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DEDICATION OF THE CHEMISTRY BUILDING OF THE COLLEGE OF THE CITY OF NEW YORK, MAY 14, 1908

IN taking the chair, Professor Baskerville, the director of the laboratory, said:—

Ladies and Gentlemen:

In the name of the honorable board of trustees, the president and the staff of the department of chemistry, I bid you hearty welcome. We are here to-day, because

First, honor is to be done to two teachers of chemistry, each distinguished in his own way as a scientist and as a citizen; and

Second, a building is to be formally opened and set aside for the study of chemistry.

It is not appropriate on this occasion to dwell upon the multitude of details incorporated in plans for a laboratory constructed to accommodate more than a thousand students. My colleagues hold themselves in readiness to show those particularly interested over the unfinished building at the close of these exercises. Papers have appeared and others will soon appear in print which call attention to the principles involved and some of the incidental details. The building is not perfect. No structure devised by the human mind or constructed by the human hand is ever perfect. Many ideas have been borrowed from other laboratories in this country and Europe. Some have been incorporated which are original. Some are good, and others not so good.

More important than all these facilities, however, is the spirit which dominates the teachers and students alike. I assure you, your presence to-day inspires us and its effect will be most lasting.

In the lecture theater of the department of chemistry in the University of Pennsylvania, where a laboratory was first opened to students in this country, is a frieze. Inscribed upon that border are these names: Priestley, Scheele, Lavoisier, Dalton, Gay-Lussac, Avogadro, Berzelius, Wöhler, Liebig, Graham, Bunsen, Hoffman, Cannizzaro and Wolcott Gibbs.

These names were placed by Dr. Edgar F. Smith, the present professor of chemistry. Electro-analysis is the most modern and the neatest means for analysis. Wolcott Gibbs was the father of electro-chemistry and Edgar F. Smith is now the world's authority on that subject. It is a great happiness to me, personally, that my dear friend Edgar F. Smith, is here today, a pioneer to speak of a pioneer, for it is his spirit I would establish in this department. I have the honor of presenting Vice-Provost Smith, who will speak to us of

A PIONEER OF CHEMISTRY

I am glad to be here on this red-letter day in the history of the College of the City of New York. I am sure that the hearts of all persons intimately connected with the college are at this moment overflowing with gladness and deepest gratitude on the completion of this splendid laboratory, which, in equipment and appointments for every kind of chemical work and investigation, stands in the first rank of laboratories designed for similar purposes.

In appearing before this happy and joyous company, it is my portion first of all, as well as my great pleasure, to offer you, President Finley and the honorable board of trustees, as well as your faculty and especially those members of it whose business it is to be in closest contact with the teaching and experimentation now being done here and which, as the years go by, shall continue to be done here—the heartiest, warmest congratulations and best wishes of the University of Pennsylvania—first of our American institutions to create a chair devoted to the science of chemistry, first also to open to its students a laboratory for practical instruction in that science.

Permit me also to extend my felicitations to the student body upon the extremely liberal and generous provisions made for them to acquire and perfect themselves in the methods of a science which has done so much for the comfort, happiness and welfare of mankind.

We see, surrounding us on all sides, innumerable evidences of a tender and deep-seated interest in those who shall come here to equip themselves for the great struggle of life. How grateful then all should be to that nation, that state or that city which has provided so munificently of its means that we may profit thereby. Indeed, it seems to me that it should create in us a great overwhelming national or civic pride—yes, more—a burning patriotism that will ever be uplifting, constructive in every respect.

However, I am not come here to read a dissertation. Not at all. I have come here to spend a few short hours with you, and to behold with my own eyes how supremely happy your beloved professor and my friend, Dr. Baskerville, is at this moment in the realization of his dream of many long years. This is his laboratory! And that reminds me that as professor of chemistry he is the successor of a brilliant line of chemists whose names shed lasting glory upon the college, and if you will bear with me, I should like to trace for a few minutes the activities of your first professor of chemistry—Wolcott Gibbs, who still lives, at the advanced age of eighty-six years, and who, though absent in body, must surely at this moment be present with us in spirit.

When we pause to read the record of his life, or his activities in the cause of chemistry here in America, we stand entranced, as it were, and freely admit that it is worthy of the highest praise and the most careful, thoughtful consideration, for there is scarcely a contribution that has emanated from his hand which does not fairly teem with suggestive thoughts.

As a junior in Columbia College when but nineteen years of age, Wolcott Gibbs gave to the scientific public a new form of voltaic battery in which, for the first time, carbon was used as the negative electrode. In his dissertation of 1845, upon a natural system of chemical classification, there is evinced a power of discrimination and understanding of analogies in crystalline form in relations of combinations and types of compounds that betrays the superb order of chemical intellect.

Beginning here in your laboratory with the analysis of the dust of a sirocco, there followed at a close interval a series of contributions upon analytical chemistry which demonstrated his acumen in devising new methods for the determination of various metals as well as separating them with the finest accuracy when associated in complicated mixtures. Though simple, it was Wolcott Gibbs who showed how simple lead dioxide might be or was in the separation of manganese from a series of allied metals, and cerium from its almost constant associates, lanthanum and the two didymiums.

This early attention to things analytical no doubt paved the way for later contributions upon the use of sodium thiosulphate as a reagent of separation; of hypophosphorous acid as a quantitative precipitant of copper, and of others too numerous to mention.

And then in 1857, in conjunction with my own chief and honored predecessor, Dr. Genth, there appeared the first of a series of contributions upon the cobaltamines—those fascinating bodies which taxed to the utmost the analytical skill of both Gibbs and Genth. In their hands the number of these compounds in which cobalt is differently combined from what it is in its ordinary salts, was greatly multiplied; but the complete interpretation of their constitution was not given by them. The solution of that problem was reserved for Werner of Zurich. And here at least is one instance where a discovery made by Americans arrested the attention of European minds to such a degree that from following the studies of Werner we are obliged to radically modify our long-cherished views upon the doctrine of valency.

It may also be said that Gibbs remarked, "very numerous and carefully made analyses of the salts of the cobaltamines, executed in my laboratory, indicate 59 as the true atomic value of cobalt." This and other published data make certain that as early as 1858 your first professor of chemistry was wide awake to the importance of the atomic numbers and to their methods of determination—problems of deepest interest to chemists of the present time.

There is scarcely an element that Dr. Gibbs did not follow in its many combinations. He knew them all. He knew them well.

And there in your early laboratory he also carried out an exhaustive study of platinum ore, patiently reviewing the many suggestions made for the separation of the several metals of the platinum group, and then, venturing forth on his own initiative to find new and better processes, met with the most abundant success. His research made in 1860 upon osmium bases stands to-day unfinished. Wolcott Gibbs opened the door. Who will enter and reap the rich harvest apparent there?

But it was not only in the field of analysis or in synthetic inorganic chemistry that your first professor was busy, for under date of October 27, 1857, we find him writing from the Free Academy in New York "On the Rational Constitution of Certain Organic Compounds" and concluding with this observation: "I conclude with the expression of my conviction that every complex molecule is built up, not directly of the elements which it contains, but of simpler organic molecules, which are more or less perfectly fused together but which may yet in the majority be distinctly traced in the complex whole." And then he called attention to the preparation of methyl and ethyl derivatives of silicon, as well as to the theoretic interest attaching to their vapor density determination. Though of historic value alone at this moment his study of the "Molecular Structure of Uric Acid and its Derivatives" reveals a deep appreciation of the intricacies of that great problem, the solution of which has only been made possible by such efforts as he and others put forth for its realization.

Wolcott Gibbs is the father of electroanalysis, that branch of gravimetric practise which to-day is widening its applications and winning for itself a distinct and permanent place in the great domain of analytical chemistry. But the great crowning study, perhaps, of your first professor of chemistry was that relating to complex inorganic acids—compounds in which several acid radicals unite to form a nucleus with functions like a single radical. Such derivatives have been greatly increased in number in recent years. They offer stupendous analytical problems. Their constitution is barely known. Here and there hints have been obtained as to the same. The future must disclose the methods to be pursued in unraveling their enigmatical structure, and when that is once accomplished perhaps then the constitution of the great host of silicates will also be made clear.

And now I must pause. Inadequately, superficially have I traced the activities of your first professor of chemistry. Time forbids anything more elaborate, more exhaustive. But reflect for a moment upon the cobaltamines—the amines of the platinum metals—the beginnings of electro-chemistry—the beginning and development of complex inorganic acids—and all that these represent in the way of philosophic treatment and generalization, and I think you will agree with me that it is the work of a master mind. And yet some years ago when discussing these matters with our honored and beloved Nestor of chemical research in America, he said, "I have only been a pioneer in this work, nothing more!" He has indeed been a pioneer, but better still, he inspired hosts of young men to enter these fields of inquiry and rich indeed has been their reward.

And now in conclusion let me express the wish that under the guidance and inspiration of the present occupant of the chair of chemistry, there may be trained in this palatial laboratory many young men who will pursue not only the science of chemistry, but all other sciences, in the spirit of Wolcott Gibbs, the pioneer, and like him serve well their day and generation.

The following letter from Professor Gibbs was then read:

Gibbs Avenue, Newport, R. I.,
April 6, 1908.

My dear Mr. Baskerville:

I received with pleasure your kind letter of March 28 and it gratifies me very much to have the library named after me.

I should very much like to see the new college, but at my advanced age I can not hope to be able to do so.

I recall with pleasure and interest my connections with the old institution and send heartiest good wishes to the new.

With kindest regards, I am,

Very sincerely yours,

(Signed) WOLCOTT GIBBS

Prof. Charles Baskerville.

In unveiling the portrait of Professor Wolcott Gibbs, Professor Baskerville said:

Handsome bronze doors will soon grace the main west entrance of the capitol in Washington. On one of the eight panels, four being on each side of the door, is a scene depicting science. On the sides of this panel are two figures, one of Joseph Henry, the physicist, and the other is Oliver Wolcott Gibbs, the chemist, and founder of the Union League Club of New York. There he stands, a model to all Americans, as a scientist and a citizen, and here we have his memory and likeness as a constant inspiration and a stimulus to those who follow in our footsteps.

Addressing the audience, Professor Baskerville continued:

We know from the press that there is a three days' gubernatorial picnic in progress at Washington. This is an unusual proceeding, but our distinguished president in establishing this precedent has displayed unusual common sense. This conference looking toward the conservation of our natural resources is not to become a mere speech-fest, but is intended to be really productive. To insure that, Mr. Roosevelt has commanded the presidents of the various scientific organizations of our country to be present. For that reason, and solely for that reason, we are deprived of the pleasant and happy company of Dr. Ira Remsen, of the class of 1865, president of Johns Hopkins University, and president of the National Academy of Sciences. President Remsen, however, has written of his keen regret in being absent, and has forwarded his address on "Some Changes in Chemistry in Fifty Years," which will be presented by my colleague, Professor Herbert R. Moody.

SOME CHANGES IN CHEMISTRY IN FIFTY YEARS

What changes have taken place in chemistry since this college was founded? It would be a bold and foolish man who would attempt to answer this question in fifteen minutes. As the writer does not claim to be especially bold and does not wish to be regarded as especially foolish, he will not make the attempt, but will confine himself to a few reflections of a general character, to some extent in keeping with this occasion.

First, it may be of interest to note that I had the pleasure of hearing the lectures of Professor Wolcott Gibbs in the years 1861–2. At that time there was no laboratory for students. We did not have even a text-book wherewith to cram. Once a week, as nearly as I can remember, Professor Gibbs gave us a lecture and showed us a few specimens. In another place I have recorded the interesting fact that all that I can now remember of that course of lectures is the word "sesquioxide." That stands out in bold relief. It is a great satisfaction to me to recall the fact that I had the opportunity to come in contact, though not in close contact, with Professor Gibbs at that early period. In later years we became intimate friends and have often talked over these early efforts. There were rumors then among the boys that he was a man of wide reputation. One of the older boys to whom I looked up said to me one day, "Dr. Gibbs is a remarkable man. He would be recognized as such by all the world if he would only publish his results." Well, that boy did not, of course, know what he was talking about, but his words made an impression. Here was a man who, according to the statement quoted, was actually doing things of value to the world. Whether I learned anything from his lectures or not was a secondary matter. It was worth much to be permitted to see him and to hear him talk.

Dr. Doremus did not teach chemistry at the college in my day, but shortly afterward he gave some popular lectures on chemistry at the Cooper Institute, in the course of which he performed extremely striking experiments, many of which I can remember as clearly as if they had been performed yesterday. In fact, I have never seen more brilliant chemical lecture experiments. The hall was crowded and I am sure the lectures set many to thinking. I have always felt that my own interest in chemistry, which soon became absorbing, was due to what I saw and heard in these lectures.

With this brief reference to chemistry at the college nearly fifty years ago let me pass to chemistry as it was in the world at large at that time. We often hear the statement that chemistry has been completely revolutionized within a comparatively brief period. I have been hearing that statement ever since I have known anything about chemistry. After all, progress in chemistry has not been by revolution, but by evolution. Probably the nearest to a revolution was that which happened during the last quarter of the eighteenth century when Priestley and Scheele and Lavoisier explained the nature of combustion and paved the way to the overthrow of the theory of phlogiston which had so long controlled the views of chemists. But that theory was not overthrown in a day or in a year. Priestley and Scheele, whose discovery of oxygen led to Lavoisier's work on combustion, both remained phlogisticians to the end of their days, as did most of their contemporaries.

Within the last half century the change that has made the most impression on the outside world and has led to the common belief that the older views have been completely given up and that radically new ones have taken their place, is that which is due to the gradual acceptance of what is generally known as the law of Avogadro. The conception embodied in this law is very simple. It is that the number of molecules contained in a given volume of a gas or vapor is the same, no matter what the gas or vapor may be, provided only that the temperature and pressure are the same. That it is difficult to prove the truth of this statement is evident from the fact that it was nearly a half century after it was propounded by Avogadro before it came to be generally accepted. Few, if any, accepted it at the time it was first put forward. The leaders tried to apply it to well-known facts and gave it up. And yet, in the light of facts discovered later, it came to be recognized as a fundamental truth of great value.

When Gibbs was teaching chemistry in the old Free Academy, Avogadro's law was not taught in this country and only a few of the younger teachers were beginning to teach it and to use it in Italy and Germany. It was a most confusing time for the student. According to the prevailing system, to take an example, the atomic weight or the combining weight or the equivalent of oxygen was 8, whereas, according to Avogadro, it was 16. And yet it was the same old oxygen that had been discovered by Priestley and Scheele, and it supported combustion in exactly the same way whether we assigned to it the atomic weight 8 or 16. How could both be true? I remember in 1867, when I finally decided to give up medicine and study chemistry, meeting a man who knew a very little more chemistry than I did, who asked me what I thought of "the new chemistry." Not being willing at that time to confess my ignorance, I believe I said I thought very well of it, and in the silent watches of the night I often found myself wondering what was meant by "the new chemistry." Arriving in Germany, I found that the old masters like Liebig and Wöhler would have nothing to do with the new chemistry, while the younger teachers in the same universities used the new system. In the end the law of Avogadro prevailed, and now it is generally, I fear, taught dogmatically, and the evidence upon which it rests is lost sight of.

The conception that proved to be most fruitful during the period immediately following the acceptance of the law of Avogadro was that of the constitution of compounds as first clearly set forth by Kekulé in his great "Handbook of Organic Chemistry." Soon after the appearance of this book the majority of the younger chemists were ardently engaged in trying to determine the constitution of chemical compounds. Results came rapidly. The determination of constitution led, further, to efforts to build up natural substances artificially in the laboratory and factory. One of the first great successes in this line was the artificial preparation of the coloring matter of madder, known as turkey red, or alizarin. Since then achievements in synthetical chemistry have been innumerable. Great industries have been developed in the wake of these efforts and there seems to be no end to the possibilities. Perhaps the most sensational of the successes in synthetical chemistry is that which has culminated in the artificial preparation of indigo. It took about a quarter of a century to work out that problem—a problem that is of great interest not only to the chemist, but to the agriculturist, the political economist and the anthropologist.

Let us not forget that, while Kekulé's clearly expressed views gave the principal impetus to the work on constitution that led in turn to the work in synthetical chemistry, the way had been prepared by a long line of predecessors, among whom should be especially remembered Berzelius, Gay-Lussac, Laurent, Liebig, Wöhler, Dumas, Williamson and Frankland. Kekulé did not lead a revolution, he helped an evolution. The work in the field of synthetical chemistry is still progressing, and results as valuable as ever are being obtained. The problems under investigation are in general more difficult of solution than those that have already been solved. I need only mention in this connection the magnificent researches of Emil Fischer, of Berlin, on the synthesis of proteins, the complex substances that enter so largely into the composition of living things. It is of the highest importance that the chemistry of these substances should be worked out. The more we know about them, the better shall we be able to understand the mechanism of the living organism.

Within the last twenty-five or thirty years that branch of science which is called physical chemistry, and sometimes chemical physics, has been largely developed, and this has contributed to the advance of chemistry in many ways. The beginnings of physical chemistry are to be found, however, in the very beginning of the last century. Bertholet's work on "Chemical Statics," which appeared in 1801, may fairly be regarded as an important contribution to the subject, but more important, because more fruitful, was the work of Guldberg and Waage on the law of mass action which appeared in 1867. Since then, through the labors of Ostwald, Van't Hoff, Arrhenius and a host of others, physical chemistry has taken an independent position, and it may now be regarded as a new branch of science, occupying a field midway between chemistry and physics, and helpful to both. We are in the era of ions. It took chemists many years to learn to use the words atom and molecule in a rational way. Now that they have learned this lesson fairly well, the ion has come in to plague them and—to help them. Here again it must be remembered that the ion is no new thing. Indeed we owe the word and the first conception to Faraday. But Arrhenius has emphasized its importance in connection with reactions that take place in solution and we have fallen captive. So thoroughly have we yielded to its influence that we are now using the ion as food for babes. It is an exception now-a-days to find one who has studied chemistry a few weeks who will not discourse at length on ions. Do not misunderstand me. I acknowledge gladly the great impetus that has come to chemistry through the conceptions of dissociation and ions, but I do question the desirability of attempting to introduce these conceptions at too early a period in the teaching of chemistry. The result must inevitably be dogmatic teaching and dogmatic teaching is not scientific teaching.

The development of physical chemistry has not interfered with the study of constitutional chemistry or of any other branch of chemistry, but has made it possible to interpret many phenomena more satisfactorily than formerly. The result of the application of physical methods to the study of chemical phenomena has been to give us more refined views and deeper insight. It is idle to claim that one method of investigation is higher than another. As Professor Nernst has recently said: "The question whether chemistry has profited most by the atomic theory or by thermodynamics is a foolish one. It is like the question whether Goethe or Schiller is the greater poet. Let us rejoice that we have two such poets. Let us rejoice that we have two such valuable methods of chemical research. We need all the aid we can possibly get and even with this aid progress will be relatively slow."

The latest developments in chemistry are in some respects the most remarkable of all. A recent writer has said: "The ideas which guide chemists when they use the molecular and atomic theory, when they apply the periodic law, when they deduce composition from crystalline form, when they use the hypothesis of ionization, when they discuss certain aspects of chemical affinity, when they connect changes of composition with changes of energy; these and many other guiding ideas are the gifts of the physicist to the chemist. The measure has been returned by the chemist 'pressed down and running over.' By the discovery of radium the chemist has called a new world into being; and, with a fine generosity, he has given it to the physicist to investigate." The study of radium and similar elements has led to most unexpected results of fundamental importance which have already thrown much needed light on the constitution of matter and have made it appear probable that electric charges, whatever they may be, are responsible for all forms of matter as well as for some forms of energy. But the statement that matter is made up of electric charges, however soothing it may be, raises the question what is an electric charge?—a question as difficult to answer as the older one, what is matter? Everything then resolves itself into electricity. Truly, "The old order changeth, yielding place to new." But not so fast. What we call matter still exists and the old phenomena presented by it still call for study, and will through eternity.

Let us finally return to the earth for a moment. Leaving out of consideration the theories that have grown out of the study of radioactivity, let us note the conclusion that has been forced upon us that the atom is a changing system, that it is an aggregate of much smaller particles called corpuscles or electrons. This carries with it the thought that it may be possible to change one of the so-called elementary forms of matter into another, and some observations have already been recorded that seem to show that this possibility can in fact be realized. Sir William Ramsay has shown that, in the course of the decomposition which radium naturally undergoes, one of the products is another element, helium, and, further, it appears that, by allowing the emanation from radium to act upon copper, he has obtained a minute quantity of the element lithium. These observations have interested the chemical world profoundly. We are anxiously awaiting confirmation and further developments.

It has been suggested that, because some, and perhaps all, atoms are changing, the atomic theory, which for a century has been the principal theory of chemistry, is no longer tenable, that we must revise our entire terminology. It is hardly necessary to say to this audience that this is an extreme view. The atomic theory is as useful as it ever was. Under the conditions which surround us on the earth most atoms do not undergo change that can be discovered in any ordinary way. The atomic theory is based upon innumerable weighings. Now, the changes in weight which atoms undergo are not such as can be detected, so that we have as much evidence in favor of the atomic theory as we ever had, though we must supplement it by the conception of corpuscles or particles much smaller than atoms which can be given off from the atoms.

While chemistry is making rapid advances the great mass of knowledge of chemical phenomena that has been collected needs study now as in the past. No discoveries will ever make it possible to ignore oxygen and hydrogen and the other chemical elements and the compounds which they form with one another. I fear, however, that in our zeal for the new, we do not always give as much attention to the old as it deserves. I know that to talk in this way is furnishing evidence of my advancing years, yet, even at the risk of this, I wish to leave with you the thought that the new is built upon the old and includes the old. Chemistry was a great science fifty years ago. It is a greater science in the year 1908.

The presiding officer then said:

Fifty years is a long time. President Remsen has depicted the many and rapid changes that have come about in our science during that period. In 1852 Robert Ogden Doremus assumed the professorship of natural history in this college. Two years previous to this, while connected with the New York Medical School, he opened the first chemical laboratory for medical students in this country. The students of the College of Pharmacy, then without a home of its own, were allowed similar advantages in that laboratory. He soon extended this method of instruction to the Bellevue and Long Island Hospital Medical Colleges.

With a member of the faculty, who had already demonstrated unique activity in teaching chemistry, it was the natural and only thing to do, when Gibbs was called to the Rumford Professorship at Harvard in 1863, to ask Professor Doremus to transfer his activity to the chair of chemistry.

Then in unveiling the portrait of the late Professor R. Ogden Doremus, Professor Baskerville said:

This ardent devotee of science, this impressive teacher, this lover of art, poetry and all learning, occupied the chair for forty years, retiring in 1903.

In that time he was unremitting in his efforts to secure laboratory facilities for the students. The crowning of his labors in that direction came when the honorable board of trustees, as the result of his insistence, decided upon making one of this magnificent group of buildings a laboratory for the teaching of chemistry.

Professor Doremus, who never did anything on a small scale, was an eloquent and brilliant experimental lecturer. When I recall his charm of manner and courteous hospitality, his tremendous influence over the students of the college is easily understood, and it has been attested by Professor Remsen to-day.

It is fitting that his portrait be in this room, but for reasons familiar to chemists only a reproduction will remain here, but the name on the doors will serve ever to remind those who come of this successful expounder of the principles of our science through two generations.

Professor Baskerville then addressed the audience:

If, when Wolcott Gibbs was first professor in this college, he had told his students that we should soon read the history of the stars, he would have been said to be very erratic. Yet while he was still here, Bunsen and Kirchoff invented the spectroscope. While he was here mauve was discovered by Perkin and the coal-tar color industry started. While here oil was found in Pennsylvania and the great petroleum industry begun. If Gibbs, who was professor of physics and chemistry, had early said that nations would soon communicate across the depths of the ocean by cables, he would have spoken to incredulous listeners. Yet, as he left this institution, Cyrus Field laid the cable and William Thomson made its operation practicable.

If Doremus in the sixties had said that within a score of years the human voice would be recognized after transmission by wire for hundreds of miles, he would have been laughed at. Yet Graham Bell convinced the Emperor of Brazil and a distinguished group of interested scientific people in Philadelphia that it was an actuality.

If in the eighties Doremus, for he also was professor of physics and chemistry, had said in those remarkable and instructive lectures of his, that we should soon see through the human body, that nations would communicate across land and sea without connecting wires; if he had said that chemical elements would be found devoid of their characteristic property of chemical affinity; if he had said that chemical elements would be discovered which spontaneously and without chemical change produce vastly more energy than that evidenced in the most violent chemical reactions known—he would have been thought of as a man of delusions. Yet knowledge of all these things is common property at present.

In this day when a professor of chemistry publicly states that light and electricity are the same and that it is nearly proved (one of our distinguished speakers has done this and I believe he is right) he is greeted with a tolerant smile. So what of the "future in chemistry" in our day and generation? No one is better qualified to speak upon that subject than Professor Wilder D. Bancroft, whose esteemed and diplomatic grandfather epitomized the past. Dr. Bancroft, having drawn inspiration from the spirit of Gibbs at Harvard, is a daring and far-seeing investigator, whose vivid imagination visualizes the realms of the unknown, ever, however, holding it within reason.

Professor Bancroft then spoke upon

THE FUTURE IN CHEMISTRY

The future in chemistry! No two people agree as to what the future development of chemistry is to be, and it is probable that any one man would give you a different answer if the question were put to him at an interval of five years. Depending on whom you ask, you will be told that the really important thing is: organic chemistry, inorganic chemistry, physical chemistry, electrochemistry, photochemistry, physiological chemistry, industrial chemistry, or what not. I could even name one man who has believed all these things at one time or another. It is easy to see that predictions like these are the results of opinion that exists. The same diversity of opinion as to what is fundamentally important appears very clearly when we remember that the Carnegie Institution is not making any large grant to chemistry, for the simple reason that the chemists of the country can not agree as to what problem or group of problems should be attacked. My task to-day is to point out to you what the real future of chemistry will be and to make you see that my prophecy is the one that will come true.

We shall reach our goal most quickly by what is at first sight an indirect way. At the dedication of a chemical, physical, engineering, geological, biological or medical laboratory, it is customary to have addresses, even as now; and it is the orthodox thing to say that the most important of all the sciences is the science to be studied in that laboratory, whether it be chemistry, physics, engineering, geology, biology, medicine or something else. I sympathize fully with the practise and I intend to do the same thing myself to-day. You will admit, however, that the people who make addresses of this type at the dedication of laboratories, can not all be right when they talk like that. Some of them must be exaggerating just a little, and in order to acquit the chemist of any such a charge, we must first consider the relation of chemistry to the other sciences.

We will define chemistry as a study of all properties and changes of matter depending on the nature of the substances concerned. This definition is wider than the usual one. It is one that I have used for years and it is one which Sir William Ramsay suggested but did not make in his "Introduction to the Study of Physical Chemistry." It follows from this definition that physics is a subdivision of chemistry; an important and interesting subdivision, it is true, but only a subdivision. Chemistry includes all of what is known as physics except the law of gravitation, the laws of motion, and a few other abstract formulations. Everything else that gives life and interest to physics is chemistry pure and simple. I admit that this point of view is not popular among my colleagues, the physicists, but their objections are natural enough without being valid. Physics was a flourishing science at the time when chemistry, in the narrower sense of the word, was of very little importance. In the case of anything that is expanding and developing, it seems to me axiomatic that you must have the part before we have the whole, and that in the first stages the part will seem the whole. In 1600 the men of Great Britain were the whole of the Anglo-Saxon race. To-day they are only a part of it; an important part, it is true, but only a part. Let us try another illustration. As children we were told that "great oaks from little acorns grow." If you only have the acorn, of course, it is the important thing; but later one sees that the acorn is merely an interesting subdivision or product of the oak and that is all it is. We may, therefore, class physics as a subdivision of chemistry.

When we come to engineering, it is clear that we are dealing with applied chemistry. If it were not for the specific properties of iron, copper, concrete, brick, etc., and of all the other materials of engineering, there would be no such subject as engineering. Speaking in a broad sense we may say that engineering is the art of making the structural properties of matter useful to man.

Geology is the study of the chemistry of the earth. This has been recognized for a long time, and though we speak of the Geophysical Laboratory at Washington, its work is geochemical in fact though not in name.

In biology of the present and future we are interested in the chemical changes in the living organisms due to heredity and environment. Growth is a chemical change. The internal and external structures of plants and animals are the result of a series of chemical changes. After the first stage of identification, enumeration and classification has been passed, the interests of the biologist are essentially chemical and the quality of his work is likely to increase as his methods become chemical. The work of Loeb in California is a striking instance of what may happen when a biologist realizes that his subject is a subdivision of chemistry.

In curative medicine we are dealing largely with the action of drugs. In preventive medicine we are dealing with inoculations, diet, exercise and fresh air. In the first case we are checking and eliminating an abnormal process, sickness, by the action of one set of chemicals on the system. In the second case we are preventing the occurrence of a disturbing chemical process, sickness, by the action of another set of chemicals on the system. Owing to the difficulties involved and to the number of variables concerned, our knowledge of the chemistry of medicine is not yet what it should be; but it is clear that real progress will be made just in so far as we study physiology and medicine as subdivisions of chemistry. I cite as an instance the brilliant work of Arrhenius in the field of immuno-chemistry.

I have tried to show you that physics, engineering, geology, biology and medicine are all subdivisions of chemistry. My task is over. The future in chemistry will consist in the change from chemistry as a coordinate science to chemistry as the dominant science. With this in mind can you wonder at the fascination which chemistry has for the chemist? Now you will see why I rejoice that to-day the world is to be the better for a well-equipped laboratory in the hands of a well-equipped staff.

In introducing the next speaker, Professor Baskerville said:

Dean Swift said a certain university was a learned place; most persons took some learning there, few brought any away, hence there was accumulation. This caustic arraignment is probably true of some institutions. Yet in my humble opinion, a college should not be regarded merely as a place of learning. I like to fancy it as a machine which grasps the refined, but still raw, metal of mentality and turns it out a tool fit for efficient citizenship.

M. Leroy-Beaulieu, who has shown a robust faith in the United States, has said that we are fast approaching undisputed leadership in practical things. According to Professor Munroe, and he is qualified to speak, in 1840 the coal production and consumption was one quarter ton per person in the United States; in 1860 it was one half; in 1880 one ton, and 1890 five tons. These figures show the increasing energy demands of a growing manufacturing country. The colleges must produce the men who utilize and direct these great forces.

We are peculiarly fortunate to-day in having as one of our speakers a man, a college man, the man whose successful constructive ability is seen in several powerful, but legitimate, morally legitimate, corporations, one bearing his name. His gratitude to the college course, his appreciation of its relation to the manufacturing world, have been evidenced in large generosity and his willingness to serve as chairman of the board of trustees of a great Polytechnic School in Brooklyn. I refer to Dr. W. H. Nichols, who will address us upon

THE COLLEGE COURSE AND PRACTICAL AFFAIRS

The dedication to the cause of higher education of this magnificient group of buildings on this superb site, marks an epoch in the history of our city. It is one of the glories of this country that the schoolhouse has always followed closely after the axe of the pioneer. Government by the people is not practicable where ignorance is the rule, or even the state of a considerable minority, and this fact was recognized by the fathers. A good common-school education has always been obtainable by a large majority of white children, outside of that neglected and almost unknown region in the Appalachian mountain belt. This city justly prides itself on its public school system, in spite of the criticism of those who do not make sufficient allowance for the difficulty of keeping pace with the tremendous growth in population; especially of that class in which a tendency towards "race suicide" is not noticeable, and whose children must be educated at the public expense, if at all. No one would venture to raise the question of the value as an investment of that portion of our taxes which goes into our common-school fund. All realize that we have here a plain instance of duty and self interest running concurrently.

A step upward in the development of our educational system brings us to the high school. Many scholars are so fortunately situated that they are not obliged to earn their own living on leaving the grammar school, and the city has provided for them a system of high schools which is exceedingly creditable. These turn out a goodly number of boys and girls who have much more than the rudiments of education, and are qualified to fill positions of considerable importance. It was found, however, that many of these were worth the cost of still higher education, and financially able to undertake the work. Hence the College of the City of New York, which to-day, after many years of experience in unsatisfactory quarters, dedicates this great plant to this purpose. I suspect that our city fathers in making the investment were not actuated solely by motives of altruism, but were looking for returns in better citizenship. The students and graduates of this institution must realize that their education has cost the city a large sum, which they should repay with usury in one or more of the many ways of usefulness open to cultured men.

It is a truism which few will question, that life, from conscious infancy to old age, is a school in which all who will take advantage of experience and mistakes as they occur will receive an education of a certain sort. Only the very stupid fail to profit in this way. It is astonishing to note how much may be daily added to one's store of knowledge by observation, if only we mean business, and "Knowledge is power." After all, is not one of the principal objects of the college course the training of the mind so that it may more surely and logically appropriate knowledge thus offered? The great rank and file of our fellow citizens possess a large share of the total stock of that rare gift—common sense—and it is a fortunate thing for the country that it is not confined to what is sometimes called the "ruling class." It seems to be more inborn than acquired and I have never heard of a chair having been founded in any of our institutions of learning for instruction in this subject. It is one of the elements of wisdom, and wisdom is not necessarily learning. Knowledge is a fine foundation for wisdom, but it is not the only one. It is indeed power, but it may be a power for harm, which is not true of wisdom. Solomon said: "Wisdom is the principal thing. Therefore get wisdom." How to get it and how to keep it are very different questions, and are questions which every one must settle for himself. If Solomon be right, time can not be better spent than in seeking it, even if the quest occupy a lifetime. In all practical affairs, it is a most valuable asset.

I am asked to discuss briefly "The College Course and Practical Affairs." Now what are practical affairs? I suppose the comprehensive answer to this is that nearly all affairs are or should be practical. The mechanic, the farmer, the teacher, the merchant, the chemist, the engineer, in fact nearly everybody excepting possibly the pure theorist, and the impure loafer of both the corner and the society sort, is engaged in some kind of practical occupation. We even hear of practical politics. The measure of success or reward depends on fitness and application, not often on luck, unsuccessful ones to the contrary notwithstanding. Of course, allowance must be made for ill health or accident; but all other things being equal, the man who is best qualified by training, and does not neglect his opportunities, will come out ahead. The best training to make a good bricklayer is, of course, different from that needed to produce a good merchant, and both are totally unlike the preparation for a good chemist or a good lawyer. But the principle is the same. No one should neglect or omit a single step necessary to perfect himself in the trade, occupation or profession he seeks. And just here is where the rub comes in so many instances. The boy may not be qualified, or his parents may not help him intelligently to decide on the career for which he is best suited, and hence so many sad misfits and failures. One of the most important decisions a young man has to make is frequently postponed over and over again, or left altogether to chance, so that when the necessity for action arrives he is quite unprepared and hopelessly confused. Some may find themselves even at that late stage, and struggle out and up, but the majority will follow the line of least resistance, and drift down with the current, to an aimless and more or less useless existence.

It is then immensely important that as early as possible every boy should decide on the calling he feels best qualified to follow, and do all in his power to fit himself to make good in it. It must not be assumed that his success in life will be measured by the money he accumulates. We are all glad to acknowledge that the contrary view is becoming more and more generally accepted, and we are really beginning to feel a healthy contempt for the man who has nothing but money or other tangible property to recommend him. In fact even great learning will be found not to be sufficient. The man to receive universal respect and approval to-day must have character; and if he have this, and yet is without wealth or learning, even, he has the essential element of true manhood.

While I believe all this to be true, there is, of course, no doubt that the better education a man has, the better he is qualified to enjoy his own life, and be of use to his fellow men. As the beauties of nature, of art and of literature, are better comprehended by him, his nature broadens, and his life grows fuller and richer. Whatever may be the ordinary grind of his daily existence, he moves on higher and ascending planes, and has for his more or less intimate companions the great of all ages. He has at his disposal fountains of pleasure and profit which the uneducated man knows not of.

As I said a while ago, life is a school in which all may be educated by hard knocks and experience. It is, however, not the only school, and the man who boasts that he is self-educated does not often have to prove the assertion. It is generally self-evident. I am aware that there are and have been many men who without the advantages of college training have become eminent in the fields of science and art and even literature. But they never boast of what they have accomplished under adverse conditions, but rather repine because they have been prevented from reaching far higher levels which would have been attainable if only they had been able to command a college education. The college, the university, the engineering school need no apologist. Their output of educated men and women is their sufficient answer to any heterodox critic who questions whether they are worth what they have cost in lives and means.

In order, however, that the college education may contribute all it should to the formation of the wisdom which we all seek, and which has so much to do with the satisfactory working out of practical affairs. care must be taken that it shall not turn out deformed men; that is men who are over-developed on some sides, and under-developed on others. We frequently hear that this is an age of specialists, and success in any field depends largely on specializing in that field. There is a good deal of truth in this, and yet it is not the whole truth. Specialization should not be carried to the point of deformity, if we want to qualify a man to be a practical success. I have known excellent engineers who could not write an intelligible report in good English, not because they did not understand the subject, but because they had not been taught to express themselves properly. No scientific student should be denied a thorough education in culture studies. Neither should an arts course man neglect chemistry, mathematics or the sciences in general. The course should be designed and arranged to turn out good all-round scholars, while at the same time paying due attention to specialization.

But however the course may be arranged, or whatever may be its shortcomings, no young man who has the chance should fail to take it, whatever kind of practical affairs he expects to engage in, unless, perhaps, he intends to learn a trade. But even in this case, a college course would be a luxury if not a necessity, and make him all the better artisan and citizen. We have only got one life to live, and one brain and body to carry us through it. Let us, therefore, do what in us lies—fit both brain and body for their tasks. This is indeed the beginning of wisdom.

Professor Baskerville then introduced the Honorable Herman A. Metz as follows:

When the trustees of our educational institutions tired of the theological fad, they looked to the departments of chemistry for managers of the corporations for which they were held responsible. In seeing some of the most distinguished of these gentlemen before me, I hesitate to call the roll, but realize how unfortunate it has been for our science, but how fortunate for those institutions that professors of chemical economics have become their presidents. A more recent movement in the selection of college and university presidents has shown a favoritism to political economists. Perhaps a combination may prove the best solution. A live wire carries energy; if insulated it is safe. Professional modesty forbids me from mentioning which is the wire.

A physical chemist sits as a member of the privy council of Great Britain and is helping in the readjustment of its politico-economic policy. A plain, but distinguished, chemist was for years a senator and member of the cabinet of France during its trying period of recovery from disastrous conflicts without and within. Our nation has been so blessed in natural resources that it has achieved a reputation for extravagance, national, communal and personal. "In times of affluence prepare for depression," is a trite rendering of an expression usually enunciated in simpler words. In recent times no chemist has had a voting voice in affairs at Washington. It was fortunate for our city that in a time of the fullest prosperity it should place in charge of its finances a chemist who had known the needs of laboratory economy and the benefits of earned prosperity. For he successfully applied those principles to the municipality in times of stress, and perhaps will yet apply them for the welfare of the nation. I have the honor of presenting the Comptroller of the City of New York.

Mr. Metz spoke of the important part the chemist plays in the control of structural work, the purchase of supplies, health and happiness of the community, and emphasized the reliance a large municipality should place in the chemical profession. He called attention to the immense saving to the City of New York which had come about through his establishing a chemical laboratory in conjunction with the department of finance. He expressed his obligation to his course in chemistry in the Cooper Union, and the gratification of the city officials at present in power in having had a part in completing the handsome buildings of the college of the city where the high and low alike might secure adequate preparation for their life work.

In presenting the Honorable James W. Hyde, the secretary of the board of trustees, Professor Baskerville referred to Mr. Hyde's reluctance to appearing too prominently at public functions where such striking evidence of his remarkable executive capacity was to be seen on every hand. After thanking those who had come for their presence, Dr. Baskerville said: "Come again. This college and its every department is yours. It belongs to you, to me, to every man, woman or child of our great city, who pays taxes or rent, and you have a right to know whether we keep the faith."

Mr. Hyde then formally opened the building and declared it fit for the use for which it was devised.

At the conclusion of the exercises, an informal reception was held by the speakers and the laboratory was inspected by parties under the direction of the various members of the staff.

SCIENTIFIC BOOKS

Conductivity and Viscosity in Mixed Solvents. By Harry C. Jones, Professor of Physical Chemistry in the Johns Hopkins University, and C. F. Lindsay, C. G. Carroll, H. P. Bassett, E. C. Bingham, C. A. Rouiller, L. McMaster and W. R. Veazey. Carnegie Institution of Washington, Publication No. 80. Pp. v + 235.

In this volume are presented the results of an extended series of investigations on the electrical conductivity and viscosity of solutions of certain electrolytes in water, methyl alcohol, ethyl alcohol and acetone; and in binary mixtures of these solvents.