arms of chlorophyl after bidding goodbye to their deserted oxygen partners. The wanderings of Ulysses as described by Homer are a prosy tale when compared with the wanderings of the carbon atoms through the labyrinths of organic life, in the vegetable and animal kingdom, to appear again in the busy stream of the living blood where they meet their former partners, the deserted oxygen atoms, and unite with them for a honeymoon of blissful idleness. Oxygen and carbon atoms no longer appeared to me like mere symbolic entities carrying on their backs, like state prisoners, a mysterious number, which told me nothing beyond the meaningless tale of their atomic weight. Chandler's epic revealed them to me as my most precious personal friends who toiled day and night in order to keep me alive. There was not one among the many chemical elements which did not play a leading part in some of Chandler's epics of chemistry, which he recited with matchless art. It is no wonder that students flocked to the School of Mines, the School of Pharmacy, and to the College of Physicians and Surgeons, in order to enlist in the ranks of Chandler's boys.

M. I. PUPIN

COLUMBIA UNIVERSITY

CHANDLER AND THE COLUMBIA SCHOOL OF MINES[1]

IN this memorial meeting an appropriate subject is "Chandler and the School of Mines" because the life of Professor Chandler was chiefly lived in the School of Mines of Columbia College and its outgrowths in Columbia University, and it may justly be said that his life has formed a larger part of the School of Mines than any other one of the many lives that have been given to its service.

Many in this audience have been privileged to hear Professor Chandler tell the brave story of the foundation of the School of Mines; how the plan of a School of Mines sprang complete from the brain of Thomas Egleston, a graduate of Yale and the Ecole des Mines of Paris, set forth in the pamphlet printed in 1863, entitled "Plan for a School of Mines and Metallurgy in New York City," by Thomas Egleston. How the establishment of the school was proposed to Peter Cooper, the founder of Cooper Union, who declined it saying: "You are proposing a great deal of education for a small number of men while the aim of Cooper Union is to give a moderate amount of education for a large number of men." How finally certain trustees of Columbia College became interested. How fifteen other interested citizens were made associate members of a committee of the trustees of the School of Mines. How they contributed a small amount of money to fit up crude laboratories for twelve students in the basement of an old broom factory on university land. How Vinton, a West Pointer and classmate of Egleston at the Ecole des Mines, and Chandler joined themselves with Egleston to constitute the first members of the faculty, with salaries unstated and uncertain. How, to the surprise of all concerned, twenty-four students made their appearance on the opening day, the fifteenth of November, 1864.

The passing of Chandler leaves the story of the foundation of the School of Mines to the written record and to tradition. We can not hear it any more from the lips of a founder.

To understand the significance of the School of Mines at its foundation and the importance of Chandler to the young school as well as the importance of the young school to Chandler, it is necessary to picture, in 1864, a condition of affairs with respect to scientific and technical education as different from that which exists the country over to-day as the Columbia College of that day with its 157 students is different from Columbia University in the City of New York to-day.

The Rensselaer Polytechnic Institute had been founded in 1824 and had become a school of civil engineering. That school together with the West Point Military Academy, some two hundred of whose students entered engineering before 1860, had furnished most of the engineering graduates of the country, five or six hundred in all.

In 1847 scientific schools had sprung up under pretty distinct disapproval of the academic faculties at Harvard and Yale and became the Lawrence Scientific and Sheffield Scientific Schools, respectively. However, they had few graduates and were struggling. At one state university, namely, the University of Michigan, a course in civil engineering was established in 1847, but there were no graduates until 1861.

While before 1864 there were only the four schools just referred to offering a definite curriculum in scientific and technical studies, there had been widespread agitation on the subject of scientific and technical schools, and in 1862 Congress had passed the Morrill Act setting aside public lands for the support of schools of agriculture and the mechanic arts.

In the general readjustment of views consequent upon the turmoil of the Civil War, the necessity for the application of science to the service of the growing industries of the country was becoming understood. It was at such a time that Egleston brought forward his proposal of his School of Mines and

[1] Address delivered at the memorial meeting in honor of the late Professor Charles Frederick Chandler, Havemeyer Hall, Columbia University, November 16, 1925.

Metallurgy, not to be located at the mouths of mines or beside great blast furnaces and smelters where the students should daily see the toiling practice of the mine and the furnace, but a School of Mines to be located in a great city, a center of science, of education and of human intercourse in all the affairs of civilization.

The result was one to be expected. The new enterprise drew to itself as professors and as students men of the type that strike out for themselves, that venture where others would be timid, that defy educational conventions where these conventions have become confining. After Vinton, who was an old acquaintance and classmate of Egleston, Chandler was the first of these men to come to the new school.

Equipped with the best training of the German universities, he had, at the age of twenty-eight, already occupied the chair of chemistry at Union College for seven years with great success. Looking back at Chandler's life, it is easy for us to picture how the new School of Mines appealed to him.

This was to be a school in which science was not to occupy a secondary or subordinate place, but was to be made the basis of the curriculum. A school, therefore, in which his own science of chemistry would have the fullest chance for development. We know how he loved and magnified that science. Furthermore, the new school was to be in a great city where the opportunities for public service would be unlimited, and you have heard this evening how he rose to those opportunities. Therefore it was only natural that Chandler, regardless of what pay he might receive, decided to throw himself into the work of the new school.

It is sufficient to say that there was probably not a man in the country better qualified in ability and training to occupy a professorship of chemistry than young Chandler.

To sketch the development from that early School of Mines would take too long, but before Chandler retired in 1910 it had grown into the School of Mines, Engineering and Chemistry with a faculty of fifty-one professors and numerous junior instructors, offering degrees in mining engineering, metallurgical engineering, civil engineering, electrical engineering, mechanical engineering, chemical engineering and chemistry with an attendance of 516 students.

The graduates up to 1910, practically every one of whom had received instruction from Chandler in chemistry, numbered 2,271. In mining, engineering and metallurgy particularly they had occupied a predominant place in the profession for many years.

It was always the opinion of Professor Chandler that the success of the School of Mines was due to the fact that from the first the curriculum broke completely away from the college curriculum and offered strictly a professional education. In his own words, he says:

"Professor Egleston's idea, with which President Barnard, General Vinton and myself fully concurred, was that the course of study in the new School of Mines should be purely professional and that no matter how desirable a subject might be to an educated man, if it were not professional or necessary to the profession, it must be acquired outside of the new School of Mines, as we felt that we needed all the time at our disposal to give a man a thorough professional education as a mining engineer, a chemist, or as any other professional scientist.

"It was on this plan that the opening of the School of Mines was announced, and it is on this plan that it has been conducted for the past forty-six years as is also true of each of the other courses of engineering under the direction of the faculty of applied science.

"This is the real secret of the success of Professor Egleston's plan. Our Schools of Mines, Engineering and Chemistry stand by the side of the Law School and the Medical School as purely professional schools."

To the public, on account of his many public lectures and his distinctive service in public office, Chandler, more than any other professor, typified the School of Mines as a place where scientific training was combined with practical resourcefulness and devotion to the public good.

To his colleagues in the School of Mines, Chandler was a friend ever ready with his help in any situation. In the deliberations of the faculty he was a master in convincing debate. A well remembered incident is of the time when he desired to have more mathematics taught in the curriculum for chemists and the head of the department of mathematics was opposed.

Professor Chandler appeared at the faculty meeting with an arm full of books which he spread out on the table with pages marked and when the question came up for discussion, he pointed to the books, and said: "There, gentlemen, are important articles in chemistry which I can not read because I do not have enough mathematics. We do not want our students to be in my predicament." The desired mathematics was added to the curriculum.

To his students, those thousands whom he called "my boys," he was the teacher who could with apt illustration or with witty account make a fact or principle impossible to forget. In his enthusiastic love of his science he never slackened in trying to communicate his understanding of the greatness of chemistry and its significance in life; an ever-approachable elder brother.

As dean of the School of Mines for thirty-three years from its foundation, Chandler must have had to

administer discipline, but one never hears of that. We can not think of him as a strict disciplinarian. We can only think of him as the man who would always help to set a student right.

His help was not limited to advice, but often took his pen to his check book. One of his colleagues happened in his office one day as Professor Chandler was opening a letter. A check fluttered out and when it was handed back, Professor Chandler said: "Do you know what this is? It is a return of $500 from a student whom I was able to help when he was in college." But Chandler made few remarks about this kind of thing.

In Columbia University the specialized advanced or graduate work in the departments of chemistry and of geology and mineralogy, and, to somewhat less extent, in the department of physics, grew directly out of the School of Mines. In the department of chemistry, Chandler was always eager to provide facilities for the most advanced work in the subject.

His influence had much to do with the gifts from the Havemeyer family that erected this building. When the trustees seemed unable to find money for some of the equipment of this building when new, Chandler quietly paid out $5,000 of his own money for apparatus that he thought the department needed. When a worthy citizen of New York came to make his will, he let Professor Chandler write it for him and Columbia University as the legatee of Mr. Stephen Whitney Phoenix has received a great fund to provide that no equipment should be lacking in physics and chemistry for purposes of instruction and research.

The department of chemistry at Columbia under the guidance of Professor Chandler was one of the first in the country to recognize the importance of organic chemistry as a special branch of chemistry by the appointment of an officer of professorial grade in this branch of the subject. Again, it was one of the first departments to bring to its staff one of that small but important group of young men trained in German universities in the early development of physical chemistry who became the pioneers in that subject in this country.

Upon his retirement in 1910 a final act of devotion to his science in this university was the gift of his incomparable museum of chemistry, now known as the Chandler Museum.

The School of Mines has its Professor Chandler for always and shares him with the whole of this university, with this city in which he lived, with industry which he promoted in many ways and with the whole chemical profession. His deeds kept in memory will lead others his way.

GEORGE B. PEGRAM

SCIENTIFIC EVENTS

THE SCIENCE EXHIBITION AT THE KANSAS CITY MEETING OF THE AMERICAN ASSOCIATION

As has already been announced (SCIENCE for November 27, page 475), a new departure is being made this year by the American Association for the Advancement of Science. For the Kansas City meeting of December 28 to January 2 the science exhibition is being planned on a much larger, more interesting and useful scale than has ever been attempted before at a convention of the association. Arrangements for this are in the hands of Major H. S. Kimberly, of Washington, D. C., director of the Kansas City Exhibition, and Mr. Albert Saeger, of the Kansas City Junior College, is chairman of the local subcommittee on the exhibition. The exhibits are to be housed in the Aladdin Hotel, newly opened to the public, and there will be ample space and facilities for excellent displays.

Exhibitions have been held in connection with earlier meetings of the association, notably at New York in 1916, at Toronto in 1921, at Cincinnati in 1923, and at Washington in 1924, and the scope and importance of this feature have been widened and increased in recent years. The idea is before us that the annual exhibition of the association may become progressively of greater use and consequence to the advancement of science in America. The enlargements and improvements to be instituted at Kansas City will be in that direction.

There seems to be no question that American makers and distributors of scientific apparatus and materials and American publishers of scientific books will continue to welcome and support the annual science exhibition as an excellent means for bringing their products to the attention of professional scientists and the public at large. The general program of the meeting will include advertising this year and it is hoped that many firms that take space in the exhibition will also insert their notices in the program, which may thus be not only the very good outline of American scientific progress that it has been in recent years, but also a convenient and valuable directory of manufacturers, distributors and publishers.

But the most needed improvement in our science exhibition is with regard to the part devoted to exhibits by individual research workers and research laboratories and institutions. While recent exhibitions have shown a considerable and steady advance in this respect, very much still remains to be accomplished. An effort is being made this year to secure