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CHANDLER: THE TEACHER AND THE CHEMIST[1]

THE history of Charles Frederick Chandler's life is an essential part of the history of chemistry and chemical engineering in the United States during the last sixty years. In the early fifties, when young Chandler entered the Lawrence Scientific School at Harvard, chemical science in England and in this country was practically a monopoly of the druggists. Those were the days when the druggists in England were called chemists, and the name has persisted down to the present day. Young Chandler had to leave the Lawrence Scientific School and go to Professor Woehler, of Göttingen, in order to study the science of chemistry. Neither Harvard nor any other college in the United States was equipped in those days for training students in chemistry. When Chandler returned in 1857, decorated with a Göttingen Ph.D. degree, nobody seemed anxious to engage his services. He finally found some odd jobs with the oil men of New Bedford, analyzing their whale oil. His old friend, Professor Joy, of Union College, needed his assistance in the college laboratory, but the trustees were unwilling to appropriate a salary for an assistant in chemistry after they had appropriated five hundred dollars for a janitor of the chemical laboratory. The young doctor of philosophy took the vacant position of janitor. The privilege of giving scientific assistance to the professor of chemistry attracted him to the position of janitor. Nothing can describe better the state of the chemical science in this country in those days than this beginning of Chandler's scientific career. Nothing can describe better the latent energy of the young doctor of chemistry than his willingness to start his career as a janitor.

Who can tell to-day how long Chandler would have had to stay as janitor at Union College, if Professor Joy had not been called to Columbia College in 1857? But Joy stepped out of Union College and the trustees advanced Chandler from janitor to professor. Chandler's biography, entitled "From Janitor to Professor," would furnish a story of eminent value to the history of American science. Chandler soon outgrew his position at Union College and joined his old friend Professor Joy at Columbia College, where

[1] Address delivered at a Memorial Meeting, November 16, 1925, in honor of the late Charles Frederick Chandler.

with Eggleston and Vinton he started an enterprise which is unique in the history of engineering education in this country. They started the School of Mines of Columbia College, with no salary and no financial assistance from the trustees. Chandler was less than thirty when he became dean of the new school. The trustees of Columbia College were the typical college trustees of those days: lawyers, clergymen and gentlemen of leisure. The conservatism of men of that type would have hardly countenanced the venture of Chandler, Eggleston and Vinton, if Barnard had not been elected in that very year president of Columbia College. To them the venture would have looked very much like an adventure. But Barnard, although a Reverend, was one of those American scientists of vision who at the end of the Civil War started the new movement for higher endeavor in all our intellectual activities. Joseph Henry, John Draper, Barnard and Andrew White were the prophets of the new movement, which needed young apostles full of action, enthusiasm, training, and discipline. No young scientist in those days was better qualified than Chandler to preach the gospel of salvation which science promised to those who believed in it. Chandler became the apostle of the Chemical Science in the City of New York. One who knows the history of this apostolic mission can not help seeing a striking similarity between Chandler's scientific activity in the American metropolis fifty years ago, and the apostolic mission of St. Paul in Athens and of St. Peter in Rome. The mental attitude of the New York alderman and politician of fifty years ago was not a bit more kindly disposed to the gospel of science than the mental attitude of the Roman politician was to the gospel of Christianity. If American democracy had permitted it Chandler would have shared the fate of St. Peter. But fortunately there were in those days men in high places like Dr. Harris, of the Board of Health, and the Mayors Havemeyer and Ely who were converted by Chandler's gospel of science. His study of and report upon the sanitary problems of the city of New York opened their eyes. Chandler became the consulting chemist of the Board of Health and in 1873 its president. By reappointment he continued in presidential authority until 1883. During this period of ten years Chandler created the science of Sanitary Engineering and the science of nursing and public health and demonstrated their power in protecting the health and the life of the metropolitan population.

No belief is stronger to-day in the hearts of scientific men and engineers than the belief that in a democracy like our democracy science and engineering must form an essential part of our national government, and that the leaders of our scientific activities must be in closest contact with our national problems. Chandler was one of the earliest apostles of this belief, and he preached its gospel not only to the politicians but also to the captains of industries. Fifty years ago the mental attitude of the New York captains of industries with regard to science was just as hostile as that of the New York aldermen. They were all from Missouri and wanted to be shown, and it required the discipline, the enthusiasm, the courage and the inexhaustible energy of a Chandler to do the showing. He won them all and they ultimately became his friends and admirers. One of our greatest national assets to-day is the wonderful cooperation between American science and American industries; Chandler was one of the earliest advocates of this cooperation. His official position as president of the Board of Health of New York compelled him often to demonstrate before the courts that a metropolitan chemical industry which refuses to grasp the guiding hand of science is destined to become a public nuisance. The advocate of a good cause who is not too proud to fight is bound to win. Chandler was never too proud to fight for the cause of science, and he won many legal victories for the claims of science in the municipal administration of New York.

During my earliest student days at Columbia I was devoted to modern and classical literatures, to physics and mathematics. The science of chemistry had no fascination for me. It was in my untutored opinion, too sloppy, too wet and too empirical. The chemical laboratory, I thought, looked like a drug store or a dispensary, and smelt like a hospital. But one day I heard of Chandler's lectures and I made up my mind to try them. I tried them, and I became one of Chandler's boys during the remainder of my college career. Later, when he and I had become colleagues, I told him that he never met a New York alderman of fifty years ago who had a smaller knowledge of chemistry and larger prejudice against it than I had when as a sophomore of Columbia College I first entered his lecture room. "Then how in the world," asked Chandler, "did I manage to draw you away even temporarily from the ethereal heights of Homer, Shakespeare, Newton and Faraday and induce you to listen to my prosy language of chemistry?"

But Chandler's language of chemistry was never prosy. It was a thrilling epic which Chandler recited when, for instance, he described the wandering of the carbon atoms from the carbon dioxide of the atmosphere. One could see them glide along the beams of golden sunlight and plunge into the loving

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.