SCIENCE

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*THE DIGNITY OF CHEMISTRY.**

CHEMISTRY as a profession may be said to have completed its hundredth year, and we have met to-night to celebrate the quarto-centennial of chemical organization in America.

In our democratic country, all attempts to create a class or caste should be discouraged, especially if the attempt be made to endow the class with unusual or special privileges. We have no place for an hereditary or purchasable aristocracy, but in the function of the civic body there must be specialization, and those individuals who by choice or fortuitous incident devote themselves to special duties are brought together by occupation, by congeniality and by desire for mutual helpfulness and improvement. In this mutual attraction we find the genesis of all trade and professional organization. The aggregate is always stronger than the segregate. This unity of purpose and this conformity of effort become reprehensible only when autocratic, imperative and insolent. The assumption of superior virtues, the assertion of peculiar privileges and the interference with the rights of others are never to be advocated nor condoned.

* An address delivered before the American Chemical Society, April 12, 1901, on the occasion of the celebration of the 25th anniversary of the founding of the Society.

Every honest effort to earn a living and a competency is worthy of equal praise, and therefore in dignity of effort there is no rank. The workman in the woods, the farmer in the fields, the artisan in the atelier and the mechanic in the mill have an equal claim to the dignity of labor with the preacher, the lawyer and the professor. There is no form of labor which is beneath the dignity of any man. Instead of being a curse, labor is the greatest blessing which Providence, fate or evolution has conferred on humanity. Tolstoy, one of the greatest of living novelists, earns his living from the soil. Peter the Great was a carpenter and is said to have done much of the work in building the old palace at Peterhof. Louis XVI. was a locksmith. Washington was a farmer, Lincoln a rail-splitter, Grant a tanner, Garfield a canal boy. The natural and normal desire of men who have achieved greatness is for a piece of land where they can be in touch with the great mother of us all, the soil. To him who appreciates the true dignity of labor, no task is menial. The hands are made for toil as much as for fighting, and sweat is the most efficacious of all detergents. In derision on one occasion the Romans made Cato commissioner of sewers, but he discharged the duties of his menial office with such industry and benefit to the city that thereafter to be made commissioner of sewers was considered to be a distinguished honor.

So the true philosophy should teach us that our calling in life is a *cloacum magnum* which we are to administer, not with closed nostrils, but with open eyes and hands that do not recoil before thickened cuticle and stains.

He who is not proud of his profession is not worthy of it. This does not mean that his profession is any better than another, but when the heart is not in the work the head is sluggish and the hands are slow. Nor do I mean that a profession should not be regarded as a means of making a living. On the contrary, that is the first and chief end of any occupation. The number of persons who work alone for the love of it is exceedingly small. Perhaps there is only one profession where it is better that a man be rich, and that is the profession of politics. Making a living out of a public position is the most precarious of all professions, and there is no collection of dependent fossils which appeals so pathetically to general commiseration as that vast aggregation of exes which lingers near the cupola of the Capitol. The *functus officio* faster has fed so long at the public crib that he knows not the taste of other food nor the means of getting it. The last of his life is an eternal Lent on which no Easter morn of soothing satiety will ever rise.

In one short walk a few days ago, I met one ex-senator and two ex-representatives, who a few years ago were farming patronage and feasting on lobster Newburgh at Chamberlins, who are now seeking to be attorneys for the holders of claims that live only in the hope that a far-off indulgent future will no longer know their worthlessness. Hungry are the looks of these men, with jaws cavernous as those of Cassius, and sad warnings of the fate of a statesman out of a job. A profession, therefore, should offer some guaranty of a livelihood dependent on merit and industry, and not upon the whim of a capricious public.

It is not my purpose to-night to discuss chemistry as a living-provider. Often young men come to me and ask my advice in regard to choosing a profession. They come often with a strong inclination to chemistry and want to know what I think of the prospects for success. If they have already studied chemistry, I invariably ask: Have you a taste for chemistry? Do you love chemical studies? If they do not know, or if the answers are indefinite or

evasive, my advice is always, 'Stay out.' But especially is this so if they propose to study chemistry as a profession because it is an easy road to wealth. Alas! the paths of chemistry seldom lead to 'easy street.' True it is, you rarely see the chemist begging bread. Perhaps he knows too well of what it is composed. The chemist tramp too, is a kind of a *rara avis in terris cygno simillima nigra*. The chemist may be able to change phosphorus into arsenic by oxidizing it in presence of ammonia, but even so distinguished a man as Carey Lea could only make silver yellow, and further than this scientific transmutations have not extended. Fortunes have been made by a few. A happy discovery in metallurgy or in manufacturing processes has often brought a modest fortune to the inventor, but most of the roads leading from the Patent Office end in the cemetery of hopes at first vigorous from the pliant pabulum labeled 'Having now described my invention what I claim is,' etc., 'substantially as set forth.' The parchments with the flaming seals that protect you in the sole usufruct of your genius for a period of 17 years serve most frequently as fitting cerements for the deceased. If the chemist be a teacher or employed at a salary the prospect for a competence is not much better. At best these stipends are not very large. In a manufacturing enterprise, the chemist often becomes the manager, and in this case he can put by something for 'a rainy day.' If a professor, he sometimes gets to be the president of the college, provided his theology is untainted. But Universities of Chicago are not found in every academic grove. Most of our institutes of higher learning are chronically impecunious, and even the professional chair is not upholstered with a cushion which would tempt the expectant Croesus.

In general, then, it must be admitted that whatever of dignity is due the profession of chemistry is not attributable to its tendency to wealth.

I am not of that school which despises wealth, nor yet of the cult that loves it. Poverty, doubtless, has its uses in evolution and molding of character. Wealth often corrupts youth and makes of manhood but a purveyor of vice. But poverty also invites crime, and is not the most efficient preservative of virtue. A modest competence, possibly, is the ideal state, best suited to highest development and greatest usefulness. It is not always dignified to be in debt. For this reason, I should like to see the influence of this great organization whose foundation we celebrate to-night, exerted to secure better pay and more permanent employment for its members. I know this seems sordid and mercenary, but we must not always live in the clouds. The cerulean atmosphere will be more gratefully stimulating and its views be more thoroughly appreciated if we manage somehow to keep our feet well braced on terra firma. To him who cannot swim, things begin to feel a little queer when the advancing tide leaves him touching only a little flowing sand with the tips of his toes. Good and steady pay, therefore, to its devotees is no small contribution to the dignity of chemistry.

The pursuit of science is nothing else than an effort to know something of the constitution of the natural world. That knowledge is not derived from an ingenious system of vain imaginings, but is secured by a study of nature herself.

"To him who in the love of nature holds communion with her visible forms she speaks a various language," sang one of our great poets at the age of 17. Had he lived until he was 100 and grown in wisdom every year he could not have touched a truer note. The language which nature speaks to the chemist is a description of the ultimate nature of things. It is to the

chemist that nature teaches the alphabet of human knowledge. In this sense the chemist comes nearer than any other to first principles. As we grow in knowledge, we sometimes forget our small beginnings. And so it sometimes seems to me that our professional brethren of other schools are prone to despise the day of little things. Atoms and molecules are too small to cut much of a figure in the economy of nature, think some. But it is no true mark of greatness for the macrocosm to forget the microcosm. A megatherium is not the 'whole show.' It is true that in some respects chemical achievements appeal least of all scientific accomplishments to the popular attention. The isolation of krypton does not have half the interest for the public that attaches to the discovery of a new bug, especially if it have domestic tastes. In fact all the biological sciences, with the possible exception of physics, find a readier and more appreciative public than those which deal with things lifeless and for the most part incomprehensible to the layman. This truth is uttered in no complaining mood, but only to explain why Davy is not as well known as Darwin, nor Hoffmann as Haeckel. It is when chemical studies and discoveries come directly into contact with life that they lead to recognition, as in the case of Pasteur, whose great genius is recognized the world over, perhaps more generally than that of any other scientific man has ever been. But it is not alone for public applause that life is worth living, and the dignity of our science suffers no depreciation because of its apparent remoteness from human interest. I say apparent, because I do not believe that any other science has in reality any nearer bearing on human welfare than chemistry. Think for a moment how many of our industries that lie at the foundation of wealth and progress are based directly on chemistry. Think of the many others that are intimately related to it indirectly. If the clock of political progress and liberty were turned back 50 years by the battle of Waterloo, think of the loss to humanity should such a disaster befall the hosts of chemistry. Bourbonism is the natural foe of human progress, and unhappily the world is still full of anti-scientific Bourbons.

Whatever may be the branch of the profession which the chemist may pursue, he should not be indifferent to feelings of justifiable pride which come to him when he realizes all that our science has done for humanity. The disciples of evolution may have attached some opprobrium to the epithet, but the chemist is the 'connecting link' between the world of matter and mankind. We stand the nearest of all our brethren to the ultimate constitution of things, so near, in fact, that we almost tremble at the thought that by some subtile synthesis we may yet strike the spark of organic life. Of one thing at least we may feel sure. We know best of all our brethren the environment of development and growth. We may never create an environment which will make autogenesis possible, but we surely can soften some of the harder conditions of existence. To be so near the first forms of life, to be so nearly in touch with the ultimate secrets of nature, are facts which show some of the principal elements of the dignity of chemistry.

No man can lay claim to the term scientific who does not reverence the truth. That is the first element of a scientific mind. The truest proof of a reverence for the truth is a willingness to be convinced. In the times of Cromwell, the truth was supposed to be simply the dogmas of the creed, which led Hudibras to say:

> "Convince a man against his will,
> He'll hold the same opinion still,
> And prove his doctrine orthodox
> By apostolic blows and knocks."

The most difficult mental attitude, which the scientific man has to contend with in his struggle for the truth, is bias. We inherit, in a measure, certain notions of things and of life. This natural inheritance is strengthened by the earlier teachings of childhood, so when we reach the age of maturity we have formed certain opinions, we are endowed with certain habits of thought which tend to dominate our mental attitude. Happily, most of these habits and most of these inheritances are sound, but now and then we find one which is clearly opposed to the conditions of existence as science reveals them. How difficult in this case to let go the old notion; how hard to bring one's self into an attitude to receive the truth! Perhaps it is only a species of conservatism which leads man to hold on to that which he has, and in this sense a certain difficulty of conviction is a guaranty of stability of thought and of social, economic and political conditions. In other words, we should heed the warning in the Bible and not be swayed by every 'wind of doctrine.' The tendency to too eagerly accept is more reprehensible than tardiness of belief. We have all seen wave after wave of illogical belief sweep over the country, and no difference how absurd a theory may be or how impossible a course of action which is marked out, it finds plenty of adherents. This instability tends to render all the conditions of natural growth and development precarious. The scientific man must be on his guard against being buncoed by any plausible or specious doctrine, as well as to keep his mind open for the acceptance of the truth. Here is where judgment comes into play, and not only should the scientific mind be open to conviction, but it should also be controlled by a sober and discreet judgment which can discriminate between the true and the false in evidence. But when soberly considered, certain facts are brought home with an overwhelming evidence of truthfulness, the results of this evidence should be accepted, no matter how contrary they may be to our preconceived notions. Perhaps the greatest offense in this direction which the scientific man commits is a distortion of evidence to suit the case. By a slight inclination this way or that from the true point of direction an observed fact may be made to support this or that theory or condition. I am far from belittling the value of theory. When formed on substantial evidence and with a becoming ingenuity it is a valuable aid in the discovery of further truth, but a theory should never be a fetich to be reverenced and worshipped with the blind devotion of the religious devotee. There is nothing sacred about the theory. It is only a valuable tool to be cast aside when a better or more effective one is at hand. The dignity of our profession, therefore, has been strengthened and increased by the habit of the chemical mind of accepting the dicta which experimental evidence has provided. Detracting somewhat, however, from this dignity has been the fact that certain contentions have arisen in our profession over the interpretation of ascertained phenomena. Chemists may agree upon the character of certain phenomena which are presented, but construe them differently, and often with acrimony. A scientific discussion should be conducted with all the dignity of a scientific dissertation, and the honest differences between chemists should never be allowed to degenerate into personalities or innuendo. There is no excuse whatever for speaking slightingly of the honesty or ability of a brother chemist who may happen to differ from you in his opinion of phenomena. Envy, backbiting, slander and scandal have no place in the chemical profession. I believe every one will admit that there has been less of it in the profession of chemistry than in almost any other. We know to what extent the per-

sonal quarrels among many scientific men have been carried in this country, and we are glad to say that there is no instance in which these quarrels between chemists have come into our organization to influence our action and mold our policies or to cause the growth of faction and the promotion of feuds.

There is enough for every one to do in this country without wasting his energies with envy of the accomplishment of others. About the most unprofitable occupation into which a man can fall is to complain of a lack of appreciation. It is doubtless true that in many cases the worthy man is cheated of his dues and the unworthy receives a reward out of all proportion to his services. These are accidents, which are due to the imperfection of human nature, and not to any peculiarity of scientific pursuits. There should be room for the philosophy of life in chemical science as in every other. The sensible way is to accept what happens, and not to degenerate into a kicker or the carrier of a club. The chips which are found on the shoulders of our associates are usually magnifications of the motes in our own eyes, and not due to the deposition of any really ligneous material upon the clavicle of our supposed enemy. We have plenty to do in this world without going about knocking off hypothetical chips. I have the profoundest sympathy for the man with a just grievance, and I know how many have them, but there is no greater nuisance than this same man with this same just grievance. The man who shuts his mouth, compresses his lips and bears the pain and humiliation without a sign is the one who wins our admiration in the end and often turns disaster into good.

With a proper appreciation of the dignity of our profession, we will therefore do our work as well as we can and be glad of the greater success of our professional brethren, and not find in it a cause of sorrow and dejection. Every man who succeeds in chemistry does a work to elevate our profession and to help us all, and therefore, even from a selfish motive, we should be glad of his achievements. I realize how hard it is to see others preferred when we feel convinced that we should have had it, and yet I must be allowed to praise the courage of the man who with a smile on his face and a true feeling of well-wishing in his heart can congratulate the more successful man not with hypocritical words, but with a real sentiment of satisfaction.

There is one special way in which I think our great organization can do much to elevate the dignity of chemical science. I have spoken of the fact that chemistry does not appeal directly to the public imagination, and for this reason many of our best people do not have a true appreciation of the value of chemical services. An honorable and praiseworthy part of our profession is the rendering of professional services of a chemico-technical nature to the great industries of the world. Too often the promoters of these industries, the men with the money, the men on the boards of directors, and the stockholders, do not appreciate the real value of the services they ask for. A great corporation is perfectly willing to pay a great lawyer $10,000, $15,000 or even $50,000 for professional services, whereas if a chemical expert should ask $1,000, it would produce a kind of corporative hysteria or nervous prostration, while, in point of fact, the technical services demanded would probably be of far greater financial utility than the legal services so much more liberally paid for.

There has been a tendency among some of our profession to foster this spirit of contempt for the value of chemical services of a professional nature, not intentionally, I am glad to say, but because of a feeling, which I can hardly describe, that it is not

dignified for a chemist to sell his services for money. The falseness of this position, it seems to me, has been fully set forth in the earlier part of this address, and I believe that every right-minded person will admit that it is not derogatory to dignity to receive pay. Otherwise, I should think that we should cast dignity to the winds and look out for the 'main chance.' In my opinion, it is just as honorable and worthy to give professional advice to a great industry as it is to discover an unknown element. In our society we should have far more *esprit de corps*, more regard for the rights and privileges of each other, and a better understanding of the ethics of our profession. It is true that we now act upon the principle that it is dishonorable to take an investigation out of the hands of a brother who has once commenced it, without his permission, or in any way to trespass upon the fields which he has preempted. In like manner we have learned that it is dishonorable to underbid a professional brother in offering our professional services. It seems to me that the Society can do a great good towards promoting the dignity of our profession in this way by establishing not a hard and fast schedule of prices for professional services, but by bringing closer together our members who give these services so they may have a better understanding of the rights and privileges of each other. Other professions do this, especially the medical, and great benefit would be derived from a better understanding in regard to these matters.

Especially is this true from the effect it would have upon the public at large who, seeing a profession stand together and in a dignified manner demand what is right and just, would better appreciate the value of the services which they often hope to get for the very smallest possible consideration.

Perhaps the bitterest criticism to which the chemist has been subjected has grown out of his services as expert before the courts. Here we often have the spectacle of two men, under oath, one in affirmation, one in negation. It is only natural that the expert should favor his client, but that favor should never go so far as to impugn the truth. When there is room for disagreement, I can see no impropriety in the chemist supporting with all his ability the side that employs him. He is not hired to discuss the whole problem in all its aspects, but to develop those points which make for the benefit of his employer. We cast no reflection on the honesty of the lawyer who defends, nor should we on the rectitude of the witness who testifies. But no worthy chemist will deliberately undertake to support a falsehood. Whatever of viciousness may attach to expert evidence is the fault of the system rather than of the witness. We all admit that it would be far better for the court to employ the expert, and not the plaintiff or defendant. But until that change has been made, the chemist is undoubtedly right in making out the best case possible for his client, provided he distorts no facts.

How far he can go with patent medicines, nostrums and secret preparations is another story. The dignity of our profession forbids any taint of humbug or quackery. This field, therefore, seems to be absolutely closed for professional purposes.

I would not have our Society become a trades union, and especially would I be sorry to see it exercise the tyranny which such unions often manifest, but I would like to see a better understanding established in matters of this kind, both for the sake of our members and for the benefit of the public at large.

The dignity of the profession of chemistry is illustrated in a striking way by the active participation which it exercises in many of the greater walks of life. I have not time

here to go into statistics and show the relative number of chemists employed in the industries as compared with members of other scientific professions. We will admit without such an array of figures that there is no other scientific profession, with the possible exception of physics, which begins to be so numerously represented in the great industries as the science of chemistry, and even in the case of physics, aside from the electrical industries and those of a purely engineering character, the physicists engaged in the active industries are not numerous.

When it comes to mining engineering, we find that the engineer himself must be a chemist in order to be fully able to discharge the duties of his profession. In so far as statistics are concerned, I will content myself with a few citations showing the preponderance of chemical employees in the great scientific agricultural industries of our country.

In a study of the impress which chemical research has made upon agriculture, there has been no factor during the past twenty years which can compare with the work of the agricultural experiment stations of the United States. Richly endowed as they are by the General Government, they have had every opportunity to secure the best results for practical agriculture.

In this work chemical science has played a very important part in the furthering of agricultural prosperity. Of the forty-nine directors of the stations at the present time twenty were professional chemists at the time of their appointment. The selection of so many professional chemists was no mere chance, but evidently had some relation to the dominant position which the science of chemistry holds to the promotion of agricultural chemical research. The list of directors of the agricultural experiment stations of Germany shows the same condition of affairs.

The great influence of chemistry on the agricultural experiment stations of this country is not measured alone by the number of professional chemists which is found in the directorates, but also by a comparison of this number with that of other scientific men holding similar positions. Very few of the other sciences are represented among the directors of stations, and no one of them can compare in its number of representatives to the science of chemistry. Among the working forces of the stations chemists also predominate. There are twice as many chemists employed in the stations as there are men engaged in any other professional scientific work. Statistics show that the number of chemists employed in the agricultural experiment stations of the United States is one hundred and fifty-seven, while the number of botanists is fifty and the number of entomologists forty-two. The number of employees belonging to other branches of science is very much less than that of the botanists and entomologists, and the total number of scientific men employed in all other branches of scientific work in the station does not greatly exceed, even if it be equal to, the number of those employed in chemical research alone.

While dwelling upon the predominance of professional chemists in the directorates and upon the staffs of the experiment stations, it seems eminently proper to mention here in a special manner some of the earlier eminent chemists who have contributed so much to the value of chemical research in our agricultural colleges and experiment stations. Among these must be mentioned Professor F. H. Storer, of the Bussey Institute (Massachusetts), who first began the regular publication of a bulletin recording the work of the school and station, which has 'set the step to which the bulletins from many other stations are still marching.' The bulletins of the Bussey Institute describing original research work on agricul-

tural subjects have proved of the highest benefit to agriculture. Professor Storer's work, entitled 'Chemistry in some of its Relations to Agriculture,' the first edition of which was published in 1887, has had a marked effect upon agriculture in this country.

As early as 1846 Yale University, then called Yale College, appointed a professor of agricultural chemistry. This was John Pitkin Norton, who had devoted himself to the study of scientific agriculture both in this country and in Europe, especially with the celebrated Liebig. He brought to his position a ripe knowledge and wisely directed enthusiasm for agriculture, which he used with the greatest profit in its service. In 1855 Samuel William Johnson was appointed instructor in agricultural and analytical chemistry, and soon after full professor. Perhaps no one ever succeeded more fully in popularizing scientific agriculture than Professor Johnson. His two books, 'How Plants Feed' and 'How Plants Grow,' the first editions of which were published in 1868 and 1870, respectively, have been kept abreast of modern progress in successive editions, and are still used as standard text-books and as authorities on the practical relation of chemistry to agriculture.

In the University of California, the work of Professor E. W. Hilgard must be mentioned as being of fundamental importance in the development of the relation of chemistry to agriculture in this country. Professor Hilgard, in his classical work on soils, has placed himself in the front rank of investigators on this subject, not only in this country, but in the world, and his achievements have been recognized both by his countrymen and by the most celebrated societies of Europe. A knowledge of the soil and its relation to plant growth constitutes one of the fundamental principles of agriculture chemistry, and the researches of Professor Hilgard in this line have done much to place agriculture in the United States on a strictly scientific basis.

At Cornell, even before her doors were open to students, a professorship in agricultural chemistry was established. Professor G. C. Caldwell was appointed to fill this position, and he has done so with distinction to himself and to the University and with the greatest benefit to agriculture. One of the most important services in connection with Professor Caldwell's labors at Cornell was the publication of his work on agricultural chemical analysis in 1869. At that time no work of a similar nature existed in the English language, and Professor Caldwell's book was a veritable boon to students in agricultural science.

This brief reference to the contributions of some of the earlier workers in agricultural chemical science in this country would not be complete without mention of the labors of Professor C. A. Goessmann, of the Massachusetts Agricultural College.

It is not possible in the space assigned to this address to even name the more prominent later workers.

A national epoch in agricultural education in this country began with the passage of the Morrill Act, in 1862, establishing and endowing colleges where agriculture should be one of the principal branches in which instruction is given. An additional impetus was given to this great work in 1887 by the passage of the Hatch Act, establishing agricultural experiment stations in the several States. The organization list of the agricultural colleges of the United States now shows the great number of men working in lines of agricultural chemistry. This most remarkable evolution of agricultural education has taken place practically within the last thirty years, and there is no country which can now be compared with the United States in the munificence of the endowment for agri-

cultural chemical research or in the vast amount of research and experimental work conducted in these lines.

Another way in which our profession has influenced higher education in this country is found in the large number of chemists who have been called to preside over our higher institutions of learning. Of the leading institutions in this country, Harvard University, Lehigh University, the University of North Carolina, the University of Tennessee and Purdue University are presided over by professional chemists, or rather, I should say, by those who before elevation to the presidential rank were professional chemists. I doubt if any other branch of science can show so many college and university presidents as our own. It is certainly not a mere accident that in the breaking away from the old scholastic habit of placing ministers of the gospel over institutions of learning, chemistry has received so marked a favor. In fact, the pursuits of chemical science, it seems to me, tend more than other scientific occupations to broaden the mind and to bring it in contact with all the varied industries and forces of active life. It is true that other branches of science have their economic aspects, and we do not by any means desire to minimize that important relation, but they do not come so generally into contact with human affairs. While they appeal in the nature of their services more to the public imagination, when it comes to real practice they do not have that influence which our own science possesses.

I am far from saying that the pursuit of chemical studies tends, in any peculiar way, to develop administrative ability, and hence it cannot be in this collateral way that so many of our brethren have reached these higher places of administrative effort.

While we do not claim that chemical science holds in any way the same dominant position in didactics that it does in agriculture, we do find, even in the smaller institutions of higher learning, that, as a rule, chemical science is taught more thoroughly and more effectively than other branches. The consideration of these facts, if prominently brought before the attention of the public, would certainly do much to increase the estimation in which our profession is held.

The above only illustrates in one industry the dominant influence of chemical research, and in so far as science comes into direct contact with the industries of the world it is evident that in almost every one chemistry occupies the predominant position. This well-recognized fact is a firm basis for the substantial claims of the dignity of our profession.

There is one point, however, in which it seems to me we are much at fault, and that is in the fact that the chemists of this country seem to have taken but little interest in the science of civics. We are too prone to regard politics as a profession beneath the dignity of a scientific man, and yet we must admit that the organization of the body politic for the public good is the highest work to which a man can devote himself. In other words, real politics is the most useful and most honorable of professions. The trouble here in this country is that politics becomes too much of a profession. In other words, it becomes a source of revenue or of sole revenue. How much better it would be if men who have reached success and competence in other professions, without abandoning these in their maturer years, would devote a portion of their time to the public good. In Europe this is commonly the case and we are all familiar with the names of eminent scientific men who have become celebrated also as leaders in political life. In Germany, we recall the name of Virchow, who, for more than thirty years, has been a member

of the National Legislature, and of Mommsen, the great historian, who has taken an active part in politics. In Italy, one of the honorary members of our society, Cannizaro, is a senator and vice-president of that body. In France Berthelot is a life senator and has been minister of foreign affairs. In England, Roscoe has been a member of Parliament and Faraday and Humphry Davy and other scientific men were active in public affairs. In our country, I believe, only one member of the Chemical Society has ever become a member of the National Legislature and this was due to a fortuitous combination of most incompatible elements, namely, a union of democracy and prohibition.

I think we should all strive to discourage this sentiment, which is so prevalent, that politics is a dirty pool and that men of science should keep out of it. When you have reached competence and distinction in your profession what better service to which to apply your leisure hours than the study of the public weal? There are so many ways in which science can be utilized in political and civic affairs. The conservation of the public health, the prevention of epidemics and contagious diseases, the control of the water supply of cities, the disposal of the refuse of cities, the study of dangerous and fraudulent counterfeits of foods, are all matters affecting directly the public health and the public welfare. To become interested in these matters would be to more actively participate in public affairs, and it seems to me it is an ambition which every scientific man might well entertain, not only to become eminent in his profession, but also to devote a portion of his more mature life to the study of the public welfare and the active participation in those political relations of life which will enable him to become more useful to humanity.

May we not then expect to see the day when our State and National Legislatures shall not be considered as properly organized until they have among them members representative of the great body of American chemists?

On April 12, 1976, will be celebrated the centenary of our society and shortly thereafter the bicentennial of our national independence. May I drop for a moment the rôle of chemist and assume that of prophet? Our country will have then about 225,000,000 inhabitants. Our foreign export trade will amount to more than $500,000,000 annually. The revenues and expenditures of our Government will each reach the annual sum of $4,000,000,000.

The average yield of wheat in the United States will be nearly 25 bushels per acre, and the average yield of other field crops be proportionately greater than now.

Diversified manfacturing industries will flourish in every part of the country, thus distributing population and encouraging agriculture. The product of a day's labor will be double that of to-day, thanks to new processes, improved machinery and greater skill. The condition of the artisan and the laborer will be greatly ameliorated, and the principles of the trust, which now help chiefly the capitalist, will be extended to include the working man as well. The laborer will not only have a larger daily wage, but will also share in the legitimate profits of the business.

The advancement of chemical science will not only make the fields more productive and more easily tilled, but will also teach how their products can be more economically and easily consumed. Good roads will lead everywhere and the horse be relegated to the museum and the stable of the sportsman. New sources of energy will take the place of coal and gas, and this energy will come from the winds and the rains. The sun directly and indirectly will monopolize the power of the country, working

through evaporation and precipitation and by means of electricity or some more useful force.

By a general comprehension of the principles of nutrition, food will be more wholesome and more potent. The general acceptance of the principles of hygiene will make the average life of man longer and his usefulness more fruitful. Man will not only live longer, but he will be happier and practically free from the threats of enzymic, contagious and epidemic diseases. When this Society meets on that founders' day, the membership will be nearly 10,000 and its organization will reach to all quarters of our imperial country. The number of those who to-day are members and who shall live to 1976 is not large, possibly *nil*, but many who are infants to-day will be the revered old men on that centennial occasion. The orator who will address you on that day is perhaps not yet born. I hope he will take for his theme, the 'relation of chemical work to the advancement of mankind in the past century.' He will find in the development of some of the thoughts which I have tried to bring to your attention to-night the most potent causes that make for the good of man. In such a light as he can shed on life and its conditions the coming man will be able to see the true dignity of chemistry.

H. W. Wiley.

U. S. Department of Agriculture.

DIAMOND-GLASS FLUORESCENCE.

Some five years ago I had occasion to cut a large number of photographic dry plates to smaller sizes. They were cut in the usual way—with a diamond and on the side of the plate opposite the film. In developing it was noticed that the film, to a breadth of a few millimeters along the edge of the plate, turned dark as if exposed to light.

Several possible explanations suggested themselves.

1. The breaking of the glass might produce momentary fluorescence and a fogging of the film near the break.

2. The breaking or tearing of the film might result in some sort of change in its character.

3. The scratching of the diamond might set up mechanical disturbances or vibrations in the glass and these might affect the film.

4. The friction between the diamond and the glass might cause a momentary fluorescence along the line traced by the diamond, and the radiation might penetrate the glass and fog the film on the other side.

The first and second suggested explanations were thrown aside at once, for the dark band in the film was found along the diamond scratch, whether the plate was broken or not.

That the third is not the true explanation was shown in several ways. The breadth and density of the dark band did not appear to depend upon the depth of the cut or the rapidity with which it was made. The line was always of about the same breadth on the same plate, but of different breadths on different plates. Moreover, the film always developed first on the side next the glass. The effect was noticeable on the most sensitive plates only.

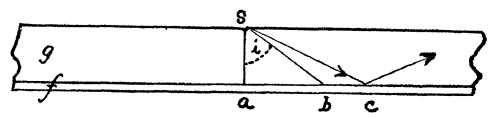

fig 1.

Let f represent the film on a section of the glass plate g, perpendicular to the diamond scratch s. Let s be a source of radiation.

All rays (as sc) outside the critical angle i are totally reflected and hence do not affect the film. Those having an incident angle smaller than i penetrate the film and