title investigation, a broad foundation may be demanded as a prerequisite. Thus will the dignity and usefulness of the professional schools be increased and thus will the university fulfil its trust by giving to the service of the state sons strong to withstand the wayward blasts of popular superstitions, keen to search out and expose their fallacies, and strenuous in laying secure foundations for advancement in literature, science and the arts and in fostering their development and application.

J. PLAYFAIR MCMURRICH
UNIVERSITY OF MICHIGAN

THE CHEMIST AND THE COMMUNITY[1]

ON April 18 of this year there occurred at San Francisco a vast catastrophe as the result of which more than 1,000 people are said to have lost their lives while 250,000 were rendered homeless in the midst of a conflagration involving an area of six square miles and a property loss of at least $300,000,000. On April 19 there was run over and killed in the streets of Paris a simple, unassuming, absent-minded man. The Boston *Herald* in an editorial comment upon the two events said that it might well be questioned whether of the two the accident in Paris did not in its broad relation to the welfare of mankind constitute the greater calamity. This was an amazing thing to say of the death of any man, even of one so preeminent in attainment as Professor Curie. Let us consider why it was said and upon what basis it may, if at all, be justified. It was said in tacit recognition of the fact that the quality of intellectual leadership is one of the rarest and most precious possessions of our race and that the world can better afford to lose a city or a province than one of its great investigators, philosophers or teachers. One pregnant thought, one flash of insight from a master mind, has often done more for the advancement of mankind than all the toil which built the pyramids. The result of the researches of Professor and Madam Curie has been as you all well know to change our whole conception of the material universe and to bring within the reach of our perception stupendous natural forces the existence of which had not even been suspected. The effect has been even more far-reaching for with the farther vision has come new views of what life is and of our relations to this greater universe, such views for instance as those put forth by Sir Oliver Lodge in his recent 'Life and Matter.'

In the accounts of the war between Japan and Russia frequent reference was made to the parties of chemists who far ahead of the main army were testing water supplies and posting notices which warned the oncoming troops where danger from polluted water must be avoided. It seems to me that this little vanguard well typifies what the chemist should stand for and where he should be found in his relations to the community. He is or should be essentially a pioneer rushing forward and serving the community in the best sense in serving science.

It has doubtless occurred to some of you that chemists as a professional class do not have that direct and strong hold on the regard of the community which has been established and is well maintained by physicians, lawyers and ministers. The reasons for this are not far to seek. The work of the chemist deals with things and in carrying on this work he is rarely or never brought into such direct and vital personal relations with individual members of the community as the family doctor who presides at birth, the lawyer who conducts affairs, or the minister to whom one turns in times of stress and trouble. Moreover,

[1] Read at the general meeting of the American Chemical Society, on December 27, 1906, at Columbia University.

every one knows by personal contact and experience something of the field and manner of work of the members of these professions, whereas comparatively few in the community at large have any definite or adequate notion of the scope and methods and possibilities for usefulness of the science of chemistry. This is even true of an amazing number of our manufacturers and this ignorance constitutes a very serious menace to the continuance of our prosperity. To-day as never before knowledge is power and science is only knowledge at its best. Our industrial achievements, impressive though they are, cannot be properly measured without some standard of comparison, and such a standard we have in Germany. The question for our manufacturers to answer is not what have they done, but what would Germany have done with our vast resources at her command. There is no escaping from the answer that by that measure we have failed and are repeating failure. Doctor Pritchett in a recent article has said "Perhaps at our present stage of development in such matters no other preliminary work needs more to be done than some work of popular education relative to what research is," that research which a famous German chemist quoted in the same paper declares to be ' the greatest financial asset of the fatherland.' The present and pressing duty of the chemist in his relation to the community is therefore to do his utmost in self-respecting ways to develop in the community an intelligent appreciation of his proper place within it, an understanding of the nature of his science and its potentialities for helpfulness. We shall perhaps arrive at this understanding most directly by considering for a moment something of what the chemist has already done for the community.

Chemistry enters so intimately even though unobtrusively into every phase of modern life and thought that it is perhaps impossible to present in any adequate degree the real dependence of the community upon the work of chemists past and present. Industrial revolutions are seldom chronicled and more rarely celebrated, though their influence upon the welfare of mankind may be as profound as that of other revolutions the records of which are traced in blood. It can no longer be said as was said to the father of chemistry as he passed out to execution, 'the republic has no need of chemists.' If we were to take away what chemists have contributed the whole structure of modern society would break down at once. Every commercial transaction in the civilized world is based upon the chemist's certificate as to the fineness of the gold which forms our ultimate measure of values. Faith may remove mountains but modern society relies on dynamite. Without explosives our great engineering works must cease and the Panama canal no less than modern warfare becomes impossible.

Prices rise and fall with the variations in the gold supply as the barometer responds to the changing pressure of the atmosphere, so that to the cyanids and chlorination processes which have so greatly increased the world's supply of gold must be ascribed a potent influence on market prices everywhere. With the development of the steel industry have come great fortunes and greater corporations bringing with them social benefits and social problems hitherto unknown. This industry rests preeminently upon the work of chemists as its greatest master has been quick to testify and is to-day at every point under the strictest chemical control. The Bessemer process alone was estimated by Abraham S. Hewitt to add directly and indirectly $2,000,000,000 yearly to the world's wealth. Of this vast sum Bessemer himself retained in all about ten million

dollars, or one half of one per cent. of his contribution to the community in a single year. And this is characteristic generally of the rewards which come to chemists. They are not taken from the common fund, no man is poorer for them, their recipient has made others richer in those rare cases in which he has become rich himself.

In the last century the United States has grown from a narrow fringe of feeble states along the Atlantic coast line to an imperial domain which spans the continent, and yet for the purposes of business and administration it is a smaller and more compact community than it was a hundred years ago. One reason for this anomaly is found in the development of our great transportation systems and as to these it may be said that every signal lamp burns more brightly, every pound of freight is hauled more cheaply, and every traveler carried with greater safety because of the work of chemists and preeminently the work of Dr. Dudley and his confreres in standardizing and holding to the standard the materials entering into railroad equipment of every kind.

All the activities of the community are based in the last analysis on those which have to do with agriculture and as to those in the United States Secretary Wilson has said "Every sunset during the past five years has registered an increase of $3,400,000, in the value of the farms of this country," which farms have produced in a single year wealth aggregating six and one half billion dollars. Chemists from Liebig down have done much to contribute to these amazing totals by their analyses of soils and of plant products, the adaptation of fertilizers to soil requirements and the needs of special crops; the utilization of what were once waste products like corn oil, cotton oil, the gluten from starch factories, casein from skim milk, cream of tartar from the lees of wine and so on through an almost endless catalogue, and yet great as are the figures given as the output of American agriculture there can be no doubt that they might be doubled by the general application of the best teachings of agricultural chemistry and science. So much agriculture already owes to chemistry while for the immediate future is the promise of the commercial fixation of atmospheric nitrogen with all that that implies in increased productive power of the soil.

The relations of modern life, the interdependence of communities far distant from each other and the adjustments and readjustments which are constantly made necessary in these relations, has brought it about that chemistry has not always benefited agriculture but has on the contrary in some signal instances been disastrous to special though important agricultural interests. The synthesis of alizarine from anthracene in 1868 by Gräbe and Lieberman and their later commercial preparation of the coloring matter from anthraquinone proved for example a death blow to the cultivation of madder of which forty years ago the annual production was about 500,000 tons, substantially all of which, as the Avignon peasants sorrowfully say, is now 'made by machinery.' Similarly, Baeyer's synthesis of indigo upset the social economy of great regions in India where his name was never heard and today at least one half of the entire consumption of this dye stuff is produced in German chemical plants. The manufacture of these coloring matters is among the great triumphs of organic chemistry, but the inorganic chemist can point with equal pride to the production of ultramarine now sold for half the price of copper, whereas in the form of lapis lazuli it was in the time of Liebig a dearer thing than gold.

Chemists here and abroad have hardly

finished celebrating the fiftieth anniversary of the discovery of mauve, the first of the coal tar colors, and have been happy in the knowledge that its discoverer was still among them to receive their congratulations and rejoice with them at the splendid outgrowths of his work. In the addresses to Perkin at the time it was estimated that in the industries based on his discoveries no less than $750,000,000 is invested. As a result profound economic changes have been brought about not only in England and Germany, but in India, South America, Mexico, China and Japan. Our fastest dyes are now produced synthetically, the range of the dyer's art has been widely extended and through collateral channels new and powerful agencies for combating disease and suffering have been placed in the hands of physicians everywhere.

Few of the industries upon which the prosperity of the country and the comfort and material well-being of its inhabitants depend have not experienced within the memory of those before me changes so profound and so far-reaching in their effect as to be fairly described as revolutionary. I believe it to be within the truth to say, that in the great majority of cases these changes have been initiated or accelerated by chemists. For our present purpose and before this audience, it is unnecessary, even if it were possible, to catalogue the materials for which, at prices permitting their general use, the community is indebted to the chemist. They comprise a large proportion of the things which are regarded as among the necessities of life, without which comfortable, or even decent, living, would be impossible. With reference to productive industry generally, it may be said that in many instances the chemist is the most effective agent for standardizing materials, controlling the course of processes, and minimizing wastes.

The chemist has been similarly active in respect of matters pertaining to the public health. One has but to recall the splendid pioneer work of Drown in connection with the study of public water supplies in Massachusetts, work which is still regarded everywhere as the standard for other communities. The sanitary engineer can not work without the chemist, the physician relies upon him for the most potent means for avoiding or arresting disease, or alleviating suffering and domestic economy and science make increasing demands upon the laboratory.

In no way has the community benefited more through the 'diffusion of useful knowledge among men' and few if any agencies for the diffusion of such knowledge have worked to better purpose than the Smithsonian Institution, which stands as an enduring monument to the wisdom and public spirit of Smithson, who was a chemist.

We, who are 'heirs of all the ages,' have no more imperative duty upon us than that of transmitting to our successors the experience and wisdom which has been handed down to us, and in the execution of this duty the chemist has nobly borne his part. To Harvard the profession has given Eliot; to Stevens Institute, Morton; to the Massachusetts Institute of Technology, Crafts; to Lehigh, Drown; to Johns Hopkins, Remsen; to the University of Iowa, Schaeffer; to the Columbia School of Mines, Chandler. Through such educators as these, chemists have had a direct and lasting influence on public opinion, and the thought of the generation which is to follow us. Similarly, but more intimately, the heads of the chemical departments in our universities and technical schools come into contact each year with thousands of students who are influenced far more profoundly by the personality of their teacher

than by the subject matter of his pedagogic efforts.

The chemist has another and more general claim upon the community by reason of the intellectual interest which his researches add to life. Moissan extends the range of our activities to the highest temperature of the electric furnace, and we produce within our laboratories the conditions obtaining in the sun. Dewar brings us within a few degrees of the absolute zero. Bunsen and Kirchoff teach us the composition of the stars. Avogadro and Ampère picture to us the mechanism of gases. Dalton supplies a hypothesis which for almost a century suffices to explain the constitution of matter and the course of chemical change. Curie opens out new vistas in which the old thought is seen in new relations, which give to the universe, as we have known it, entirely new aspects.

Briefly and baldly as I have set forth the claim on the community which chemists may fairly make, it is, nevertheless, a showing for which no apology is required. There are perhaps as many as ten thousand chemists in the country; the census of 1900 gives 8,847 as contrasted with 125,000 lawyers and 93,000 doctors. In the light of these figures who shall say that the chemist has not borne his part as should the happy warrior in the fight against ignorance, material obstacles and the phantasms of the mind.

So much at least the chemist has done and may be counted on to do for the community; but this by no means ends his obligation, if the profession as a class is to attain its true success which is the achievement of the best of which it is capable in its broadest relations to the community at large. Dewar has said that the 'one great object of the training of a chemist is to produce an attitude of mind,' and Principal Caird has defined the scientific habit of mind as 'the faculty of grasping the universal element in all human knowledge.' Karl Pearson puts the same thing in a slightly different way by saying "The scientific man has above all things to strive at self-elimination in his judgments, to provide an argument which is as true for each individual mind as for his own." When we add to this the absolute honesty toward himself and others and toward things as well which should characterize the chemist who has responded to his training and supplement the whole by precise and special knowledge and the ability to do the things within his sphere, we not only have all the essentials of good citizenship, but an ideal basis for leadership in the great work of coordinating and utilizing and making amenable to law the new powers and resources and discoveries with which the world is now congested. The chemist from the very nature of his work and training should be the unswerving enemy of graft in every form. He should not be content with a mere passive resistance and a merely personal honesty, but should take an active and aggressive part in the fight against corruption and frauds, whether these involve sea-water gold, salted mines, corporation mismanagement or politics. He should more frequently be found on school boards and boards of health and special commissions, and I venture even to suggest that chemical societies should far more often act as a body or through committees to expose abuses or battle for their remedy. Such conditions as prevailed for years in the water supply of Philadelphia, where they are not yet fully remedied and which still prevail in many sections of our country, the stagnation and inefficiency of our patent office, the fraud on and danger to the community involved in the methods of some makers of proprietary medicines, the petty graft which many manufacturers of honest products meet with in their sale

—such things as these are things for the profession as a whole to fight if the community is to have the benefit of its best service.

The number of chemical problems with which manufacturers, large and small, throughout the country are grappling, consciously or unconsciously, must be very great indeed, and their inability to solve them readily constitutes a heavy drag upon production. There is little doubt that a large proportion of these problems have either been solved already without their knowledge or are of such a nature that they require little more than their statement to a chemist of experience to permit of their immediate solution. They still remain problems either because the manufacturer has no proper conception of what chemistry can do for him, or because the chemist to whom they may have been submitted is ignorant of the conditions injected into the problem by the requirements of practise. Were both parties to the matter properly informed I have no doubt whatsoever that ten times the number of chemists now at work in the United States could be employed to the great benefit of our industries and the advancement of the position of our country in the world. One obvious step towards a remedy for the situation is a closer touch and cooperation between societies of chemists and associations of manufacturers. Manufacturers might well appear from time to time before the one and chemists before the other to the good of both. As James P. Munroe has said in a paper on applied science and the university, "Not, broadly speaking, what the bachelor or doctor knows, but how he knows it, and to what use he can put this knowledge measure his real education."

As a technical chemist I speak with some diffidence to those engaged in pure science, but I believe the question may be fairly put, whether both science and the community might not be benefited by some readjustment of our ideas as to what constitutes pure science and the extent to which the exponent of pure chemistry may properly allow himself to be led into industrial work. Scientific research in Germany is 'the greatest financial asset of the fatherland' because there the greatest minds in chemistry come into close touch and contact with the problems of commercial enterprise. The synthesis of indigo is no less a triumph of pure chemistry because of its industrial importance, and a synthesis of the resins in the juice of the milk weed can hardly be regarded as more commendable from any point of view than a synthesis of India rubber would be. Where, then, there is so much to do is it not possible to pick the problems with more direct reference to the immediate needs of the community? By far the larger part of our best research is carried on now in the laboratories of our great industrial plants, and if the teacher and the individual investigator are to match it they must in case of most of them have the broadening influence of personal contact with the conditions and needs of industry. Through them their influence will be transmitted to their pupils whose grasp upon the science will be thereby strengthened at the same time that their possible usefulness to the community is increased.

Under such conditions the relation in which the chemist stands to the community in respect of its affairs can not fail as time goes on to become one of increasing dignity and power for good unless chemists themselves forget that the surest path to influence and position is through altruistic service.

As we look back upon the great achievements of the past and view the monumental figures from whose trained brains and hands they came, as we study the vast accumulations of fact and the broad general-

izations by which these stores of knowledge are bound together, we are apt to conclude that where so much has been wrested from the unknown there can be little left for new discoverers. The true view, of course, is that which regards our present knowledge as a sphere floating in the infinite of the unknown. As the sphere enlarges so it touches upon more points of the unknown. As our knowledge grows so also does our ignorance increase.

We have only to consider the chemical processes as carried out by plants and animals to realize how crude and clumsy our own present methods are. There is still plenty for the chemist to do and the prospect which lies before us is not only rich in promise for the material welfare of mankind, but one which in its realization must affect profoundly man's view of the universe and of his relation to it. Few of us can remember the intellectual stimulus which followed Wohler's discovery that a compound which seemed peculiarly to represent the product of vital forces could be reproduced within the laboratory, but most of us, I firmly believe, will witness the breaking down of the line which now separates living matter from dead matter. With it will come an intellectual revolution the result of which can only be to bring the whole world closer to 'the God of things as they are.'

ARTHUR D. LITTLE

ANTHROPOLOGY AT THE NEW YORK MEETING

THE joint meeting of Section H of the American Association for the Advancement of Science, the American Anthropological Association and the American Folk-Lore Society held at Columbia University, New York City, December 27, 1906–January 1, 1907, was notable for the number of working anthropologists present as well as for the length and excellence of the program. Coming, as it did, so soon after the International Congress of Americanists in Quebec, fear had been expressed that the New York program might be but the gleanings of a field already thoroughly harvested. That new fields were entered may be readily seen by a survey of the program, which included fifty-six numbers in addition to the addresses of the president of the Folk-Lore Society and of the retiring vice-president of Section H.

BUSINESS AND SOCIAL FUNCTIONS

The Council of the American Anthropological Association and the Sectional Committee of Section H held a joint business meeting on December 27, at which the retiring vice-president of Section H, Dr. George Grant MacCurdy, presided.

Professor William H. Holmes presented an official communication from the Anthropological Society of Cologne, Germany, inviting the American Anthropological Association and members of Section H to take part in the International Congress of Anthropology to be held at Cologne[1] in August, 1907; and recommended that the chair appoint a committee to further the interests of the Cologne Congress. On formal motion to that effect the chair appointed the following committee: W. H. Holmes (chairman), Franz Boas, Chas. Peabody, W J McGee, F. W. Putnam, A. L. Kroeber, K. von den Steinen, G. B. Gordon, G. A. Dorsey, C. V. Hartman, J. C. Merriam, G. F. Wright, J. W. Fewkes, S. Culin, David Boyle, A. Hrdlicka, F. M. Palmer, C. A. Peterson, S. Hagar and G. G. MacCurdy (*ex officio*).

The question of the advisability of changing the name of Section H, Anthropology, so as to read 'Section H, Anthropology and Psychology' came up for discussion. On motion the chair appointed a

[1] Place of meeting has recently been changed to Strasburg; the date is August 4–8.