parading in the guise of swaddling clothes, but the present unforeseeable situation, resulting in the cessation of imports from the chemical industries of Germany, has shown to all several strikingly weak links in our industrial chain. We can not afford such. "National self-containedness" is a more fitting slogan for us now than "Tariff for revenue only." If such links are to be strengthened, we must, as a people, meet the expense by giving for a reasonable time that measure of protection which will effect a union of capital and scientific skill under no undue stress of unfair foreign interference.

No other phase of our chemical industry illustrates so well the point in mind as the synthetic dyestuff industry about which so much discussion has turned during the past year and concerning which even more active discussion is destined to be furnished during the year just ahead of us. Although the clamor over the shortage of synthetic dyestuffs in the early period of the present war was shown by undeniable statistics to have had no basis in fact, nevertheless the present complete cessation of shipments from Germany and the constant inroads on the stocks in hand have now brought about a real and serious shortage.

True, the total annual value of our needs in this line, some fourteen or fifteen million dollars, including duties paid, is not large as compared

with the volume of many other industries, yet the use of the products is so ramified throughout industrial life, reaching in some way so many manufacturing plants and threatening to affect so many laborers that the question naturally finds anxious utterance—"What can we do about this shortage?" This question can be answered best by an unflinching facing of what we as a people have done, and, equally important, what we have not done.

The synthetic dyestuff industry stands today as Germany's triumph. It has been developed partly by that hearty coöperation of industries and universities to which I have already referred, and partly by favorable legislation. It is permeated in every branch by the spirit of research. In its interlacing character it is bound together by reasonable, common-sense coöperation, and it is long past the experimental stage with these attendant heavy financial losses.

At one time we had a young industry, nine factories in all. It is interesting to note that during the decade 1872-1882, with a tariff of 50 cents per pound and 35 per cent. *ad valorem* then in force, the price of "aniline red," the principal dye then in use, was reduced from \$6.50 to \$2.25 per pound. With the lowering of the tariff on dyestuffs in 1883, five of the factories ceased operations. I am not arguing the wisdom of such legislation, but am simply stating facts. Further, it is a matter of public record that the most earnest advocates of tariff reduction on dyestuffs and opponents of its increase were those who are now rightly so alarmed about the present shortage. Again I do not criticize, but state facts in explanation.

In spite of these difficulties one of our factories successfully undertook at one time a considerable production of aniline oil and other intermediate products for which we had depended, up to that time, on foreign countries. What was the result? A market flooded with these products from abroad at prices far below American cost of production. Why? For the express purpose of throttling the new effort in this country, the quintessence of "dumping."

What could be done in such a situation? What can be done today in any similar situation? It is a task too great for economic enterprise and there is no legal redress. In our intra-national conduct of business we have, by effective national legislation, put the stamp of public condemnation on this practice of dumping, and have insisted that in business relations with each other the spirit of true democracy must reign, granting to each full opportunity to develop to that maximum to which talents and energy enable and entitle. I badly misjudge the temper of our people and their spirit of fair play, which is the essence of democracy, if, given opportunity to understand this situation, they do not speedily set

about to correct, through their representatives in Congress, this serious defect in national legislation by the enactment of an effective "anti-dumping" clause.

To meet the present deficiency in dyestuffs some progress has been made. Naturally the use of vegetable dyes, at one time our sole dependence, has materially increased. One synthetic dyestuff factory has felt justified, through the agency of long term contracts at trebled prices with its customers, in undertaking the manufacture of those "intermediates" necessary in the manufacture of its specialty. The extremely high prices at present ruling have stimulated the organization of a few more manufacturing concerns. The Department of Commerce is seeking to aid in many ways. The outlook for raw material has improved through the realization of its waste in the beehive coke ovens, though most of the increased recovery is at present finding its way into the manufacture of explosives. After all is said, however, the serious deficiency still exists and will continue unless the day of peace be inconceivably near, or prompt and effective measures be taken.

It may seem strange that, with an intense demand for its products, an assured supply of raw material, and an abundant supply of technically trained chemists, the American dyestuff industry shows as yet no evidence of that full expansion which will enable it to meet the present crisis and provide in the future for our constantly growing needs. The explanation is simple: capital is not convinced that investment in such an industry, under present conditions, is profitable or safe—and rightly not convinced, because the opinions of experts, familiar with every phase of this industry in Germany and in America, agree that under present tariffs it would be unprofitable, and past experience with German practice justifies the fear of inordinate dumping, which will take place in the inevitable struggle to regain markets, following the return of peace.

The prime consideration, therefore, in the immediate development of this industry in our midst, is congressional action in the form of an effective anti-dumping clause and an increase, for a reasonable period, of the present tariff on dyestuffs. As a guide to what this increase should be, we have the judgment of the committee of the New York Section of this Society, a committee representative of all interests concerned, in the persons of: B. C. Hesse, chemical expert in coal-tar dyes, *Chairman*; H. A. Metz, for the importers; J. B. F. Herreshoff, for the manufacturers of heavy chemicals; I. F. Stone, for the American coal-tar dye producers; J. Merritt Matthews, for the textile interests; David W. Jayne, for the producers of crude coal-tar products; and Allen Rogers, Chairman of the New York Section. The unanimous report of this committee, which was unanimously adopted by the Section, says: "It has been conclusively

demonstrated during the past thirty years that the present tariff rate of 30 per cent. on dyestuffs is not sufficient to induce the domestic dyestuff industry to expand at a rate comparable with the consumption of dyestuffs in this country and that, therefore, all dyestuffs made from coal tar, whether they be aniline dyes or alizarin, or alizarin dyes, or anthracene dyes or indigo, so long as they are made in whole or in part from products of or obtainable from coal tar, should all be assessed alike, namely, 30 per cent. *ad valorem* plus $7\frac{1}{2}$ cents per pound specific, and that all manufactured products of or obtainable from coal tar, themselves not dyes or colors and not medicinal, should be taxed 15 per cent. *ad valorem* and $3\frac{3}{4}$ cents per pound specific."

Are the people of this country ready to cooperate with the chemists by authorizing the prompt enactment of such legislation? If so, there need be no fear that active capital will be longer withheld, and thus we can feel confident of a synthetic dyestuff industry commensurate with our needs.

As I think of the possibility of such an industry, I recall the words of the Swiss professor, Gnehm, who, in 1900, after one of his lectures on coal-tar dyes, said to me: "The natural home of the dyestuff industry is in your country and some day it will flourish there."

The creation of such a self-contained industry, however, has far deeper meaning for our national welfare than the supplying of needed dyestuffs, for such plants would constitute an easily convertible reserve for the manufacture of coal-tar explosives in times of war.

Through its stimulative effect on research, on technique and in supply of material the dyestuff industry has furthered the development of both the explosives and the medicinal industries. Its firm establishment here would foretell the complete development of each of this great trio of industries, which, as a whole, furnish the rational and economic utilization of that great mass of coal tar which now wastes itself in useless flames above the coke ovens throughout the land.

Coöperation—it is a good word, and carries with it a wonderful power of accomplishment!

CHAPEL HILL, N. C.

[CONTRIBUTION FROM THE SCHOOL OF CHEMISTRY OF THE UNIVERSITY OF MINNESOTA.]

THE REDUCING POWER OF PHOTOGRAPHIC DEVELOPERS AS MEASURED BY THEIR SINGLE POTENTIALS.

By FRANCIS C. FRARY AND ADOLPH H. NIETZ.

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One of the most important properties of a developer is its reducing power, as measured by the free energy of the reaction when it is oxi-